4 Affected Environment, Impacts, and Mitigation

Approach to Environmental Analysis

In the environmental analysis, each environmental resource is addressed in its own section. Each section includes the description of affected environment for that resource, the environmental consequences of the Proposed Action and alternatives on that resource, and proposed mitigation for any identified major environmental consequences.

Many of the environmental effects of the Project analyzed in this EIS are attributed to the continued operation of existing facilities (Navajo Mine, FCPP, transmission lines). These continuing operations are described in Section 2. The Council on Environmental Quality provides guidance on this approach:

> *"The current condition is frequently used as the benchmark for comparing the environmental effects of the alternatives. However, in cases of continued operations, the current condition may not adequately represent how actions have impacted resources in the past, are currently impacting resources, or how resources might respond to future impacts. Designating existing environmental conditions as a benchmark may focus the environmental impact assessment too narrowly, overlooking cumulative impacts of past and present actions or limiting assessment to the Proposed Action and future actions. For example, if the current environmental condition were to serve as the condition for assessing the impacts of relicensing a dam, the analysis would only identify the marginal environmental changes between the continued operation of the dam and the existing degraded state of the environment. In this hypothetical case, the affected environment has been affected for more than 50 years with accompanying declines in flows, reductions in fish stocks, habitat loss, and disruption of hydrologic functions. If the assessment took into account the full extent of continued impacts, the significance of the continued operation would more accurately express the state of the environment and thereby better predict the consequences of relicensing the dam (CEQ 1997)."*

Following this guidance, for each environmental resource, the analysis of the effects of continuing operations (described in Section 2) and of the alternatives including the Proposed Action (described in Section 3), are measured relative to environmental benchmarks specific to each resource category. The analysis identifies environmental impairments, either existing or ongoing, that would be addressed through mitigation measures or other means.

There have been two completed federal actions that may affect the continuing operations at FCPP, and at Navajo Mine. At FCPP, the EPA has made its ruling with respect to BART to control air emissions (Section 2.4.2). For Navajo Mine, OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4.1). These completed federal actions form part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared. In each description of the environmental setting, the measured current conditions (prior to 2014) are described first. This description is followed by the expected conditions as a result of BART compliance or as a result of the SMCRA (interim period: 2014-2018) permit transfer. Environmental consequences are then determined relative to this baseline condition.

In some cases, the two completed federal actions do have long-term consequences to continuing operations that are considered in this EIS. For example, installation of SCR equipment on Units 4 and 5 requires the transport of large quantities of ammonia to FCPP; the environmental consequences of the ammonia transport, storage, and use are analyzed in the EIS as the continuing operations of FCPP, even though this requirement has not yet commenced. Further, the transfer of the SMCRA permit to NTEC may

have long-term socioeconomic effects to the Navajo Nation, the State of New Mexico, and San Juan County. These long-term effects are analyzed in this EIS.

The environmental consequences would vary in duration and significance among the environmental resources. At the Navajo Mine and Pinabete Permit Areas, short-term impacts would occur during and/or immediately following construction activities and mining operations and would persist up to the reclamation phase. Based on historic operations at the Navajo Mine, a mined area is typically disturbed for 5 years prior to reclamation. Long-term impacts persist for the duration of the mining permit period (through 2041) and account for post-reclamation activities. Permanent impacts persist beyond or occur after reclamation (post 2041). For the FCPP and transmission lines, short-term impacts are those that would occur immediately following approval of the lease renewals plus a reasonable period afterwards (i.e., a total of about 5 years). Long-term impacts are those that would persist beyond or occur after the 5-year period.

The levels of significance of impacts are classified as major, moderate, minor, negligible or “no impact.” An impact is considered major if it would result in a substantial adverse change to the environment. An impact is considered moderate or minor if it would not result in substantial adverse environmental effects but could still have some effect. The determination of whether an impact is moderate or minor is described within each resource category. In contrast to “no impact”, a negligible impact could occur but at the lowest limits of detection of an effect. In cases where no impact would occur, this conclusion is noted. Quantitative thresholds are applied, where appropriate, to determine the level of significance (for example, quantitative thresholds are commonly used to determine impact levels in the areas of noise and air quality). Other issues are assessed qualitatively based on context and intensity. A summary of unavoidable adverse impacts is provided following the analyses of individual resource areas.

As part of its SMCRA permit application, BNCC included measures to reduce or avoid potential impacts. These measures are incorporated into the description of the Proposed Action and mine alternatives. These measures, as well as compliance with environmental regulations, are therefore not considered to be mitigation measures in this EIS. These measures were evaluated when considering the significance and duration of impacts, and, in some instances, the EIS identifies additional measures that would be necessary to avoid or further reduce potential impacts. Mitigation measures are agency-determined protections beyond those already proposed by the applicants or required by regulatory compliance.

The scope of the EIS was developed based on input from many sources, including the SMCRA permit applications; the cooperating agencies; open houses and public scoping and comment meetings; letters received from the public; and field inspections, research, and analyses. Conclusions and recommendations in this EIS are subject to the following assumptions:

- Project proponents would comply with all applicable laws and regulations;
- The proposed Project facilities would be constructed and operated as described in Sections 2 and 3 of this EIS;
- Project proponents would implement the measures included in the respective applications; and
- Project proponents would implement the recommendations and mitigation measures included in this EIS.

4.1 Air Quality

The proposed project is located in the Four Corners region of northwestern New Mexico within the San Juan Air Basin (Figure 4.1-1). This air basin comprises the Four Corners region of northwest New Mexico, southwest Colorado, southeast Utah, and northeast Arizona. For the purposes of this EIS, the Proposed Action area encompasses a 300-km (km) (186-mile) radius from FCPP, which includes the Navajo Nation and Hopi tribal lands. San Juan Basin air quality is generally good and meets EPA ambient air quality standards. Primary issues of concern in this region include regional haze and visibility issues, as well as the potential deposition of metals from air to soil and water as a result of industrial air emissions.

The Navajo Mine and FCPP are located on Navajo sovereign tribal land; therefore, air emissions and air quality are under the jurisdiction of the Navajo Nation Environmental Protection Agency (NNEPA) and overseen by the EPA Region IX in San Francisco.[1] Federal and tribal law defines criteria emissions to include the following: reactive or volatile organic compounds (ROCs or VOCs), nitrogen oxides (NO_X as NO and NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), respirable particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$). Of these, VOCs and NO_X are precursors of ground-level photochemical ozone (O_3), which can result in decreased visibility and haze.

In addition, the EPA published a Final Ruling regarding the Source Specific Federal Implementation Plan (FIP) to Implement Best Available Retrofit Technology (BART) at the FCPP in August 2012, which provides requirements for future operation of the plant. The FIP and associated BART requirements have been determined and as such comprise part of the environmental baseline for assessing the consequences of the Proposed Action and alternatives. A detailed discussion of the regulatory framework regarding air quality and air emissions as applicable to the proposed Project is provided below.

Coal mining would cause air emissions from combustion of motor fuels (diesel and gasoline) used to operate mining equipment, portable equipment, and support vehicles. Mining activities also cause air emissions from explosives detonation (NO_2, SO_2, and CO) and fugitive dust (PM_{10} and $PM_{2.5}$) from earthmoving activities. Power plant operation and maintenance would cause air emissions from the combustion of coal in boilers as well as motor fuels (diesel and gasoline) used in offroad equipment, portable equipment, and support vehicles. Support activities include switchyard and transmission line maintenance near the plant. Several quantitative models were conducted to evaluate the potential air quality impacts of the Proposed Action and alternatives. These include calculations of mobile and stationary source emissions in comparison to federal standards; air deposition modeling; Ozone Assessment; and plume visibility. Each of these models, their results, and implications with regard to potential impacts are described in the environmental consequences section.

Human health risk assessment of HAPs, diesel particulate matter, and fugitive dust are presented in Section 4.17, Health and Safety. These issues are also mentioned in this section.

4.1.1 Regulatory Compliance Framework

4.1.1.1 Air Quality Standards

Air quality in a given location is determined by the concentration of various pollutants in the atmosphere. National Ambient Air Quality Standards (NAAQS) have been established by the EPA under the Clean Air Act of 1970 (CAA, amended 1977 and 1990, 42 United States Code 7401 et seq.). The NAAQS represent maximum levels of background pollution that are considered safe, with an adequate margin of safety, to protect public health (primary standards) and welfare (secondary standards such as diminished production and quality of agricultural crops, reduced visibility, degraded soils, materials and infrastructure

[1] In 2005, the NNEPA and owners of the FCPP entered into a Voluntary Compliance Agreement that resolves jurisdictional authority dispute and states that the administration and enforcement of the NNEPA permit cannot be more stringent than EPA limits and federal court decisions; thereby, limiting the tribe's ability to enforce more stringent limits than that established by the EPA.

damage, and damaged vegetation). Recently, the EPA has proposed developing new secondary standards aimed at reducing the impacts of atmospheric deposition on surface waters (GAO 2013). Individual states have the option to adopt more stringent standards and to include other pollution sources. However, all states in the Four Corners region – New Mexico, Arizona, Utah, and Colorado – have adopted NAAQS in lieu of adopting more stringent state standards. Also, the sovereign nations – Navajo Nation, Hopi Tribe, and Southern Ute Indian Tribe – use NAAQS as tribal standards.

The EPA has defined six criteria pollutants for which NAAQS have been established: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable and fine particulate matter (PM_{10} and $PM_{2.5}$, respectively), and airborne lead (Pb). Each of these is described below.

Ozone (O_3)

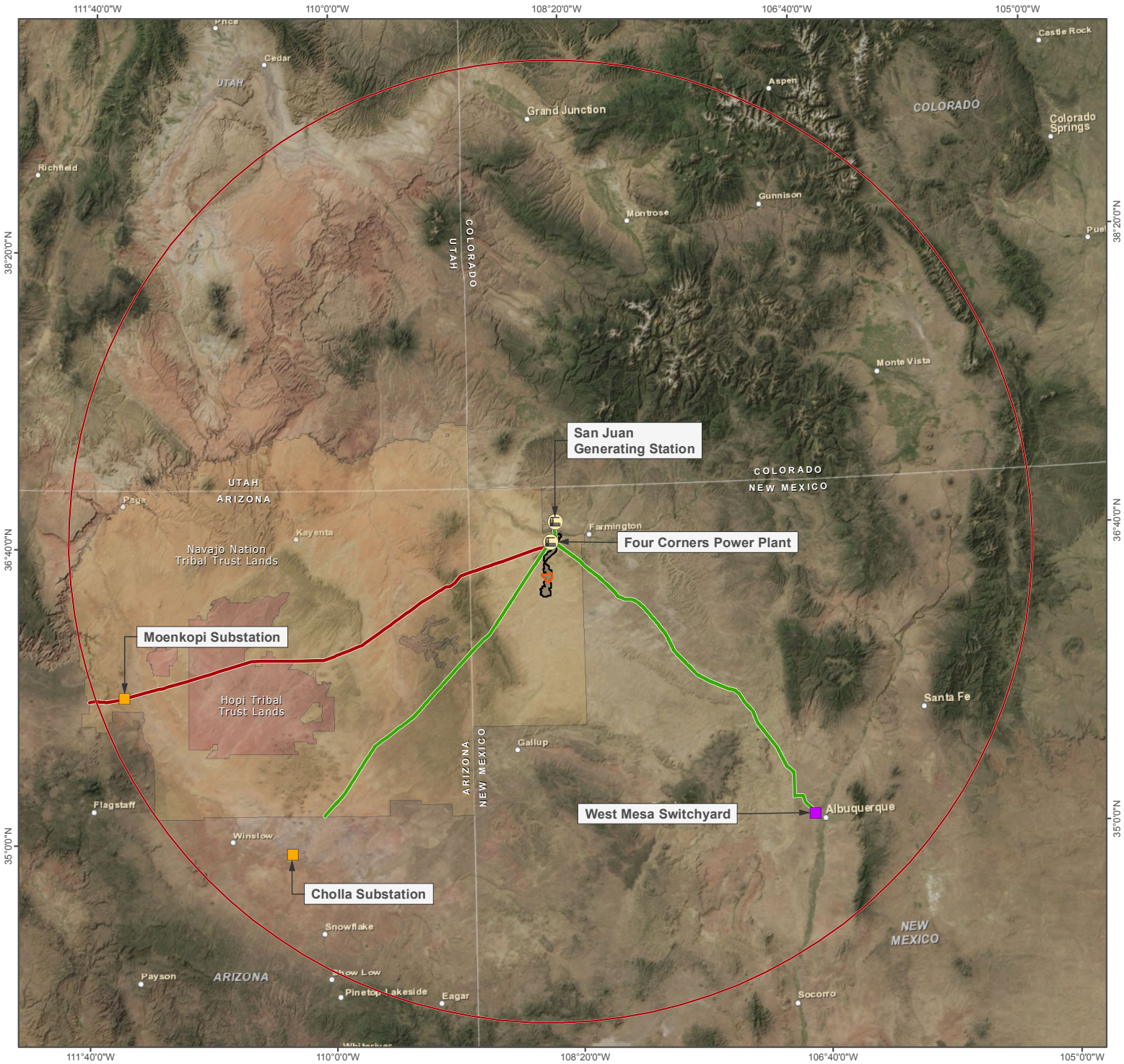
Ground-level ozone is a secondary pollutant formed in the atmosphere by a series of complex chemical reactions and transformations in the presence of sunlight. NO_X and volatile organic compounds (VOCs) are the principal constituents in these reactions. The greatest source of NO_X and VOC emissions is the high-temperature combustion of fossil fuels such as in motor vehicle engines and power plant boilers. Thus, regulation and control of NO_X and VOCs from these sources is essential to reduce the formation of ground-level ozone.

Ozone is a strong irritating gas that can chemically burn and cause narrowing of airways, forcing the lungs and heart to work harder to provide oxygen to the body. A powerful oxidant, ozone is capable of destroying organic matter, including human lung and airway tissue. Ozone damages cells in the lungs, making the passages inflamed and swollen. Ozone also causes shortness of breath, nasal congestion, coughing, eye irritation, sore throat, headache, chest discomfort, breathing pain, throat dryness, wheezing, fatigue, and nausea. It can damage alveoli, the individual air sacs in the lungs where oxygen and carbon dioxide are exchanged. Ozone has been associated with a decrease in resistance to infections. People most likely to be affected by ozone include the elderly, the young, and athletes. Ozone may pose its worst health threat to people who already suffer from respiratory diseases such as asthma, emphysema, and chronic bronchitis (VCAPCD 2003).

Nitrogen Dioxide (NO_2)

NO_2 is formed in the atmosphere primarily by the rapid reaction of the colorless gas nitric oxide (NO) with atmospheric oxygen. It is a reddish brown gas with an odor similar to that of bleach. NO_2 participates in the photochemical reactions that result in O_3. The greatest source of NO, and subsequently NO_2, is the high-temperature combustion of fossil fuels such as in motor vehicle engines and power plant boilers. NO_2 and NO are referred to collectively as NO_X. NO_2 can irritate and damage the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections such as influenza. Researchers have identified harmful effects, similar to those caused by ozone, with progressive changes over four hours of exposure causing impaired pulmonary function, increased incidence of acute respiratory disease, and difficult breathing for both bronchitis sufferers and healthy persons (VCAPCD 2003).

Figure 4.1-1
300km Radius of FCPP Boundary



PROJECT FACILITIES

- Power Plant
- Substation
- Switchyard

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Proposed Pinabete Permit Boundary
- 300km Radius

TRANSMISSION LINES

- 345kV
- 500kV

TRIBAL LANDS

- Hopi Tribal Trust Lands
- Navajo Nation Tribal Trust Lands

N

0 50 100
Scale in Miles

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Carbon Monoxide (CO)

CO is a common, colorless, odorless, highly toxic gas. It is produced by natural and anthropogenic (caused by human activity) combustion processes. The major source of CO is incomplete combustion of carbon-containing fuels (primarily gasoline, diesel fuel, natural gas, and coal). However, it also results from combustion processes including forest fires and agricultural burning. Ambient CO concentrations are generally higher in the winter, usually on cold, clear days and nights with little or no wind. Low wind speeds inhibit horizontal dispersion, and surface inversions inhibit vertical mixing. Traffic-congested intersections have the potential to result in localized high CO levels.

When inhaled, CO does not directly harm the lungs. The impact from CO is on oxygenation of the entire body. CO combines chemically with hemoglobin, the oxygen transporting component of blood. This diminishes the ability of blood to carry oxygen to the brain, heart, and other vital organs. Red blood cells have 220 times the attraction for CO as for oxygen. This affinity interferes with movement of oxygen to the body's tissues. Effects from CO exposure include headaches, nausea, and death. People with heart ailments are at risk from low-level exposure to CO. Also sensitive are people with chronic respiratory disease, the elderly, infants and fetuses, and people suffering from anemia and other conditions that affect the oxygen carrying capacity of blood. High CO levels in a concentrated area can result in asphyxiation. Studies show a synergistic effect (an effect that is greater than just the sums of the two constituents) when CO and O_3 are combined (VCAPCD 2003).

Sulfur Dioxide (SO_2)

SO_2 is a colorless gas with a sharp, irritating odor. It can react in the atmosphere to produce sulfuric acid and sulfates, which contribute to acid deposition and atmospheric visibility reduction. It also contributes to the formation of PM_{10}. Most of the SO_2 emitted into the atmosphere is from burning sulfur-containing fossil fuels by mobile sources such as marine vessels and farm equipment and stationary fuel combustion, such as coal-fired power plants. SO_2 irritates the mucous membranes of the eyes and nose and may also affect the mouth, trachea, and lungs. Healthy people may experience sore throats, coughing, and breathing difficulties when exposed to high concentrations. SO_2 causes constriction of the airways and poses a health hazard to asthmatics, which are very sensitive to SO_2. Children often experience more respiratory tract infections when they are exposed to SO_2 (VCAPCD 2003).

Respirable Particulate Matter, 10 Microns (PM_{10})

PM_{10} consists of particulate matter, fine dusts and aerosols, 10 microns or smaller in diameter. When inhaled, particles larger than 10 microns generally are caught in the nose and throat and do not enter the lungs. PM_{10} can enter the large upper branches of the lungs just below the throat, where they are caught and removed (by coughing, spitting, or swallowing).

The primary sources of PM_{10} include dust from paved and unpaved roads and construction and demolition operations. Lesser sources of PM_{10} include wind erosion, agricultural operations, residential wood combustion, smoke, tailpipe emissions, and industrial sources. These sources have different constituents and, therefore, varying effects on health. Road dust is composed of many particles other than soil dust. It also includes engine exhaust, tire rubber, oil, and truck load spills. Airborne particles absorb and adsorb toxic substances and can be inhaled and lodge in the lungs. Once in the lungs, the toxic substances can be absorbed into the bloodstream and carried throughout the body. PM_{10} concentrations tend to be lower during the winter months because weather greatly affects PM_{10} concentrations. During rain, concentrations are relatively low, and on windy days, PM_{10} levels can be high. Photochemical aerosols, formed by chemical reactions with manmade emissions, may also influence PM_{10} concentrations.

Elevated ambient particulate levels are associated with premature death, an increased number of asthma attacks, reduced lung function, aggravation of bronchitis, respiratory disease, cancer, and other serious

health effects. Short-term exposure to particulates can lead to coughing, minor throat irritation, and a reduction in lung function. Long-term exposure can be more harmful. EPA estimates that 8 percent of urban nonsmoker lung cancer risk is due to PM_{10} in soot from diesel trucks, buses, and cars. Additional studies by EPA and the Harvard School of Public Health estimate that 50,000 to 60,000 deaths per year in the United States are caused by particulates. PM_{10} particles collect in the upper portion of the respiratory system, affecting the bronchial tubes, nose, and throat. They contribute to aggravation of asthma, premature death, increased number of asthma attacks, bronchitis, reduced lung function, respiratory disease, aggravation of respiratory and cardiovascular disease, alteration of lung tissue and structure, changes in respiratory defense mechanisms, and cancer (VCAPCD 2003).

Fine Particulate Matter, 2.5 Microns ($PM_{2.5}$)

$PM_{2.5}$ is a mixture of particulate matter fine dusts and aerosols 2.5 microns or smaller in aerodynamic diameter. $PM_{2.5}$ can enter the deepest portions of the lungs where gas exchange occurs between the air and the blood stream. These are the most dangerous particles because the lungs have no efficient mechanisms for removing them. If these particles are soluble in water, they pass directly into the blood stream within minutes. If they are not soluble in water, they are retained deep in the lungs and can remain there permanently. This increases the risks of long-term disease including chronic respiratory disease, cancer, and increased and premature death. Other effects include increased respiratory stress and disease, decreased lung function, alterations in lung tissue and structure, and alterations in respiratory tract defense mechanisms.

EPA's PM Integrated Science Assessment concluded that "many constituents of $PM_{2.5}$ can be linked with multiple health effects, and the evidence is not yet sufficient to allow differentiation of those constituents or sources that are more closely related to specific outcomes" (EPA, 2009c). While some particles may have higher or lower toxicity than the average for all fine particles, the body of scientific evidence supports the conclusion that reducing all fine particles will result in substantial public health benefits.

$PM_{2.5}$ particles are emitted from activities such as industrial and residential combustion processes, wood burning, and from diesel and gasoline-powered vehicles. They are also formed in the atmosphere from gases such as SO_2, NO_X, ammonia, and VOCs that are emitted from combustion activities and then become particles as a result of chemical transformations in the air (secondary particles) (VCAPCD 2003).

4.1.1.2 Attainment Status

Table 4.1-1 displays the NAAQS (EPA 2012f). States and county or regional air districts are required to monitor air pollutant levels to ensure that NAAQS are met and, in the event that they are not, to develop strategies to meet these standards. Sovereign nations (e.g., Navajo, Southern Ute) also monitor air pollutant levels as required. Depending on whether the standards are met or exceeded, the local air basin or air quality control region is classified as being in "attainment" or "nonattainment." Where insufficient data exist to make a determination, an area is deemed "unclassified." A General Conformity determination is required for Federally-sponsored, permitted, or funded actions in NAAQS nonattainment areas or in certain maintenance areas when the total direct and indirect net emissions of nonattainment pollutants (or their precursors) exceed specified thresholds (Clean Air Act Amendments of 1990 Section 176[c]).

The states which comprise the Four Corners region (New Mexico, Arizona, Colorado and Utah) are all classified as in attainment for all federal NAAQS (EPA 2012f). In general, the Four Corners region experiences low concentrations of most pollutants when compared to Federal standards; however, ambient concentrations of ozone and particulate matter have sometimes approached, but not exceeded, Federal standards in the three most recent years for which validated data are available. Since the Action area is presently in NAAQS attainment or unclassified for all pollutants, a General Conformity determination is not applicable to the proposed project.

Table 4.1-1 National Ambient Air Quality Standards (NAAQS)

Pollutant	Type	Averaging Time	Concentration			Statistical Form
			ppmv	ppbv	µg/m^3	
Ozone (O_3)	Primary and Secondary	8-hour	0.075	75	147	Annual 4th-highest daily maximum 8-hour concentration averaged over 3 years
Nitrogen Dioxide (NO_2)	Primary	1-hour	0.100	100	188	98th percentile averaged over 3 years
	Primary and Secondary	Annual	0.053	53	100	Annual mean
Sulfur Dioxide (SO_2)	Primary	1-hour	0.075	75	196	99th percentile of 1-hour daily maximum concentrations averaged over 3 years
	Secondary	3-hour	0.5	500	1,309	Not to be exceeded more than once per year
Carbon Monoxide (CO)	Primary	1-hour	35	35,000	40,072	Not to be exceeded more than once per year
		8-hour	9	9,000	10,304	
Particulates (as PM_{10})	Primary and Secondary	24-hour	—	—	150	Not to be exceeded more than once per year on average over 3 years
Particulates (as $PM_{2.5}$)	Primary and Secondary	24-hour	—	—	35	98th percentile averaged over 3 years
	Primary	Annual	—	—	12	Annual mean averaged over 3 years
	Secondary	Annual	—	—	15	Annual mean averaged over 3 years
Lead (Pb)	Primary and Secondary	3-month rolling	—	—	0.15	Not to be exceeded at any time

Source: EPA 2012f

Notes:

All NAAQS generally correspond to an Air Quality Index (AQI) of 100

µg/m^3 = micrograms per cubic meter (10^{-6} g/m^3)

ppbv = parts per billion by volume (cc/10^3 m^3)

ppmv = parts per million by volume (cc/m^3)

For gases, equivalent µg/m^3 calculated from ppmv based on molecular weight and standard conditions:

Standard Ambient Temperature	25°C
Standard Barometric Pressure	760 mm Hg
Standard Molar Volume	24.465 liters/g-mole

4.1.1.3 Hazardous Air Pollutants

Hazardous Air Pollutants (HAPs), also known as toxic air pollutants or air toxics, are those pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. Title III of the CAA Amendments of 1990 currently identifies 187 pollutants as HAPs, the Federal term for air toxics. In 2001, the EPA identified 21 HAPs as mobile source air toxics, six of which are designated priority pollutants (66 FR 17235): acetaldehyde, acrolein, benzene,1, 3-butadiene, diesel exhaust (particulate matter and organic gases), and formaldehyde. Diesel particulate matter (DPM, as PM_{10}) is considered a carcinogenic air toxic. An EPA assessment “examined information regarding the possible health hazards associated with exposure to diesel engine exhaust (DE), which is a mixture of gases and particles. The assessment concludes that long-term (i.e., chronic) inhalation exposure is likely to pose a lung cancer hazard to humans, as well as

damage the lung in other ways depending on exposure. Short-term (i.e., acute) exposures can cause irritation and inflammatory symptoms of a transient nature, these being highly variable across the population" (EPA 2002). However, no EPA standard exists for DPM.

In addition to DPM from mining equipment and heavy trucks, coal combustion in power plant boilers emits a wide range of inorganic and organic HAPs from stacks, according to the EPA (EPA 2011a, 40 CFR 63 Subpart UUUUU). Inorganic metals include: antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni), and selenium (Se). Organics and nonmetallic inorganics include: acetaldehyde, acetophenone, acrolein, benzene, benzyl chloride, bis(2-ethylhexyl)phthalate (DEHP), carbon disulfide, chlorobenzene, chloroform, cyanide, 2,4-dinitrotoluene, ethyl benzene, ethyl chloride, formaldehyde, hexane, hydrogen chloride, hydrogen fluoride, isophorone, methyl bromide, methyl chloride, methyl ethyl ketone, methylene chloride, PAHs, phenol, propionaldehyde, tetrachloroethylene, toluene, styrene, and xylenes (ortho-, meta-, para- isomers).

Mercury and Air Toxics Standards

Coal-fired power plants are the largest source of mercury and acid gas emissions in the United States and are responsible for about 50 percent of mercury emissions and about 77 percent of acid gas emissions. Most mercury deposited in the western US, however, originates in Asia (Strode et al. 2008). Peer-reviewed scientific literature shows that mercury emissions from Electric Generating Units in the U.S. enhance mercury deposition and the response of ecosystems in the U.S. (77 FR 9339). Other toxic metals emitted from power plants include arsenic, chromium, hexavalent chromium, nickel, and selenium (EPA 2013a).

When elemental mercury from the air reaches surface waters via direct and indirect deposition, microorganisms can convert it into methylmercury, a highly toxic form that bio-accumulates in fish. Humans are primarily exposed to mercury by eating contaminated fish. Methylmercury exposure is a particular concern for women of childbearing age, fetuses, and young children because studies have linked high levels of methylmercury to damage to the developing nervous system, which can impair children's' ability to think and learn. Mercury and other power plant emissions also damage the ecological environment (EPA 2013a).

On December 16, 2011, the EPA issued the final Mercury and Air Toxics Standards (MATS) and Utility New Source Performance Standards (Utility NSPS) rulemakings which were published in the Federal Register on February 16, 2012 (77 FR 9304). Promulgated as 40 CFR 63 Subpart UUUUU – National Emission Standards for Hazardous Air Pollutants (NESHAPS) for Coal- and Oil-Fired Electric Utility Steam Generating Units, the MATS rule establishes emission limitations and work practice standards for HAPs emitted from coal- and oil-fired electric utility steam generating units along with requirements to demonstrate initial and continuing compliance with the HAP emission limits.

The EPA estimates there are about 1,400 existing generating units affected by the MATS rule – 1,100 coal-fired units and 300 oil-fired units – at about 600 power plants nationwide. As an existing coal-fired generating facility, FCPP must comply with specific HAP emissions limits for the following pollutants:

a) Filterable particulate matter (PM) or total nonmercury HAP metals or individual HAP metals (antimony, arsenic, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, nickel, selenium);

b) Hydrogen chloride or sulfur dioxide; and

c) Mercury.

The MATS emissions limits are based on existing control technologies that are widely available and commonly used in the electric utility industry such as electrostatic precipitators, fabric filters (baghouses), flue gas desulfurization (scrubbers), or dry sorbent injection. For existing controlled units such as FCPP

Units 4 and 5 which are equipped with baghouses and scrubbers, compliance can be achieved by April 16, 2015, and maintained as follows (EPA 2013a):

- *Operations and Maintenance.* Emissions and operating limits apply at all times except during periods of startup and shutdown. The plant must operate and maintain all equipment, including air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions. Determination of whether such operation and maintenance procedures are being used is based on information available to the EPA which may include, but is not limited to, monitoring results, review of operation and maintenance procedures, review of operation and maintenance records, and inspection of the source.
- *Testing and Monitoring of PM and non-Mercury Metals.* Initial performance testing is required for all pollutants to demonstrate compliance with the applicable emission limits. In certain circumstances, such as when a unit does not qualify as a low-emissions unit for total nonmercury HAP metals, individual nonmercury HAP metals, or filterable PM, compliance with applicable emissions limits must be demonstrated through an initial source compliance demonstration test and ongoing continuous monitoring through use of either a PM continuous parametric monitoring system, a PM continuous emission monitoring system, or quarterly source compliance demonstration testing. Units which use PM continuous parametric monitoring system must establish a site-specific operating limit corresponding to the results of the source compliance demonstration test for the applicable pollutant profile. Alternatively, a source can opt to install and operate a PM continuous emission monitoring system.
- *Testing and Monitoring of Hydrogen Chloride and Mercury.* If a unit does not qualify as low-emitter of the acid gas hydrogen chloride (HCl), a source may demonstrate initial and ongoing compliance through use of an HCl continuous emission monitoring system, conducting initial and quarterly source compliance demonstration testing, or if the unit uses wet or dry flue gas desulfurization technology, it may install and operate an SO_2 continuous emissions monitoring system. If a unit does not qualify as a low-emitter of mercury, a source must demonstrate initial and ongoing compliance through use of an approved mercury continuous emissions monitoring system or a sorbent trap monitoring system.
- *Recordkeeping and Reporting.* A source must monitor and collect data according to EPA specifications and a site-specific monitoring plan and periodically submit electronic reports to the EPA. As MATS sources are also Title V (Federal Operating Permit) sources, all monitoring and operating data records must be retained for a minimum of 5 years.

On March 28, 2013, the EPA finalized updates to certain emission limits for new power plants under the MATS rule, including mercury, PM, SO_2, acid gases and certain individual metals. Additionally, certain testing and monitoring requirements that apply to new sources were adjusted. The new standards affect only new coal- and oil-fired units that will be built in the future (78 FR 24073). The update does not change the final emission limits or other requirements for existing power plants such as FCPP.

4.1.1.4 Federal Visibility Protection and Atmospheric Deposition Control Programs

Protection of Visibility (Regional Haze Rule)

Visibility and haze are regulated under the Regional Haze Rule of the CAA (40 CFR 51 Subpart P). Under the CAA, Class I areas are those in which visibility is protected more stringently than under NAAQS. Class I areas include national parks and monuments, wilderness areas, and other areas of special national and cultural significance. Section 169A (42 USC Part 7491) of the CAA sets forth a national goal for visibility which is the ‘‘prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution’’ (64 FR 35714).

There are 156 Class I areas in the United States, 49 of which are national parks and monuments. The Regional Haze Rule, enacted in 1999, requires states to establish goals and emission reduction strategies for improving visibility in all Class I areas as part of State Implementation Plans (SIPs) as geographically applicable. In addition, the EPA encourages states to work together in regional partnerships to develop and implement multistate strategies to reduce emissions of visibility-impairing fine particle ($PM_{2.5}$) pollution (64 FR 35714).

Due to long range transport of visibility-impairing fine particles, all 50 states are required to participate in planning, analysis, and in many cases, emission control programs. Each state must develop coordinated strategies and implement programs to make reasonable progress toward the goal of no "man-made impairment" in Class I areas by reducing emissions that contribute to haze. The Regional Haze Rule requires states to establish goals for each affected Class I area which improve visibility on the haziest days (20 percent most-impaired days) and ensure no degradation occurs on the clearest days (20 percent least-impaired days). The reasonable progress goals are designed to reach natural conditions by 2060. States are required to conduct certain analyses, including analyses of improvement rates, to ensure that they set reasonable progress goals (64 FR 35714, CSU 2013a).

Relationship to NAAQS

On December 14, 2012, the EPA established the current primary and secondary NAAQS for $PM_{2.5}$ (see Table 4.1-1) as ''requisite to protect the public welfare'' against visibility impairment on a nationally uniform basis as provided in CAA Section 109B. However, consistent with the purposes of Section 169A of the CAA, the EPA recognizes that uniform NAAQS cannot eliminate visibility impairment in all parts of the country. The regional haze program contributes to improvement of local visibility impacts outside of Class I areas that may persist after attainment of the secondary standard (64 FR 35714).

Relationship to BART

The Regional Haze Rule (40 CFR 51 Subpart P) requires the use of Best Available Retrofit Technology (BART) at older coal-fired power plants to reduce haze and improve visibility. The BART provision in Section 169A(b)(2)(A) addresses the pollution from a specific set of existing sources, such as coal-fired power plants near Class I areas (e.g., FCPP, San Juan Generating Station, Navajo Generating Station). The BART provision requires EPA to promulgate regulations requiring states to revise their SIPs to contain measures to make reasonable progress toward the national visibility goal, including a requirement that certain existing stationary sources procure, install, and operate BART (64 FR 35714).

The CAA defines the sources potentially subject to BART as major stationary sources, including reconstructed sources, from one of 26 identified source categories which have the potential to emit 250 tons per year or more of any air pollutant, and which were placed into operation between August 1962 and August 1977. This set of sources potentially subject to BART was defined in the 1977 amendments to the CAA and the 2012 Regional Haze Rule is consistent with these amendments, 35 years later. Chief among the 26 source categories are fossil-fuel fired steam electric plants of more than 250 mmBTU/hr heat input such as FCPP.

Consistent with the Regional Haze Rule, the *Source Specific Federal Implementation Plan for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation* (40 CFR 49) requires FCPP to reduce emissions of NO_X and defines emission limits for PM based on emission rates currently achieved at FCPP. The FIP requires that Units 4 and 5 meet a BART emission limit of 0.015 lb/MMBtu within 60 days after restart following the scheduled major outages for Units 4 and 5 in 2013 and 2014, suggesting that the emission limit is achievable through the proper operation of the existing baghouses. FCPP must continue to meet the existing 20 percent opacity limit on Units 4 and 5 and is required to comply with a 20 percent opacity limit on its material handling operations, including coal handling.

NO_X and PM pollutants contribute to visibility impairment in the mandatory Class I Federal areas surrounding FCPP. These pollutants contribute to visibility impairment in the mandatory Class I Federal areas surrounding FCPP, of which there are 16 within the 300 km radius as shown in Appendix A, Section A3. For NO_X emissions, APS has opted to close Units 1, 2, and 3 and install selective catalytic reduction (SCR) controls on Units 4 and 5 to meet an emission limit of 0.098 pound NO_X per million BTU[2] (lbs/mmBTU) heat input each (30-day rolling average), which is an 80 percent reduction from 0.49 lb/mmBTU. For PM, Units 4 and 5 must meet an emission limit of 0.015 lb/mmBTU, while retaining the existing 20 percent opacity limit, through the proper operation of the existing baghouses. EPA is also requiring FCPP to comply with a 20 percent opacity limit on its coal and material handling operations (77 FR 51620) (Refer to Section 4.1.3).

Atmospheric Deposition

Since the 1970s, implementation of CAA regulations has reduced emissions of NO_X, SO_2, and mercury and reduced the impact of atmospheric deposition on water quality and aquatic ecosystems. However, in spite of progress, atmospheric deposition continues to affect water quality and harm aquatic ecosystems (GAO 2013).

According to EPA's 2008 National Emissions Inventory, domestic emissions of NO_X declined from about 26 million tons in 1990 to about 17 million tons in 2008. About 74 percent of this reduction came from reduced emissions from power plants and vehicles. Also according to the inventory, emissions of SO_2 declined from 23 million tons in 1990 to 10 million tons in 2008, and about 64 percent of this reduction came from reduced emissions from power plants (EPA 2011b, GAO 2013).

Three key regulations or programs have contributed to reductions in acid rain precursors: (1) Title II emission standards for mobile sources (motor vehicles), (2) actions designed to meet primary NAAQS, and (3) the Acid Rain Program. Although neither vehicle emissions standards nor actions to meet primary NAAQS are designed to address the deposition effects of NO_X and SO_2 emissions on surface waters, these standards have contributed to overall reductions in these criteria pollutants. In contrast, the Acid Rain Program was designed, in part, to address the effect of NO_X and SO_2 on surface waters (GAO 2013).

The Acid Rain program implements requirements for significant decreases in the emissions of NO_X and SO_2 from power plants to improve air quality and protect ecosystems that have been damaged by acid rain, including aquatic ecosystems. According to the 2011 National Acid Rain Precipitation Assessment Program report, the Acid Rain Program has been successful in reducing NO_X and SO_2 emissions from electric power generation to below levels set by Congress in 1990. By 2009, SO_2 emissions from power plants were 3.25 million tons lower than the final 2010 cap level of 8.95 million tons, and NO_X emissions were 6.1 million tons less than the levels projected for 2000. As a result of these reductions, air quality has improved and acid deposition has decreased to the extent that some acid-sensitive areas are beginning to show signs of recovery. However, current emission reductions pursuant to rules finalized in 2005 are not sufficient to allow full recovery of acid-sensitive ecosystems. Estimates from modeling presented in the National Acid Rain Precipitation Assessment Program report show that additional emission reductions are necessary to protect and recover acid-sensitive ecosystems. However, since the mandated emission reductions have been achieved, no additional reductions in emissions can reasonably be expected from the Acid Rain Program as currently designed (NSTC 2011).

[2] One British Thermal Unit (BTU) is the amount of heat required to raise the temperature of one pound (453.6 grams) of pure water from 39 to 40 °F (3.9 to 4.4 °C)

Two recent developments–new environmental regulations and changing market conditions – could affect future NO_X and SO_2 emissions from power plants (EPA 2013b, GAO 2013):

- The Cross-State Air Pollution Rule promulgated by EPA on July 6, 2011, was challenged in the DC Circuit Court of Appeals (Case No. 11-1302, August 21, 2012) on the grounds that the Cross-State Air Pollution Rule exceeds the EPA's statutory authority in two independent respects. For each of those two independent reasons, the Court ruled that the Cross-State Air Pollution Rule violates federal law and therefore must be vacated. On October 5, 2012, the EPA filed a petition with the Court seeking en banc rehearing of the case, and on January 24, 2013, the Court denied EPA's petition. On March 29, 2013 the U.S. Solicitor General petitioned the Supreme Court to review the DC Circuit Court's decision. The Supreme Court granted certiorari and heard arguments for the case on December 11, 2013.
- Contemporaneous (occurring at the same time) changes in energy market conditions have been weighing on the future viability of coal-fired power plants. Key among these has been the decline in the price of natural gas due to increased supply, which has made it more attractive to electric power providers in lieu of burning coal. Natural gas emits far less NO_X and SO_2 than coal, and about half as much GHGs for the same level of generating efficiency, and even less in new high-efficiency (i.e., combined-cycle) generating units. Thus, as more new power plants opt for natural gas in lieu of coal, acid deposition would be expected to continue to decrease overall (GAO 2013).

Similar to NO_X and SO_2 emission reductions, mercury emissions from domestic anthropogenic (caused by human activity) sources declined from about 246 tons in 1990 to about 61 tons in 2008, according to the 2008 National Emissions Inventory (NEI). More than half of this decline can be attributed to reduced emissions from municipal waste combustors and medical waste incineration. According to the inventory, in 1990, these two sources emitted about 108 tons of mercury; in 2008, they emitted less than 2 tons of mercury (an approximately 98 percent decrease). Mercury emissions from power plants also declined from about 59 tons of mercury in 1990 to about 30 tons of mercury in 2008 (EPA 2011b, GAO 2013).

On February 16, 2012, EPA promulgated the Mercury and Air Toxics Standards establishing for the first time emission limitations on mercury and other toxic pollutants, mainly metals, from existing and new power plants. Legal challenges are pending before the DC Circuit Court of Appeals; however, proceedings have been delayed until EPA, in response to a petition for reconsideration, updates certain emission limits for new power plants, which were finalized on March 28, 2013. EPA reopened the public comment period on reconsideration of startup and shutdown provisions on June 25, 2013 and argued the case before the Court of Appeals on December 10, 2013. Existing sources have 3 years to comply with the new standards but can seek an additional year from the permitting authority. When fully implemented, EPA projects that the Mercury and Air Toxics Standards will reduce future mercury emissions from domestic power plants to about 9 tons by 2016, a 70 percent reduction from 2008 (GAO 2013).

Acid Rain Program

The EPA's Acid Rain Program (40 CFR Parts 72 through 78) is the principal regulatory mechanism designed to achieve significant environmental and public health benefits through reductions in emissions of SO_2 and NO_X which are the primary causes of acid deposition. To achieve this goal in a cost-effective manner the program employs both traditional command-and-control and innovative market-based approaches for controlling air pollution. The program also encourages energy efficiency and pollution prevention. The Acid Rain Program was developed with consultation from various stakeholders including electric utilities, energy companies, pollution control equipment vendors, labor, academia, public utility commissions, state environmental agencies, and conservation groups. As an affected source, FCPP is a participant in the Acid Rain Program.

Title IV of the Clean Air Act Amendments of 1990 set the goal of reducing annual SO_2 emissions by 10 million tons per year below 1980 levels. To achieve these reductions, the Act required a two-phase

approach to reducing SO_2 and NO_X emissions from fossil fuel power plants. Phase I began in 1995 and affected 445 generating units, mainly at coal-fired electric utility plants located in eastern and mid-western states. Phase II began in 2000 and lowered annual emissions limits imposed on large, higher emitting plants and also set limits on smaller, cleaner plants fired by coal, oil, and gas, encompassing over 2,000 generating units rated 25 megawatts or greater nationwide. The Act also required a 2 million ton per year reduction in NO_X emissions by 2000 using technology such as low-NO_X burners in coal-fired units.

FCPP is subject to the principal provisions of the Acid Rain Program, under the authority of the NNEPA and EPA Region IX, respectively. This includes appointing a Designated Representative, filing an Acid Rain permit application and compliance plan, and monitoring and recording emissions. FCPP is also able to take part in allowance trading, and is required to hold sufficient SO_2 allowances to cover annual emissions (EPA 2013b). These provisions are described in detail in Appendix A.

4.1.1.5 Federal Prevention of Significant Deterioration (PSD) Program

Prevention of Significant Deterioration (40 CFR 51.166 and 40 CFR 52.21) provides the overall regulatory framework for the permitted operation of FCPP. The PSD Program is designed to:

- Protect public health and welfare;
- Preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value;
- Ensure that economic growth will occur in a manner consistent with the preservation of existing clean air resources; and
- Ensure that any decision to permit increased air pollution in any area to which this section applies is made only after careful evaluation of all the consequences of such a decision and after adequate procedural opportunities for informed public participation in the decision making process.

PSD does not prohibit new or existing stationary sources, such as oil refineries, factories, or power plants, from increasing emissions; rather, PSD is designed to ensure that emissions increases would have no significant effect on regional air quality (EPA 2013d).

PSD permitting applies to new major sources or major modifications at existing sources (e.g., FCPP) located in NAAQS attainment or unclassified areas for applicable pollutants. Since FCPP is located in an NAAQS attainment area for all criteria pollutants (see Table 4.1-4), PSD applies to emissions of NO_X, VOC, CO, SO_2, PM_{10}, $PM_{2.5}$, and lead (EPA 2013d). Details of the requirements of PSD permitting are provided in Appendix A.

A PSD permit would be required for a major modification at FCPP. A recent DC Circuit Court decision on PSD rules related to $PM_{2.5}$ increments and baselines could affect FCPP in the future. On January 22, 2013, the US Court of Appeals for the District of Columbia Circuit granted a request from the EPA to vacate and remand portions of two PSD $PM_{2.5}$ rules which addressed the Significant Impact Levels so that the EPA could correct errors in the rules. The Court also vacated parts of rules establishing $PM_{2.5}$ Significant Monitoring Concentrations due to regulatory errors. The Court's decision became final on March 15, 2013, and the affected provisions of 40 CFR 51.166 and 52.21 were vacated. The EPA will develop replacement PSD $PM_{2.5}$ rules to correct errors and address the Court's decision (EPA 2013d).

Specific to the Proposed Action, APS is planning to install SCR NO_X control equipment on FCPP Units 4 and 5 in compliance with 40 CFR 49 BART requirements. Preliminary engineering calculations have shown that this would result in byproduct emissions of sulfuric acid gas (H_2SO_4) in excess of the 7 ton per year threshold. APS has prepared the PSD permit application for the Proposed Action, including PSD increments modeling. The PSD permitting action is exempt from NEPA; but not from Endangered Species Act (ESA) Section 7 reviews. As such, APS is also preparing an ESA impacts analysis (discussed in

detail in Section 4.8 Special Status Species). Engineering estimates for NO_X and H_2SO_4 emissions used in the impacts analyses were done prior to installation of the SCR equipment. These estimated values were conservative and subsequent analyses are expected to result in lower values and lower impacts once actual SCR performance is known. The PSD permit will ultimately contain actual values determined after the SCR equipment is installed and operating. For Section 7 ESA compliance, EPA has its own permitting process, commencing with publication of the draft PSD permit and the public comment period. Before EPA can take further action on the PSD permit, it must comply with ESA requirements.

4.1.1.6 Federal Stationary Source Regulations

The NNEPA and EPA are both cooperating agencies in the review of the continued operations of FCPP. As described above, the Regional Haze Rule requires the use of BART at older coal-fired power plants to reduce haze and improve visibility. In August 2012, EPA issued its final rule for BART compliance at FCPP. The final rule allows APS the choice in either complying with the EPA's 2010 draft rule or the APS counter-proposal to meet stated NO_X and particulate matter emissions limits. In compliance with the first of the options provided by EPA, APS shut down Units 1, 2, and 3 on December 30, 2013 and plans to install selective catalytic reduction devices on Units 4 and 5 by July 31, 2018. Because EPA's decision precedes this EIS, the compliance actions are considered part of the environmental baseline for analysis of the consequences of the Proposed Action and alternatives.

Source Specific Federal Implementation Plan (FIP) for Implementing BART for FCPP

The primary goal of the *Source Specific FIP for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation* [EPA-R09-OAR-2010-0683; FRL-9703-2] is reducing emissions of the $PM_{2.5}$ precursor NO_X, thereby improving visibility in the region. The FIP requires FCPP to meet new emissions limits required by the BART provision of the CAA for NO_X and PM. These pollutants contribute to visibility impairment in the 16 mandatory Class I Federal areas surrounding FCPP. Under the FIP, FCPP could choose between two emissions control strategies (options) and notify EPA of its choice by July 1, 2013 (EPA 2012g), which was extended by EPA to December 31, 2013. The final BART determination requires FCPP to meet a plant-wide heat input-weighted emission limit of 0.11 pound per million BTU (lb/mmBTU) on a rolling 30-day average, which represents an 80 percent reduction from historic NO_X emission rates in one of two ways:

- FCPP could implement post-combustion NO_X controls (i.e., SCR) on Units 1 through 5, with implementation of SCR devices on one of the 750 MW units (i.e., 4 or 5) completed within 4 years of promulgation, and SCR devices on the remaining units completed within 5 years of promulgation.
- FCPP could implement an alternative emissions control strategy which required permanent closure of Units 1, 2, and 3 by December 31, 2013, and implementation of SCR on Units 4 and 5 by July 31, 2018, to meet a NO_X emission limit of 0.098 lb/mmBTU each on a 30-day rolling average. This represents an 80 percent reduction of NO_X, down from 0.49 lb/mmBTU. For PM, the Rule requires Units 4 and 5 to meet a BART emission limit of 0.015 lb/mmBTU within 60 days after restart following the scheduled major outages for Units 4 and 5 in 2013 and 2014. This emission limit is achievable through the proper operation of the existing baghouses and FCPP must continue to meet the existing 20 percent plantwide opacity limit, which also applies to material handling operations, including coal handling.

On December 31, 2013, APS notified EPA that it preferred the alternative FIP emissions control strategy. As such, Units 1, 2, and 3 were shut down on December 30, 2013. Thus, emissions from Units 1, 2, and 3 permanently ceased. In addition, APS will install SCR devices on Units 4 and 5 by July 31, 2018. As a result, there would be a transition period from 2014 to mid-2018 during which Units 1, 2, and 3 are shut-down and Units 4 and 5 operate without SCR (refer to Section 4.1.3).

Title V Operating Permits

Parts 70 and 71 implement Title V of the CAA, 42 U.S.C. 7661, et seq. Title V operating permits are legally enforceable documents that permitting authorities issue to major stationary sources of air pollution regulating their emissions. Title V major source thresholds are defined by the NAAQS attainment status of the jurisdiction, with progressively lower (more stringent) thresholds in moderate, serious, severe, and extreme nonattainment areas. Part 70 permits are issued by state and local (county or district) permitting authorities. Part 71 permits are issued either directly by the EPA or through tribal EPAs on sovereign tribal lands. The Part 71 permit for FCPP is issued by the NNEPA.

Section II.A.2 of the current Part 71 permit for FCPP (NN-ROP-05-07, expires August 1, 2013) contains the following enforceable limitations on SO_2, NO_X, PM, and opacity emissions (40 CFR 49.23):

- Minimum 88 percent SO_2 control efficiency (reduction) on a plantwide weighted annual average basis, calculated daily using heat input data (this is stated as a maximum 12 percent post-control residual SO_2 emissions compared to pre-control uncontrolled emissions).
- Maximum 17,900 pounds per hour SO_2 emissions on a plantwide 3-hour rolling average basis.
- Maximum 0.050 pound per million BTU particulate matter emission rate from any unit, determined by source testing.
- Maximum plume opacity of 20 percent from Units 4 and 5, except for brief periods of not more than 27 percent opacity lasting not more than six minutes in an hour.
- Maximum 0.85 pound per million BTU NO_X emission rate from Units 1 and 2 on a 30-day rolling average basis.
- Maximum 0.65 pound per million BTU NO_X emission rate from Units 3, 4 and 5 on a 30-day rolling average basis.
- Maximum 335,000 pounds per day NO_X emissions on a plantwide 24-hour basis, discounted by 1,542 pounds per hour for any of Units 1, 2, or 3 not operating and discounted by 4,667 pounds per hour for any of Units 4 or 5 not operating.

Section II.A.3 of the Part 71 permit contains testing and monitoring requirements to quantify the above emissions limitations, and Section II.A.4 contains emissions recordkeeping and reporting requirements. Section II.B incorporates by reference provisions of the Phase II Acid Rain permit (40 CFR Parts 72, 72, and 75). Section II.C defines Compliance Assurance Monitoring (CAM, 40 CFR Part 64) requirements for monitoring particulate matter emissions from Units 1, 2, 3, 4 and 5 per the above limitation.

Continuous Emissions Monitoring

The FCPP is subject to Part 75 requirements for the monitoring, recordkeeping, and reporting of SO_2, NO_X, CO_2 emissions, volumetric flow, and opacity data from affected units under the Acid Rain Program pursuant to Sections 412 and 821 of the Clean Air Act, 42 U.S.C. 7401-7671, et seq. Part 75 also sets forth provisions for the monitoring, recordkeeping, and reporting of NO_X mass emissions, which are required to be controlled to demonstrate compliance with a NO_X mass emission reduction program. For FCPP, this is consistent with the *Source Specific Federal Implementation Plan for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation.* Under Part 75 operating and emissions records must be retained for a minimum of 5 years.

4.1.1.7 Mobile Source Regulations

The EPA regulates mobile sources of air pollution in the State of New Mexico and Navajo Nation via Federal mobile source standards. In most jurisdictions, self-propelled nonroad mining and construction equipment is considered a vehicle, as defined by vehicle codes. Operations at both the FCPP and Navajo Mine are subject to mobile source emissions standards.

A vehicle may have an engine that both propels the vehicle and powers equipment mounted on the vehicle, typically via hydraulics. As such, single-engine vehicles are generally exempt from direct regulation by states, air districts, or sovereign tribes. However, not included in most exemption provisions is any nondriveline engine-powered equipment mounted on a vehicle that would otherwise require a permit under state, air district, or tribal regulations. An example of this dual-engine configuration would be a vacuum street sweeper where an auxiliary engine drives the vacuum blower. Another example would be a mobile crane or drilling rig with an independent hoist or draw-works engine, respectively.

Federal Tier 1 standards for offroad diesel engines were adopted in 1995. Federal Tier 2 and Tier 3 standards were adopted in 2000 and selectively apply to the full range of diesel offroad engine power categories. Both Tier 2 and Tier 3 standards include durability requirements to ensure compliance with the standards throughout the useful life of the engine (40 CFR 89.112).

On May 11, 2004, the EPA signed the final rule implementing Tier 4 emission standards which are to be phased-in over the period of 2008-2015 (69 FR 38957-39273, June 29, 2004). The Tier 4 standards require that emissions of PM and NO_X be further reduced by about 90 percent. Such emission reductions can be achieved through the use of advanced control technologies – including advanced exhaust gas after treatment similar to those required by the 2007-2010 standards for highway diesel engines.

4.1.2 Affected Environment Pre-2014

4.1.2.1 Area Climate

The Four Corners area is located in a high desert region averaging over 5,000 feet elevation and over 270 clear days per year with low humidity and generally warm daytime temperatures. As shown in Table 4.1-2, average summer daytime high temperatures in Shiprock and Fruitland are about 93 °F and average winter nighttime low temperatures are about 15 °F, with an average year-round temperature of about 52 °F. Average annual precipitation is typically 7.8 inches with light snowfalls in winter (WC 2013). Average high desert wind speed is about 9 miles per hour with a typical east-by-northeast and west-by-southwest diurnal wind direction pattern (NOAA 2008, 2013). Due to the area's aridity, climate change could have a substantial impact if the already low precipitation amounts decrease in the future (NM 2005).

Table 4.1-2 Climate Data for the Navajo Nation (Based on Measurements in Shiprock and Fruitland)

Month	Maximums °F	Minimums °F	Averages °F	Precipitation inches	Wind mph
January	41.6	15.4	28.6	0.6	8.0
February	50.5	21.8	36.1	0.6	8.8
March	59.5	27.2	43.3	0.6	9.9
April	69.0	33.0	51.0	0.5	10.7
May	78.5	41.5	60.0	0.5	10.5
June	88.5	49.9	69.2	0.3	9.8
July	93.0	57.5	75.2	0.7	8.9
August	90.3	56.0	73.3	1.0	8.1

Month	Maximums °F	Minimums °F	Averages °F	Precipitation inches	Wind mph
September	82.9	47.1	65.0	1.0	8.4
October	71.1	35.5	53.4	1.0	8.2
November	55.7	26.2	40.8	0.8	7.9
December	43.7	17.4	30.7	0.7	7.6
Annual	**93.0**	**15.4**	**52.2**	**8.3**	**8.9**

Sources: WC 2013, NOAA 2008

4.1.2.2 Ambient Air Quality

Air quality is affected by a variety of sources in the Project Area. Large stationary sources such as FCPP and San Juan Generating Station emit substantial amounts of NO_X and SO_2, along with PM_{10} and $PM_{2.5}$. Oil and gas production facilities in the region emit mainly NO_X and VOCs along with some SO_2, PM_{10}, and $PM_{2.5}$. Light motor vehicles, diesel powered construction equipment, and commercial trucks used in the region are another source of these pollutants. Non-combustion sources of PM_{10} and $PM_{2.5}$ include fugitive dust from roads, construction, demolition, and earthmoving. Finally, commercial and general aviation aircraft operating at nearby airports generate emissions that affect air quality.

O_3 is a secondary pollutant that is not emitted directly by sources, but rather is formed by a reaction between NO_X and VOCs in the presence of sunlight. Reductions in O_3 concentrations are dependent upon reducing emissions of these precursors. Principal sources of O_3 precursors are motor vehicles and other mobile equipment (including agricultural equipment), solvent use, petroleum industry activities, nonelectric agricultural water pumping, and electric utilities operation such as power plant boilers. Another secondary pollutant is condensable $PM_{2.5,}$ which is formed by precursors SO_2, NO_X, VOCs, and ammonia (CARB 2005). Condensable $PM_{2.5}$ is a principal driver of regional haze (visibility degradation); therefore, reductions in regional levels of NO_X and SO_2 would also reduce the amount of haze.

The New Mexico Environmental Department (NMED), Navajo Nation, Southern Ute Indian Tribe, Colorado Department of Public Health and Environment, US Forest Service (USFS), and National Park Service (NPS) in combination operate an extensive regional air monitoring network composed of 17 stations that collectively measure the ambient concentrations of six criteria air pollutants: O_3, NO_2, SO_2, CO, PM_{10}, and $PM_{2.5}$. Not all monitoring stations are fully instrumented for these pollutants, while some sites have not been operating for adequate periods of time to provide representative data for determination of attainment status. In addition, one site measures lead (Pb) and sulfate (SO_4) within total suspended particulate matter (TSP). Each site listed in Table 4.1-3 and shown on Figure 4.1-2 is categorized by the monitoring program it operates under (EPA 2012e):

- State and Local Air Monitoring Stations (SLAMS) (New Mexico, Colorado)
- Tribal Monitors (Navajo Nation, Southern Ute Indian Tribe)
- Non-EPA Federal Monitors (USFS, NPS)
- Special Purpose Monitors (Colorado)
- Interagency Monitoring of Protected Visual Environments (IMPROVE) (NPS)

Data collected by the various monitoring programs is ultimately reported to the EPA, which oversees the programs and provides technical support, quality assurance, data processing, and public access (EPA 2012e). Ambient air monitoring data summaries are presented in Table 4.1-4.

Table 4.1-3 Ambient Monitoring Site Descriptions and Parameters – Four Corners Region

Site ID Code	State	County	Location	North Latitude	West Longitude	Type of Site	Reporting Agency	Criteria Pollutants Monitored						
								O_3	NO_2	SO_2	CO	PM_{10}	$PM_{2.5}$	Other
35-45-0006	New Mexico	San Juan	Farmington	36.727500	-108.220833	SLAMS	NMED				X	X	X	
35-45-0008	New Mexico	San Juan	Farmington	36.735833	-108.238333	SLAMS	NMED			X				
35-45-0009	New Mexico	San Juan	Bloomfield	36.742222	-107.976944	SLAMS	NMED	X	X	X				
35-45-0014	New Mexico	San Juan	Kirtland (near FCPP)	36.708333	-108.500278	SLAMS	NMED		X	X				
35-45-0017	New Mexico	San Juan	Shiprock	36.752778	-108.716667	SLAMS	NMED			X		X		
35-45-0018	New Mexico	San Juan	Navajo Dam	36.809730	-107.651580	SLAMS	NMED	X	X				X	
35-45-0019	New Mexico	San Juan	Farmington	36.774162	-108.165034	SLAMS	NMED					X	X	
35-45-1005	New Mexico	San Juan	Farmington	36.796667	-108.472500	SLAMS	NMED	X	X	X				
35-45-1223	New Mexico	San Juan	Shiprock (Diné College)	36.807100	-108.695230	Tribal	Navajo	X	X	X		X		
08-67-1004	Colorado	La Plata	Weminuche Wilderness	37.303890	-107.484167	Federal	USFS	X	X					
08-67-7001	Colorado	La Plata	Pine River Valley	37.136780	-107.628630	Tribal	S. Ute	X	X		X	X	X	
08-67-7002	Colorado	La Plata	La Plata River Plateau	37.096389	-108.183333	Tribal	S. Ute	X	X					
08-67-7003	Colorado	La Plata	Animas River Valley Rim	37.102580	-107.870219	Tribal	S. Ute	X	X			X	X	

Site ID Code	State	County	Location	North Latitude	West Longitude	Type of Site	Reporting Agency	Criteria Pollutants Monitored						
								O_3	NO_2	SO_2	CO	PM_{10}	$PM_{2.5}$	Other
08-83-0005	Colorado	Montezuma	Mesa Verde NP	37.203611	-108.491944	SLAMS	CDPHE							X
08-83-0006	Colorado	Montezuma	Cortez	37.350054	-108.592334	Special	CDPHE	X					X	
08-83-0101	Colorado	Montezuma	Mesa Verde NP	37.198333	-108.490278	Federal	NPS	X						
08-83-9000	Colorado	Montezuma	Mesa Verde NP	37.198413	-108.491357	IMPROVE	NPS					X	X	

Source: EPA 2012e

Notes:

CDPHE = Colorado Department of Public Health and Environment
Federal = Non-EPA Federal Monitors (USFS, NPS)
IMPROVE = Interagency Monitoring of Protected Visual Environments (NPS)
NMED = New Mexico Environment Department
NPS = National Park Service
SLAMS = EPA State and Local Air Monitoring Stations (New Mexico, Colorado)
Special = Special Purpose Monitors (Colorado)
Tribal = Tribal Monitors (Navajo Nation, Southern Ute Indian Tribe)
USFS = U.S. Forest Service

Site 08-83-0005 monitored Total Suspended Particulate, Lead, and Sulfate in 1996 (as Other)

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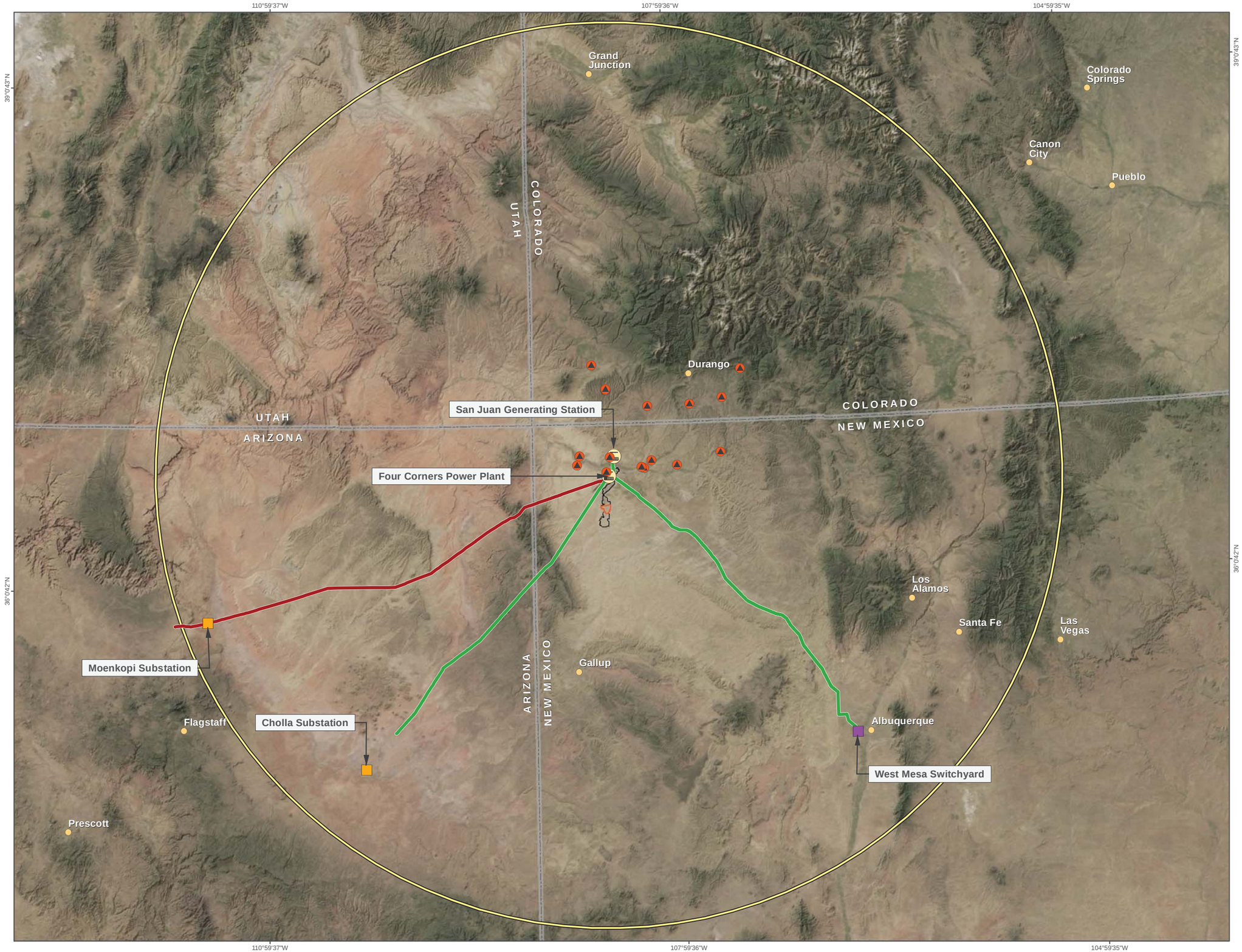

Figure 4.1-2

Air Quality Monitoring Stations

PROJECT FACILITIES

- Power Plant
- Substation
- Switchyard

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Proposed Pinabete Permit Boundary
- Four Corners Power Plant 300km Buffer

TRANSMISSION LINES

- 345kV
- 500kV

AIR QUALITY FEATURES

- Monitoring Locations

N

0 25 50
Scale in Miles

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Table 4.1-4 Ambient Air Monitoring Sites and Parameters in Vicinity of Proposed Action - Four Corners Region

		Data Years	**00-08**	**00-03**	**00-11**	**94**	**98**	**05-11**	**08-11**	**00-11**	**10-11**	**04-11**	**00-11**	**94**	**00-11**	**96**	**08-11**	**00-11**	**95**
		State Code	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**08**	**08**	**08**	**08**	**08**	**08**	**08**	**08**
		County Code	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**67**	**67**	**67**	**67**	**83**	**83**	**83**	**83**
Aerometric Parameter	**Averaging Time**	**Site Number**	**0006**	**0008**	**0009**	**0014**	**0017**	**0018**	**0019**	**1005**	**1233**	**1004**	**7001**	**7002**	**7003**	**0005**	**0006**	**0101**	**9000**
O_3	1-hour	ppmv			X			X		X	X	X	X	X	X		X	X	
	8-hour running average	ppmv			X			X		X	X	X	X	X	X		X	X	
CO	1-hour	ppmv	X										X						
	8-hour running average	ppmv	X										X						
Nitric Oxide (NO)	1-hour	ppbv			X			X		X		X	X		X				
NO_2	1-hour	ppbv			X	X		X		X	X	X	X	X	X				
NO_X	1-hour	ppbv			X			X		X		X	X		X				
SO_2	5-minute	ppbv			X					X									
	1-hour	ppbv		X	X	X	X			X	X								
	3-hour bulk average	ppbv		X	X	X	X			X	X								
	24-hour bulk average	ppbv		X	X	X	X			X	X								X
PM_{10} Total 0-10 µm STP	1-hour	$\mu g/m^3$									X								
	24-hour bulk average	$\mu g/m^3$	X				X		X		X		X		X				
PM_{10} Local Conditions	24-hour composite	$\mu g/m^3$	X				X		X										X

Aerometric Parameter	Averaging Time	Data Years	00-08	00-03	00-11	94	98	05-11	08-11	00-11	10-11	04-11	00-11	94	00-11	96	08-11	00-11	95
		State Code	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**08**	**08**	**08**	**08**	**08**	**08**	**08**	**08**
		County Code	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**67**	**67**	**67**	**67**	**83**	**83**	**83**	**83**
		Site Number	**0006**	**0008**	**0009**	**0014**	**0017**	**0018**	**0019**	**1005**	**1233**	**1004**	**7001**	**7002**	**7003**	**0005**	**0006**	**0101**	**9000**
$PM_{2.5}$ AQI and Speciation Mass	1-hour	$\mu g/m^3$						X											
$PM_{2.5}$ AQI and Speciation Mass	24-hour bulk average	$\mu g/m^3$						X											X
$PM_{2.5}$ Local Conditions	24-hour composite	$\mu g/m^3$	X						X				X		X		X		X
Pb	24-hour composite	TSP $\mu g/m^3$														X			
SO_4	24-hour composite	TSP $\mu g/m^3$														X			
Total Suspended Particulate STP	24-hour composite	$\mu g/m^3$														X			

Source: EPA 2012d

Notes:

$\mu g/m^3$ = micrograms per cubic meter (10^{-6} g/m^3)
µm = microns (10^{-6} meters)
08 = State of Colorado
35 = State of New Mexico
45 = San Juan County
5-minute SO_2 data applies only for 2010-11 (new averaging time)
67 = La Plata County
83 = Montezuma County

AQI = Air Quality Index
FED = Non-EPA Federal Monitors (USFS, NPS)
IMPV = Interagency Monitoring of Protected Visual Environments (NPS)
ppb = parts per billion (by volume)
ppm = parts per million (by volume)
SLAMS = EPA State and Local Air Monitoring Stations (New Mexico, Colorado)
SP = Special Purpose Monitors (Colorado)
STP = standard temperature and pressure for ambient air measurements (25 °C, 760 mm Hg)
TRB = Tribal Monitors (Navajo Nation, Southern Ute Indian Tribe)
TSP = total suspended particulate matter

4.1.2.3 Stationary Sources of Air Pollutants – Electric Power Generation

The electric utility sector involves the generation, transmission, and distribution of electricity. The main source of emissions from the sector is power plants. Stack criteria emissions include NO_X, SO_2, CO, VOC, PM_{10}, and $PM_{2.5}$. Air toxics (HAPs) are emitted in relatively small quantities compared to criteria pollutants or greenhouse gases (GHGs). These gases and particulates are released during the combustion of fossil fuels, such as coal, oil, and natural gas (EPA 2011a).

Fossil fuel combustion to generate electricity accounts for about 70 percent of SO_2 emissions and about 20 percent of NO_X emissions nationwide (EPA 2012c), and coal combustion emits significantly more air contaminants, SO_2 in particular, than burning natural gas or petroleum to generate electricity (EPA 2011a). In 2010, about 45 percent of electricity was generated using coal and about 25 percent was generated using natural gas. The percentage of natural gas generation has grown in recent years due to its reputation as a “clean” fuel and increased supply, which has driven down prices. Petroleum accounts for less than 1 percent of electricity generation, down significantly from the past. The remaining generation comes from nuclear plants (about 20 percent) and renewable sources (about 10 percent), which includes hydroelectric, geothermal, biomass (wood and agricultural wastes), wind, and solar (photovoltaic and thermal) (EPA 2012d). Nuclear, hydroelectric, wind, and solar emit no criteria pollutants. Geothermal may emit some SO_2, depending on the resource being tapped, and biomass emits NO_X, SO_2, CO, VOC, PM_{10}, and $PM_{2.5}$ because it involves combustion of nonfossil fuels.

Although $PM_{2.5}$ is a subset of PM_{10}, it differs from the rest of PM_{10}. While most of ambient PM_{10} results from direct emissions of the pollutant, a significant amount of the ambient $PM_{2.5}$ results from transformation of precursors and condensing of gaseous pollutants in the atmosphere. Other than direct $PM_{2.5}$ emissions, the key pollutants contributing to $PM_{2.5}$ concentrations in the atmosphere are SO_2, NO_X, VOCs, and ammonia (CARB 2005). Pursuant to 40 CFR 49, *Source Specific Federal Implementation Plan for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation*, the primary goal of controlling NO_X emissions from FCPP is to reduce $PM_{2.5}$ precursors and thereby improve visibility in the region.

Electric power generating resources are rated terms of kilowatts (KW) or megawatts (MW) output capacity. As a point of reference, at an average peak load of 10 kilowatts each, 1 megawatt would power 100 homes. Except for photovoltaic “solar panels” which have no moving parts, all generation of 50 or 60 Hertz (Hz) sine-wave alternating current (AC) power involves spinning a synchronous generator (alternator) from a source of rotational energy (turbine or engine). Utility-scale turbines include hydraulic turbines, steam turbines, gas or combustion turbines, and wind turbines. Utility-scale engines include spark-ignition natural gas, compression-ignition diesel, or dual fuel.

Steam turbines, due to their ability to use a wide range of heat sources (fuels), are a principal means of generating base load[3] electric power in the U.S. and worldwide. Four Corners is a coal-fired steam turbine power plant, as are other large generating stations in the region, such as San Juan and Navajo generating stations (San Juan Generating Station and Navajo Generating Station, respectively). While turbine-generator arrangements are basically the same, i.e., synchronous direct drive operating at 3,600 or 1,800 revolutions per minute (rpm) in 60 Hz systems, the source of steam can be a boiler or steam generator heated by combustion of fossil fuel, biomass, solar thermal energy, or nuclear fission; geothermal energy also powers steam turbines, either directly or indirectly.

[3] Base load is continuous generation operating at or near full capacity 24 hours per day for optimum efficiency

Four Corners Power Plant

Turbine-generator nameplate capacities at FCPP are 170 megawatts each for Units 1 and 2, 220 megawatts for Unit 3, and 770 megawatts each for Units 4 and 5. The boilers are rated at 2,551 million BTU[4] per hour (mmBTU/hr) each for Units 1 and 2, 3,387 mmBTU/hr for Unit 3, and 8,612 mmBTU/hr each for Units 4 and 5. Total installed generator capacity is 2,100 megawatts and combined boiler ratings are 25,713 mmBTU/hr.

Air pollution control equipment installed on FCPP Units 4 and 5 consists of baghouses (fabric filters) for particulate matter (fly ash) control, low-NO_X burners designed to reduce NO_X emissions, and caustic wet scrubbers (i.e., flue gas desulfurization, FGD) which use hydrated lime (calcium hydroxide, $Ca(OH)_2$) in solution to control SO_2 and acid gases via absorption. Commissioned in 2005, the FGD system consists of ten 100-foot tall absorber towers for reduction of SO_2 and acid gases to base salts (e.g., $CaSO_4$, $CaCl_2$). Mercury (Hg) is incidentally captured by the baghouses and FGD. During operation, boiler exhaust (flue gas) passes through the baghouses and then FGD before being released to the atmosphere via the auxiliary stacks, bypassing the original Units 4 and 5 stacks. The Units 4 and 5 baghouses trap over 99 percent of particulate matter and FGD removes approximately 90 percent of SO_2 from the flue gas.

The following summarizes stationary sources of emissions from the FCPP. For the representative 12-year[5] period 2000 to 2011, Table 4.1-5 shows historic plantwide generation (megawatt-hours per year), SO_2 and NO_X emissions (short tons per year), and emission rates (kilograms per megawatt-hour, same as grams per kilowatt-hour) from FCPP Units 1, 2, 3, 4, and 5, as reported to EPA pursuant to the CAA. Emissions of PM are estimated by applying EPA emission factors as noted.

Projected future emissions from FCPP and regional plants are estimated in Section 4.1.4 referencing the 7-year historic baseline period of 2005 to 2011 when FGD became active on Units 4 and 5. It is necessary to define this historic baseline period because FGD affects boiler performance by a small amount, mainly due to increased exhaust back-pressure. In turn, this affects turbine-generator output by a small amount. For analysis of future emissions impacts in Section 4.1.4, the continuing operation of Units 4 and 5 with FGD and SCR represents the future baseline condition of the Proposed Action.

In addition to criteria pollutants, HAP emissions from coal combustion are estimated in Section 4.1.3 based on historic operating data for Units 1, 2, 3, 4 and 5 and projected future utilization of Units 4 and 5 using EPA emission factors (EPA 2011a, 40 CFR 63 Subpart UUUUU).

Table 4.1-5 Historic Aggregated Part 75 Emissions - ORISPL 2442 Units 1, 2, 3, 4, and 5

	Generation	Sulfur Dioxide		Nitrogen Oxides		Particulate Matter	
Year	MW-hrs/yr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr
2000	16,109,134	38,332	2.16	46,513	2.62	2,107	0.12
2001	16,472,108	39,564	2.18	47,300	2.60	2,170	0.12
2002	14,768,989	32,847	2.02	41,577	2.55	1,972	0.12
2003	16,857,882	35,094	1.89	45,197	2.43	1,998	0.11
2004	16,134,118	20,943	1.18	40,742	2.29	1,964	0.11
2005	16,829,089	12,653	0.68	41,743	2.25	2,051	0.11
2006	17,162,615	15,192	0.80	44,649	2.36	2,040	0.11
2007	15,700,442	10,239	0.59	41,083	2.37	1,979	0.11
2008	15,821,299	10,398	0.60	40,311	2.31	1,969	0.11

[4] British Thermal Unit (BTU): the amount of heat required to raise the temperature of 1 pound of water 1°F, from 39 to 40°F
[5] The Title V recordkeeping requirement is 5 years.

Year	Generation	Sulfur Dioxide		Nitrogen Oxides		Particulate Matter	
	MW-hrs/yr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr
2009	16,804,764	12,450	0.67	42,511	2.29	2,030	0.11
2010	14,955,046	11,043	0.67	38,837	2.36	1,908	0.12
2011	15,066,283	11,822	0.71	38,712	2.33	1,852	0.11
Historic Baseline	16,048,505	11,971	0.68	41,121	2.32	1,976	0.11
Plantwide Share	100%	100%	–	100%	–	100%	–

Source: EPA 2012h

Notes:

PM calculated per AP-42 Chapter 1.1 support document Tables 4-7 and A-3; Title V permit condition (Units 1, 2, and 3); 40 CFR 49 final rule (Units 4 and 5)

Baseline period is 2005-11 (flue gas desulfurization, FGD, installed on Units 4 and 5)

Navajo Mine

No stationary sources are present at the Navajo Mine; therefore, this discussion is only applicable to the FCPP.

Transmission Lines

No stationary sources are present at any of the subject transmission lines; therefore, this discussion is only applicable to the FCPP.

4.1.2.4 Mobile Sources of Air Pollutants

While stationary sources such as power plants and oil refineries emit large quantities of criteria pollutants, mobile sources, due to their sheer numbers nationwide, also emit significant amounts. Mobile sources include onroad vehicles (e.g., automobiles, trucks, motorcycles), offroad equipment (e.g., earthmovers, cranes, portable pumps and generators), trains (e.g., freight, passenger, light rail), vessels (e.g., boats, ships, watercraft), and aircraft (e.g., general aviation, commercial, military). Mobile source fuels include gasoline, diesel, heavy fuel oil, and jet fuel, all of which emit NO_X, SO_2, CO, VOC, PM_{10}, and $PM_{2.5}$ when combusted, also HAPs.

Four Corners Power Plant

Mobile sources associated with FCPP include materials handling equipment, maintenance equipment, and support vehicles, as well as employee personal vehicles. Similar to the Navajo Mine, the dominant fuel used for mobile sources is diesel fuel and some gasoline. Emissions of fugitive dust occur through earthmoving activities and unpaved road travel within the FCPP lease area. Table 4.1-6 below displays estimated criteria emissions from mobile sources at FCPP.

Table 4.1-6 Estimated Criteria Emissions from FCPP Mobile Sources

Mobile Sources	VOC tons/yr	CO tons/yr	NO_X tons/yr	SO_X tons/yr	PM_{10} tons/yr	$PM_{2.5}$ tons/yr
Power Plant Offroad Equipment	0.31	3.69	2.05	0.004	0.13	0.11
Power Plant Onroad Vehicles	0.11	0.76	0.86	0.002	0.04	0.03
Annual Totals	**0.42**	**4.46**	**2.90**	**0.006**	**0.16**	**0.14**

Sources: APS 2012a, EPA 2011a, SCAQMD 2008

Note:

PM_{10} and $PM_{2.5}$ for exhaust only, fugitive dust accounted for in BNCC FONSI

Navajo Mine

All emissions from the Navajo Mine operations (within the Navajo Mine Permit Area) are considered mobile source emissions. Mobile sources associated with Navajo Mine operations include diesel-powered draglines, loaders, coal haul trucks, support vehicles, and explosives detonation. The dominant fuel used for mobile sources at Navajo Mine is diesel fuel, also referred to as distillate fuel oil no. 2, along with some gasoline. In addition to engine exhaust, emissions of fugitive dust, as PM_{10} and $PM_{2.5}$, is caused by earthmoving and unpaved road travel at primarily at Navajo Mine. Coarser particles (e.g., PM_{30}) also may be emitted from activities that disturb topsoil, such as overburden removal at the mine. Other localized sources include agriculture, construction, wind-blown dust, pollen, salts, brake dust, and tire wear. Fugitive dust is the largest component of mining emissions. Table 4.1-7 below summarizes these emissions.

Table 4.1-7 Estimated Criteria and DPM Emissions from Navajo Mine Operations

Mobile and Fugitive Sources	VOC tons/yr	CO tons/yr	NO_X tons/yr	SO_X tons/yr	PM_{10} tons/yr	$PM_{2.5}$ tons/yr	DPM tons/yr
Overburden Drilling and Blasting	—	19.67	4.99	0.59	3.36	0.97	—
Coal Seam Drilling and Blasting	—	241.96	61.39	7.22	4.82	1.40	—
Overburden Dragline Stripping	—	—	—	—	62.96	5.56	—
Mine Extraction Operations and Loading	15.44	65.57	141.75	0.20	183.59	20.58	5.11
Coal Hauling Trucks to Stockpiles	14.16	68.08	125.40	0.18	276.47	27.65	5.31
Mining Support Vehicle Travel	3.36	9.91	33.73	0.05	180.73	18.07	0.77
Unloading at Stockpiles and Railcar Loading	—	—	—	—	0.71	0.22	—
Reclamation	—	—	—	—	124.50	24.90	—
Coal Preparation Plant (except stockpile)	—	—	—	—	13.89	4.05	—
Wind Erosion (coal and spoils piles)	—	—	—	—	58.82	21.03	—
Annual Totals	32.96	405.19	367.26	8.23	909.85	124.43	11.20

Source: OSMRE 2012b

Notes:

SO_X emissions estimated from FONSI supporting data

PM_{10} and $PM_{2.5}$ includes exhaust and fugitive dust as determined in FONSI

For diesels, DPM estimated as 7.8% of CO emissions per offroad emissions factors (SCAQMD 2008)

As shown in Table 4.1-7, mining mobile and fugitive source NO_X emissions are a small fraction of FCPP stack emissions, about 370 tons per year (OSMRE 2012a, APS 2012a). As FCPP baseline NO_X emissions are about 41,100 tons per year, mining mobile and fugitive sources represent only 0.9 percent of total NO_X emissions from the combined operations. Also as shown in the table, mining mobile and fugitive source PM_{10} emissions are about 910 tons per year and FCPP baseline PM_{10} emissions are about 1,980 tons per year.

Transmission Line Mobile Sources

Mobile source emissions associated with transmission line maintenance are included with FCPP offroad equipment and onroad vehicle usage shown in Table 4.1-6 and represent a very small fraction of overall emissions.

Hazardous Air Pollutants

Coal combustion in power plant boilers emits a wide variety of inorganic and organic HAPs. Tables 4.1-8 and 4.1-9 show estimated average annual HAP emissions from FCPP based on historic (pre-Project) operating data prior to implementation of 40 CFR 63 Subpart UUUUU for Units 1, 2, 3, 4, and 5.

Table 4.1-8 Estimated Historic HAP Metals Emissions - ORISPL 2442

HAP (Metals)	2000-11 Units 1 – 5 Average lbs/yr
Antimony (Sb)	156
Arsenic (As)	3,552
Beryllium (Be)	182
Cadmium (Cd)	442
Chromium (Cr)	2,252
Cobalt (Co)	866
Copper (Cu)	4,938
Lead (Pb)	3,639
Manganese (Mn)	4,245
Mercury (Hg)	719
Nickel (Ni)	2,426
Selenium (Se)	11,262
Average FCPP Generation (MW-hrs/yr)	**16,056,814**

Table 4.1-9 Estimated Historic HAP Nonmetals Emissions - ORISPL 2442

HAP (Organics and Inorganics)	2000-11 Units 1 – 5 Average lbs/yr
Acetaldehyde	4,938
Acetophenone	130
Acrolein	2,512
Benzene	11,262
Benzyl chloride	6,064
Bis (2-ethylhexyl)phthalate (DEHP)	632
Carbon disulfide	1,126
Chlorobenzene	191
Chloroform	511
Cyanide	21,659
2,4-Dinitrotoluene	2
Ethyl benzene	814
Ethyl chloride	364
Formaldehyde	2,079
Hexane	580
Hydrogen chloride	10,396,140
Hydrogen fluoride	1,299,518
Isophorone	5,025
Methyl bromide	1,386
Methyl chloride	4,592
Methyl ethyl ketone	3,379
Methylene chloride	2,512
PAHs (composite total)	180
Phenol	139
Propionaldehyde	3,292
Tetrachloroethylene	373
Toluene	2,079
Styrene	217
Xylenes (o,m,p)	321
Average Generation (MW-hrs/yr)	**16,056,814**

4.1.2.5 Visibility / Regional Haze

Regional haze is visibility impairment caused by multiple sources and activities which emit fine particles and their precursors and which are located across a broad geographic area. In 1980, when adopting the initial visibility protection provisions of the CAA, Congress specifically recognized that the ''visibility problem is caused primarily by emission into the atmosphere of SO_2, NO_X, and particulate matter (PM), especially fine particulate matter ($PM_{2.5}$), from inadequately controlled sources.'' Fine particulate matter such as sulfates, nitrates, organic carbon, elemental carbon, and soil dust impairs visibility by scattering and absorbing sunlight, can cause health effects and increase mortality in humans, and contributes to environmental effects such as acid deposition (acid rain) and eutrophication (depletion of oxygen in lakes and ponds) (64 FR 35714).

Visibility has been defined as "the greatest distance at which an observer can just see a black object viewed against the horizon sky." An object is usually referred to as at "threshold contrast" when the difference between the brightness of the sky and the brightness of the object is reduced to such a degree that an observer can just barely see the object. Visibility is closely associated with conditions that allow appreciation of landscape features, which is especially true in the desert southwest, where recognition and appreciation of the form, contrast detail, and color of near and distant features is valued by society (CIRA 1999).

Visibility degradation is caused by diffraction, refraction, phase-shift, and absorption of light by atmospheric particles, aerosols, and gases that are nearly the same size as the wavelengths of the visible light spectrum. Without the effects of anthropogenic (caused by human activity) air pollution, maximum natural visual range in the western United States is about 120 miles (180 km) and about 80 miles (110 km) in the east. Sulfates, including ammonium sulfate, comprise about 70 percent of visibility impacts in the east and about 30 percent in the west. Due to photochemistry, the visibility impacts of nitrates tend to be highest during the winter (less sunlight) and lowest during the summer (more sunlight) (CIRA 1999).

Sulfates and nitrates resulting from SO_2 and NO_X emissions also contribute to visibility impairment. Sulfates, including ammonium sulfate, comprise about 70 percent of visibility impacts in the East and about 30 percent in the West. Due to photochemistry, the visibility impacts of nitrates tend to be highest during the winter and lowest during the summer. In the West, nitrates and carbon are factors, but sulfates have been implicated as a cause of visibility impairment in many of the Colorado River Plateau national parks, including the Grand Canyon, Canyonlands, and Bryce Canyon (EPA 2013c, CIRA 1999).

The role of regional transport of fine particles and aerosols which contribute to elevated PM levels and regional haze impairment has been well-documented through decades of research. Data from the Interagency Monitoring of Protected Visual Environments (IMPROVE) network (described below) shows that chronic visibility impairment occurs at most national park, national monument, and wilderness area monitoring sites in the west. Average visual range in many Class I areas in the West is 60 to 90 miles (100 to 150 km) equivalent to 13.6 to 9.6 deciviews,[6] or about 50 to 70 percent of the visual range that would exist without anthropogenic air pollution from stationary and mobile sources (64 FR 35714). Table 4.1-10 through 4.1-16 provide historic ozone and ozone precursor levels in the Four Corners Region. Table 4.1-17a shows trends in regional visibility over the same time period.

[6] One deciview represents the minimal perceptible change in visibility to the human eye and is proportional to the logarithm of the light extinction coefficient. As such, it is linear with respect to perceived visual changes over its entire range, analogous to the decibel scale for sound. A 1 dv change represents about a 10 percent change in the extinction coefficient. The higher the deciview value, the poorer the visibility.

Table 4.1-10 Historic Ozone Trends

Site ID Code	Averaging Time	Standard (ppbv)	Measured Values by Year (all units ppbv)													3-Year Trend	Meet Std.
			1990s	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
35-45-0009	8-hour 4th max	75	—	79	74	76	73	68	75	63	69	63	52	65	66	61	Yes
	1-hour 1st max	—	—	96	94	91	89	78	87	79	80	76	60	77	77	77	—
35-45-0018	8-hour 4th max	75	—	—	—	—	—	—	—	79	79	69	62	69	74	68	Yes
	1-hour 1st max	—	—	—	—	—	—	—	—	104	94	83	75	80	90	90	—
35-45-1005	8-hour 4th max	75	—	80	74	75	75	69	72	71	73	69	59	63	68	63	Yes
	1-hour 1st max	—	—	93	87	87	91	80	88	93	86	82	69	80	75	80	—
35-45-1233	8-hour 4th max	75	—	—	—	—	—	—	—	—	—	—	—	185	63	—	—
	1-hour 1st max	—	—	—	—	—	—	—	—	—	—	—	—	422	79	—	—
08-67-1004	8-hour 4th max	75	—	—	—	—	—	67	75	74	69	69	71	74	77	74	Yes
	1-hour 1st max	—	—	—	—	—	—	86	91	92	79	81	93	83	86	93	—
08-67-7001	8-hour 4th max	75	—	63	52	60	62	63	—	—	58	67	65	68	72	68	Yes
	1-hour 1st max	—	—	77	68	69	75	77	—	—	77	78	76	77	90	90	—
08-67-7002	8-hour 4th max	75	69	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	1-hour 1st max	—	82	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Site ID Code	Averaging Time	Standard (ppbv)	Measured Values by Year (all units ppbv)													3-Year Trend	Meet Std.
			1990s	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
08-67-7003	8-hour 4th max	75	—	61	51	55	60	60	66	63	71	67	66	67	69	67	Yes
	1-hour 1st max	—	—	85	66	75	70	68	77	92	86	80	78	83	88	88	—
08-83-0006	8-hour 4th max	75	—	—	—	—	—	—	—	—	—	64	64	64	71	66	Yes
	1-hour 1st max	—	—	—	—	—	—	—	—	—	—	78	77	88	86	88	—
08-83-0101	8-hour 4th max	75	—	73	65	70	67	69	76	74	70	69	69	66	70	68	Yes
	1-hour 1st max	—	—	96	77	80	88	80	88	94	77	75	81	87	81	87	—

Sources: EPA 2012e, EPA 2012f.

Notes:

Standards are 2012 NAAQS; 1990s data are 1994 (08-67-7002); 8-hour trend is 3-year average of most recent data (4th highest daily maximum); 1-hour trend is 3-year maximum of most recent data (1st highest daily maximum); Site 35-45-1233 certification is not required, or the state [or tribe] has not certified to the EPA that the underlying raw data are complete and accurate

Table 4.1-11 Historic Nitrogen Dioxide Trends

Site ID Code	Averaging Time	Standard (ppbv)	Measured Values by Year (all units ppbv)													3-Year Trend	Meet Std.
			1990s	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
35-45-0009	1-hour	100	—	39	41	45	44	41	39	43	45	44	36	41	44	40	Yes
	Annual Mean	53	—	24	25	29	26	25	25	28	30	27	27	27	26	27	Yes
35-45-0014	1-hour	100	49	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Annual Mean	53	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35-45-0018	1-hour	100	—	—	—	—	—	—	49	45	47	37	40	37	40	39	Yes
	Annual Mean	53	—	—	—	—	—	—	34	25	23	21	20	21	20	20	Yes
35-45-1005	1-hour	100	—	44	42	41	55	40	39	59	44	35	35	40	36	37	Yes
	Annual Mean	53	—	22	22	22	25	21	22	27	24	19	18	20	19	19	Yes
35-45-1233	1-hour	100	—	—	—	—	—	—	—	—	—	—	—	32	34	—	—
	Annual Mean	53	—	—	—	—	—	—	—	—	—	—	—	16	18	—	—
08-67-1004	1-hour	100	—	—	—	—	—	14	18	17	19	13	16	16	21	18	Yes
	Annual Mean	53	—	—	—	—	—	5	5	5	5	5	5	5	5	5	Yes
08-67-7001	1-hour	100	—	27	30	19	30	14	29	26	35	30	47	35	33	38	Yes
	Annual Mean	53	—	22	22	22	25	21	22	27	24	19	18	20	19	19	Yes

Site ID Code	Averaging Time	Standard (ppbv)	Measured Values by Year (all units ppbv)													3-Year Trend	Meet Std.
			1990s	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
08-67-7002	1-hour	100	23	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Annual Mean	53	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—
08-67-7003	1-hour	100	—	38	45	39	42	37	41	40	42	37	37	39	38	38	Yes
	Annual Mean	53	—	18	18	18	19	19	19	18	17	16	16	14	15	15	Yes

Sources: EPA 2012e, EPA 2012f

Notes:

Standards are 2012 NAAQS; 1990s data are 1994 (35-45-0014) (08-67-7002); 1-hour trend is 3-year average of most recent data (98th percentile); Annual trend is 3-year average of most recent data (annual mean)

Table 4.1-12 Historic Sulfur Dioxide Trends

Site ID Code	Averaging Time	Standard (ppbv)	Measured Values by Year (all units ppbv)													3-Year Trend	Meet Std.
			1990s	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
35-45-0008	1-hour	75	—	37	30	28	31	—	—	—	—	—	—	—	—	30	Yes
	3-hour	500	—	26	31	56	21	—	—	—	—	—	—	—	—	56	Yes
35-45-0009	1-hour	75	—	23	30	20	18	22	18	15	5	4	5	6	9	7	Yes
	3-hour	500	—	19	24	36	17	26	20	13	4	4	5	4	8	8	Yes
35-45-0014	1-hour	75	141	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	3-hour	500	130	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35-45-0017	1-hour	75	78	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	3-hour	500	32	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35-45-1005	1-hour	75	—	182	86	73	96	78	82	74	75	20	25	14	20	20	Yes
	3-hour	500	—	144	58	61	90	58	124	45	83	16	20	10	37	37	Yes
35-45-1233	1-hour	75	—	—	—	—	—	—	—	—	—	—	—	163	136	—	—
	3-hour	500	—	—	—	—	—	—	—	—	—	—	—	175	54	—	—

Sources: EPA 2012e, EPA 2012f

Notes:

Standards are 2012 NAAQS

1990s data are 1994 (35-45-0014) and 1998 (35-45-0017)

1-hour trend is 3-year average of most recent data (99th percentile)

3-hour trend is 3-year maximum of most recent data (not to be exceeded)

Site 35-45-1233 certification is not required, or the state [or tribe] has not certified to the EPA that the underlying raw data are complete and accurate

Table 4.1-13 Historic Carbon Monoxide Trends

Site ID Code	Averaging Time	Standard (ppmv)	Measured Values by Year (all units ppmv)													3-Year Trend	Meet Std.
			1990s	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
35-45-0006	1-hour	35	—	5.4	—	—	—	—	—	—	—	—	—	—	—	—	—
	8-hour	9	—	1.9	—	—	—	—	—	—	—	—	—	—	—	—	—
08-67-7001	1-hour	35	—	—	—	—	—	2.5	1.8	1.2	1.7	1.5	1.4	1.2	1.4	1.4	Yes
	8-hour	9	—	—	—	—	—	1.6	1.6	0.8	1.3	1.0	0.9	0.7	0.7	0.9	Yes

Sources: EPA 2012e, EPA 2012f

Notes:

Standards are 2012 NAAQS; 1-hour trend is 3-year maximum of most recent data (not to be exceeded); 8-hour trend is 3-year maximum of most recent data (not to be exceeded)

Table 4.1-14 Historic Respirable Particulate (PM_{10}) Trends

Site ID Code	Averaging Time	Standard (μg/m³)	Measured Values by Year (all units μg/m³)													3-Year Trend	Meet Std.
			1990s	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
35-45-0006	24-hour bulk average	150	—	27	30	41	57	28	42	41	30	116	—	—	—	116	Yes
	24-hour composite	150	—	24	26	34	49	23	39	37	27	102	—	—	—	102	Yes
35-45-0017	24-hour bulk average	150	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	24-hour composite	150	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35-45-0019	24-hour bulk average	150	—	—	—	—	—	—	—	—	—	22	73	22	38	73	Yes
	24-hour composite	150	—	—	—	—	—	—	—	—	—	19	61	18	32	61	Yes
35-45-1233	24-hour bulk average	150	—	—	—	—	—	—	—	—	—	—	—	56	61	—	—
	24-hour composite	150	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
08-67-7001	24-hour bulk average	150	—	—	—	18	94	31	37	24	—	—	—	—	—	37	Yes
	24-hour composite	150	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Site ID Code	Averaging Time	Standard (μg/m^3)	Measured Values by Year (all units μg/m^3)													3-Year Trend	Meet Std.
			1990s	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
08-67-7003	24-hour bulk average	150	—	—	—	109	88	26	40	24	—	—	—	—	—	40	Yes
	24-hour composite	150	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
08-83-9000	24-hour bulk average	150	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	24-hour composite	150	29	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sources: EPA 2012e, EPA 2012f. Notes: Standards are 2012 NAAQS; 1990s data are 1998 (35-45-0017); 24-hour trend is 3-year maximum of most recent data (not to be exceeded)

Table 4.1-15 Historic Fine Particulate ($PM_{2.5}$) Trends

Site ID Code	Averaging Time	Standard (μg/m³)	Measured Values by Year (all units μg/m³)													3-Year Trend	Meet Std.
			1990s	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
35-45-0006	24-hour composite	35	—	12.9	14.3	16.8	13.4	13.2	11.3	11.5	14.9	14.4	—	—	—	13.6	Yes
	Annual Mean	12	—	6.0	6.0	6.9	6.7	6.1	5.5	6.1	6.0	5.9	—	—	—	6.0	Yes
35-45-0018	24-hour composite	35	—	—	—	—	—	—	4.4	6.3	9.0	7.3	7.6	12.0	10.6	10.1	Yes
	Annual Mean	12	—	—	—	—	—	—	2.1	2.4	4.5	3.3	2.5	3.0	2.7	2.7	Yes
35-45-0019	24-hour composite	35	—	—	—	—	—	—	—	—	—	9.7	10.4	18.0	12.0	13.5	Yes
	Annual Mean	12	—	—	—	—	—	—	—	—	—	4.3	4.4	4.8	4.2	4.5	Yes
08-67-7001	24-hour composite	35	—	—	—	—	—	—	—	—	—	—	8.6	7.6	10.0	8.7	Yes
	Annual Mean	12	—	—	—	—	—	—	—	—	—	—	4.4	4.1	4.3	4.3	Yes
08-67-7003	24-hour composite	35	—	—	—	—	—	—	—	—	—	—	11.8	11.1	12.1	11.7	Yes
	Annual Mean	12	—	—	—	—	—	—	—	—	—	—	4.2	4.3	4.6	4.4	Yes
08-83-0006	24-hour composite	35	—	—	—	—	—	—	—	—	—	25.3	15.0	13.3	14.8	14.4	Yes
	Annual Mean	12	—	—	—	—	—	—	—	—	—	6.1	6.8	5.9	6.1	6.3	Yes
08-83-9000	24-hour composite	35	10.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Annual Mean	12	3.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sources: EPA 2012e, EPA 2012f

Notes:

Standards are 2012 NAAQS; 1990s data are 1995 (08-83-9000); 24-hour trend is 3-year average of most recent data (98th percentile); Annual trend is 3-year average of most recent data (annual mean)

Table 4.1-16 TSP / Lead / Sulfate

Site ID Code	Averaging Time	TSP µg/m^3	Pb µg/m^3	SO_4 µg/m^3
08-83-0005	24-hour average	45	0.02	7.3
	Standard	150	0.15	—
	Meet Standard	Yes	Yes	—

Sources: EPA 2012e, EPA 2012f

Notes:

Standards are 2012 NAAQS

Data are 1996 (08-83-0005)

Table 4.1-17a Historic Composite Visibility - 10 IMPROVE Sites

Year	Lowest 20% of Days		Highest 20% of Days		Average of all Days	
	Mean dV	Median dV	Mean dV	Median dV	Mean dV	Median dV
2000	3.46	3.45	11.88	11.21	7.39	7.03
2001	3.46	3.62	10.67	10.90	7.02	7.07
2002	3.47	3.73	12.25	11.95	7.47	7.34
2003	3.36	3.22	12.67	12.25	7.44	6.80
2004	3.27	3.72	10.35	10.40	6.70	6.68
2005	2.60	2.59	11.66	11.93	6.85	6.85
2006	3.11	2.89	10.73	10.88	6.77	6.77
2007	2.95	3.09	11.18	11.20	6.92	7.09
2008	2.48	2.60	10.88	11.07	6.59	6.65
2009	2.63	2.86	11.01	10.91	6.40	6.55
2010	2.31	2.27	9.89	9.68	5.93	5.92
11-Year Trend Change	**-1.18**	**-1.22**	**-1.40**	**-1.08**	**-1.22**	**-0.82**
Relative Improvement	**33%**	**33%**	**12%**	**9%**	**16%**	**11%**

Source: CSU 2013b.

Notes:

Aggregated data for 10 sites: BAND1, CANY1, CAPI1, GRCA2, GRSA1, MEVE1, PEFO1, SAPE1, WEMI1, WHPE1; Missing data substituted by interpolation (11 of 110 sets); Change and improvement calculated on linear trend basis

Table 4.1-17b Historic Visibility - 10 IMPROVE Sites

National Park or Wilderness (NPS code)	dV Lowest 20% of Days	dV Highest 20% of Days	dV Average of all Days
Bandelier National Monument (BAND1)	4.45	11.82	7.87
Canyonlands National Park (CANY1)	3.21	11.08	6.82
Capitol Reef National Park (CAPI1	2.88	10.66	6.57
Grand Canyon National Park (GRCA2)	2.12	11.62	6.54
Great Sand Dunes National Park (GRSA1)	3.97	11.90	7.71
Mesa Verde National Park (MEVE1)	3.66	12.11	7.44
Petrified Forest National Park (PEFO1)	4.76	12.96	8.52
San Pedro Parks Wilderness (SAPE1)	1.17	9.86	5.50
Weminuche Wilderness (WEMI1)	2.63	10.10	6.16
Wheeler Peak Wilderness (WHPE1)	1.03	9.68	5.31

Source: CSU 2013b.

Visibility conditions are presented by individual park or wilderness in Table 4.1-17b to show how conditions vary geographically. The trends shown on Table 4.1-17a are represented graphically on Figure 4.1-3. As can been seen in the graphic, deciviews have steadily decreased; thus, regional visibility has improved during the 11-year period, apparently due to improved control of air pollution from sources such as power plants. Thus, progress is apparent toward the future goal of the Regional Haze Rule, i.e., achieving natural conditions by 2060.

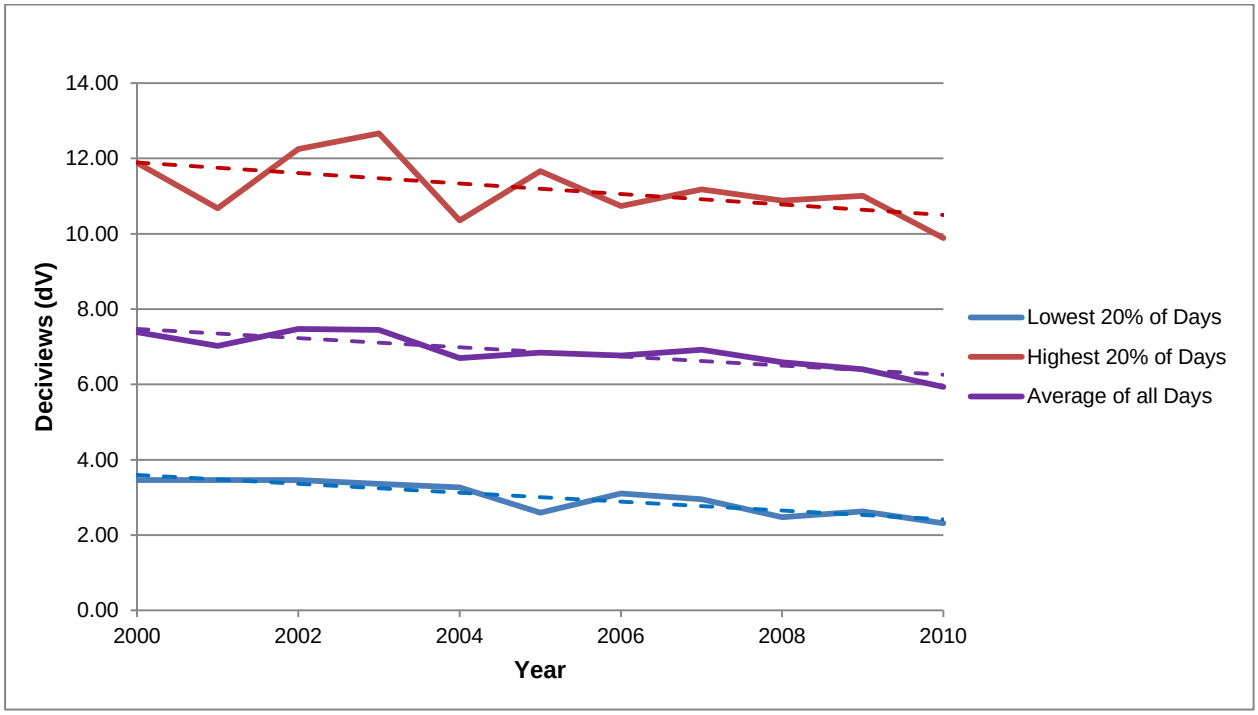

Figure 4.1-3 Historic Composite Visibility Trend

Four Corners Air Quality Study

In 2009, the NMED Air Quality Bureau released the *Air Quality Modeling Study for the Four Corners Region* (NMED 2009). The main study was conducted during the latter half of 2007 in response to concerns about the air quality impacts of growth comprising many types of sources, especially the oil and gas industry and electric power generation, on Class I and surrounding Class II areas in the Four Corners region. The speculative study examined five conceptual emissions mitigation scenarios that could be implemented in the future with the aim of halting further deterioration of regional air quality and possibly improving it.

The NMED, in coordination with the Colorado Department of Public Health and Environment, convened the Four Corners Air Quality Task Force comprised of states, tribes, Federal land managers and other stakeholders to develop strategies for air quality management in the region. As part of the effort, the Four Corners Air Quality Task Force identified the need to model the air quality impacts of various proposed mitigation strategies being developed by Task Force working groups. Estimates of mitigation scenario effects on ozone, particulate matter, visibility (regional haze), and atmospheric deposition (acid rain, metals) were needed. In addition, peak ozone and visibility impacts in the Mesa Verde, San Pedro Parks, and Weminuche Class I areas and surrounding Class II areas were of primary interest. In response to these requirements, NMED conducted a comprehensive atmospheric modeling study.

As a result, a high resolution (4 x 4 km [2.5 x 2.5 mile] horizontal grid cell size) regional scale dispersion model of the Four Corners region was developed. This effort produced a regional air quality planning tool which can be used to evaluate impacts of both future development projects and alternative emission

reduction strategies. Results of the modeling study are intended to inform the direction of future air quality management efforts in the Four Corners region.

An updated emissions inventory for 2005 and a projected inventory for 2018 were developed for use in this study. Inventories previously developed for the Western Regional Air Partnership were used as the main starting points for these inventories. The 2005 and 2018 inventories comprised emissions from electric power generation, oil and gas exploration and production, other proximate anthropogenic sources, along with applicable mobile source, fugitive dust, biogenic, and wildfire emissions. The resulting model-ready emissions were used to estimate the air quality impacts of five alternative mitigation scenarios focused on various combinations of emissions reductions from electric power generation and oil and gas activities in the Four Corners region.

Emissions in the CAMx model changed very little overall between the 2005 base case and the 2018 base case; the ozone results are nearly identical. Annual fourth-highest daily maximum 8-hour average ozone values predicted show either no change or a decline of 1 or 2 ppb in the fourth-highest modeled daily maximum 8-hour ozone concentrations at most locations. Results of an ozone source apportionment analysis performed on the 2018 base case scenario showed that local oil & gas and electric generating unit (EGU) sources are the biggest contributors to local ozone episodes.

Ozone concentrations predicted under the 2018 base case with each of five mitigation scenarios were compared for two key months; April (when high ozone is predicted at higher elevations in the San Juan and other mountain ranges) and July (when high ozone is predicted at lower elevations). Time series of hourly predicted ozone show that ozone reductions under the mitigation scenarios are generally less than 5 ppb. Some increases in ozone are evident during some off-peak hours due to negative benefits of NO_x reductions under VOC limited conditions. Seasonal differences showed that the higher ozone values observed during the late spring are more heavily influenced by precursor sources and ozone transport from outside the 4 km domain, compared to summer values.

The five emissions mitigation scenarios focused on EGU and oil and gas sources in the Four Corners area. Results in the 2018 base case inventory included a 70% NO_x reduction and a 16% SO_2 reduction from local (i.e., 4 km domain) EGU sources as well as an approximate 50% VOC reduction and a 16% NO_x reduction from local oil and gas sources. EGU and oil & gas together account for 75% of 4 km domain NO_x emissions (oil and gas alone accounts for 37% of 4 km domain NO_x emissions) and 33% of 4 km domain VOC emissions. Thus, the combined EGU and oil and gas NO_x controls considered here amount to roughly a 50% reduction in local NO_x emissions and a 16% reduction in local VOC emissions. These mitigation scenarios resulted in peak predicted ozone changes generally limited to less than about 5 ppb.

A combination of VOC and NOx controls on oil and gas sources is more effective at reducing ozone than VOC or NOx controls alone. There also appears to be a synergistic effect resulting in enhanced ozone reduction when the EGU controls are combined with the oil and gas controls: EGU controls alone result in inconsistent reductions from day to day depending on meteorological conditions but combining them with the oil and gas controls appears to put a “floor” under the reductions resulting in larger and more consistent reductions.

4.1.2.6 Atmospheric Deposition / Acid Rain

Atmospheric deposition transfers air pollutants such as NO_X, SO_2, and mercury (Hg) from the air to the earth’s surface and affects water quality due to precipitation runoff into waterbodies. Nitrogen compounds such as ammonia (NH_3) contribute to nutrient over-enrichment (i.e., algae blooms) which can result in oxygen depleted areas known as “dead zones,” where fish and other organisms cannot survive. Once in water, mercury becomes concentrated in fish and can harm the health of individuals who consume these fish, particularly children. Further, acid rain threatens certain aquatic ecosystems, especially in high-altitude mountain lakes and streams with limited buffering capacity (EPA 2013c, GAO 2013).

Nitrogen oxides react with moisture and oxygen in the atmosphere to form nitric acid (HNO_3), nitrates (NO_3^-), and nitrites (NO_2^-) while sulfur dioxide reacts to form sulfuric acid (H_2SO_4), sulfates (SO_4^{2-}), and sulfites (SO_3^{2-}). Other inorganic pollutants include ammonium ion (NH_4^+), chloride ion (Cl^-), light metals such as beryllium (Be), calcium (Ca), magnesium (Mg), potassium (K), and sodium (Na), and heavy metals such as antimony (Sb), arsenic (As), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni), and selenium (Se). Organic pollutants can include polychlorinated biphenyls (PCBs) and PAHs, both of which are carcinogenic, along with some metals listed above.

The term “acid rain” is a broad reference to mixtures of wet and dry deposition containing higher than normal amounts of sulfuric and nitric acids. The main anthropogenic precursors of acid rain are SO_2 and NO_X emissions from fossil fuel combustion. In the United States, about 67 percent of all SO_2 and about 25 percent all NO_X is emitted from fossil fuel electric power generation, in particular, coal-fired power plants. Acid rain occurs when these gases react (hydrolyze) in the atmosphere with water, oxygen, and other chemicals to form a weak solution of sulfuric and nitric acids, typically pH[7] 3 to 5. When SO_2 and NO_X are released from power plant stacks and other sources, prevailing winds transport these compounds across state and national borders, sometimes over hundreds of miles, resulting in environmental impacts far away from the pollution source. Acid rain causes acidification of lakes and streams and contributes to damage to trees and many sensitive forest soils. It also accelerates the decay of building materials and paints, including irreplaceable buildings, statues, and sculptures which are part of the national cultural heritage (EPA 2013c).

The EPA and National Acid Deposition Program (NADP) operate nationwide networks of deposition-oriented monitoring sites. Sites in the vicinity of the Project area are listed in Table 4.1-18 and shown on Figure 4.1-4. Descriptions of applicable monitoring projects are provided in Appendix A.

CASTNET Data

For the historic 12-year period from 2000 through 2011, Tables 4.1-19a (metric units) and 4.1-19b (English units) show measured precipitation, wet and dry ammonium (NH_4^+), wet and dry nitrate (NO_3^-), wet and dry sulfate (SO_4^{2-}), dry nitric acid (HNO_3), and dry sulfur dioxide (SO_2) as reported by CASTNET for cumulative annual periods (EPA 2013e). Precipitation units are depth in centimeters (cm) and inches (in); deposition units are mass per unit area in kilograms per hectare (kg/ha) and pounds per acre (lb/acre).

Table 4.1-20 shows total nitrogen compounds and total sulfur compounds deposition rates versus annual precipitation amounts. Total deposition is expressed two ways, absolute in units of kilograms per hectare (kg/ha) and normalized in units of kilograms per hectare per decimeter precipitation (kg/ha-dm).

[7] pH is defined as the negative (base 10) logarithm of the hydrogen ion concentration (moles per liter). For example, if $[H^+]$ = 0.0001 moles/liter, then pH = 4.

Table 4.1-18 Deposition Monitoring Sites - Four Corners Region and Vicinity

Site ID Code	Network	State	Location / Site Name	Elevation MSL		North Latitude	West Longitude	Monitoring Start Date
				meters	feet			
GRC474	CASTNET	Arizona	Grand Canyon National Park	2,073	6,801	36.0597	-112.1822	5/16/1989
PET427	CASTNET	Arizona	Petrified Forest National Park	1,723	5,653	34.8225	-109.8919	9/12/2002
MEV405	CASTNET	Colorado	Mesa Verde National Park	2,165	7,103	37.1983	-108.4903	1/1/1995
CAN407	CASTNET	Utah	Canyonlands National Park	1,809	5,935	38.4586	-109.8211	1/1/1995
AZ03	NTN	Arizona	Grand Canyon National Park	2,071	6,795	36.0586	-112.1840	8/11/1981
AZ97	NTN	Arizona	Petrified Forest National Park	1,707	5,600	34.8224	-109.8925	12/3/2002
CO00	NTN	Colorado	Alamosa	2,285	7,497	37.4421	-105.8680	4/22/1980
CO91	NTN	Colorado	Wolf Creek Pass[1]	3,287	10,784	37.4686	-106.7870	5/26/1992
CO96	NTN	Colorado	Molas Pass[1]	3,248	10,656	37.7500	-107.6890	7/29/1986
CO99	NTN	Colorado	Mesa Verde National Park	2,162	7,093	37.1979	-108.4910	4/28/1981
NM07	NTN	New Mexico	Bandelier National Monument	1,997	6,552	35.7788	-106.2660	6/22/1982
UT09	NTN	Utah	Canyonlands National Park	1,797	5,896	38.4584	-109.8210	11/11/1997
UT98	NTN	Utah	Green River	1,256	4,121	39.0010	-110.1740	4/25/1985
UT99	NTN	Utah	Bryce Canyon National Park[2]	2,477	8,127	37.6186	-112.1728	1/29/1985
AZ02	MDN	Arizona	Sycamore Canyon Wilderness[3]	2,046	6,713	35.1406	-111.9692	2/28/2006
CO96	MDN	Colorado	Molas Pass[4]	3,248	10,656	37.7500	-107.6890	6/30/2009
CO99	MDN	Colorado	Mesa Verde National Park	2,162	7,093	37.1979	-108.4910	12/26/2001
NM98	MDN	New Mexico	Navajo Lake	1,972	6,470	36.8097	-107.6515	4/21/2009
NM98	AMoN	New Mexico	Navajo Lake	1,972	6,470	36.8097	-107.6515	1/11/2008
NM99	AMoN	New Mexico	Farmington	1,634	5,361	36.7358	-108.2380	1/9/2008

Sources: EPA 2013e, NADP 2013

Notes:

[1] Indicates location is nondesert characteristic (mountains), data not used due to sufficient characteristic sites

[2] Indicates location is outside 300-km radius of FCPP, data not used due to sufficient characteristic sites

[3] Indicates location is outside 300-km radius of FCPP, data used due to insufficient characteristic sites

[4] Indicates location is nondesert characteristic (mountains), data used due to insufficient characteristic sites

AMoN = Ammonia Monitoring Network (NADP)

CASTNET = Clean Air Status and Trends Network (EPA)

MDN = Mercury Deposition Network (NADP). MDN Site NM98 Navajo Lake closed 9/25/12; remains active as AMoN site NM98

NTN = National Trends Network (NADP)

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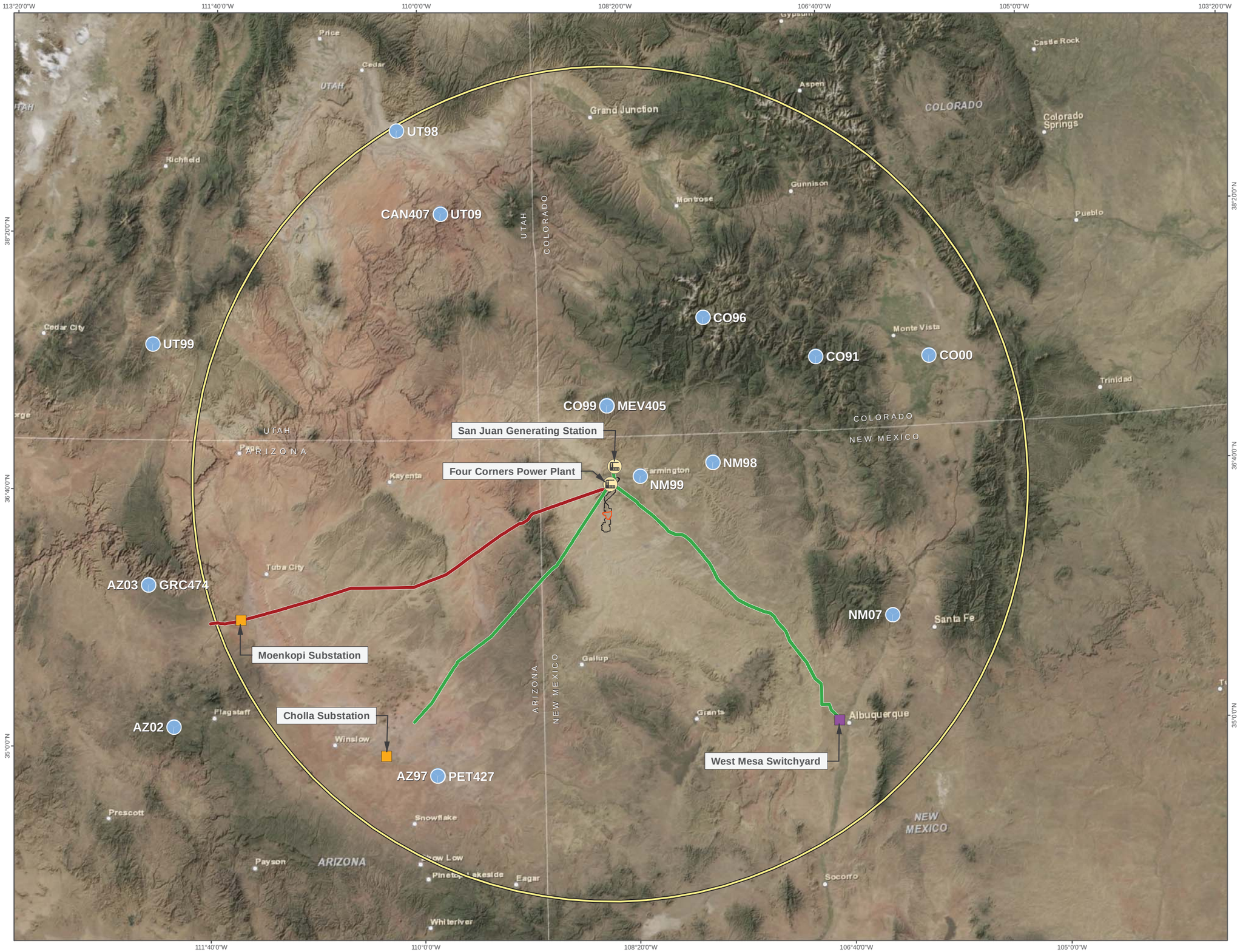

Four Corners Power Plant
and Navajo Mine Energy Project

ENVIRONMENTAL SETTING
& CONSEQUENCES

Figure 4.1-4

Deposition Monitoring Sites

PROJECT FACILITIES

- Power Plant
- Substation
- Switchyard

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Proposed Pinabete Permit Boundary
- Four Corners Power Plant 300km Buffer

TRANSMISSION LINES

- 345kV
- 500kV

AIR QUALITY FEATURES

- Deposition Monitoring Sites

N

0 30 60
Scale in Miles

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Table 4.1-19a Historic Speciated Deposition - 4 CASTNET Sites (metric units)

Year	Precip cm	Wet NH_4 kg/ha	Wet NO_3 kg/ha	Dry HNO_3 kg/ha	Dry NO_3 kg/ha	Dry NH_4 kg/ha	Wet SO_4 kg/ha	Dry SO_2 kg/ha	Dry SO_4 kg/ha
2000	23.6	0.34	0.68	0.89	0.03	0.12	0.58	0.12	0.14
2001	27.0	0.40	0.71	0.85	0.03	0.12	0.64	0.12	0.15
2002	19.2	0.48	0.53	0.89	0.04	0.11	0.50	0.11	0.13
2003	21.8	0.39	0.53	0.97	0.03	0.11	0.41	0.22	0.13
2004	31.1	0.68	0.78	0.91	0.04	0.11	0.79	0.21	0.14
2005	36.4	0.58	0.70	0.92	0.03	0.12	0.73	0.21	0.15
2006	28.9	0.64	0.77	0.92	0.03	0.10	0.68	0.21	0.13
2007	29.8	0.49	0.70	0.96	0.04	0.12	0.57	0.24	0.14
2008	30.2	0.42	0.59	0.78	0.03	0.11	0.48	0.15	0.14
2009	22.1	0.50	0.54	0.68	0.03	0.10	0.66	0.11	0.12
2010	44.5	0.83	0.90	0.64	0.03	0.09	0.75	0.11	0.11
2011	32.4	0.67	0.76	0.63	0.03	0.10	0.69	0.10	0.12
Mean	28.9	0.54	0.68	0.84	0.03	0.11	0.62	0.16	0.13
Median	29.3	0.49	0.70	0.89	0.03	0.11	0.65	0.13	0.14
Cumulative	347.0	6.42	8.20	10.03	0.40	1.31	7.49	1.89	1.60

Source: EPA 2013e

Notes:

Aggregated data for 4 sites: CAN407, GRC474, MEV405, PET427

Missing data compensated by aggregation (25 of 384 points = 6.5%)

Table 4.1-19b Historic Speciated Deposition - 4 CASTNET Sites (English units)

Year	Precip in	Wet NH_4 lb/acre	Wet NO_3 lb/acre	Dry HNO_3 lb/acre	Dry NO_3 lb/acre	Dry NH_4 lb/acre	Wet SO_4 lb/acre	Dry SO_2 lb/acre	Dry SO_4 lb/acre
2000	9.3	0.30	0.61	0.80	0.03	0.10	0.52	0.10	0.13
2001	10.6	0.36	0.63	0.76	0.03	0.11	0.57	0.10	0.13
2002	7.6	0.43	0.48	0.79	0.04	0.10	0.44	0.09	0.12
2003	8.6	0.34	0.48	0.87	0.03	0.10	0.37	0.19	0.12
2004	12.3	0.61	0.70	0.81	0.03	0.10	0.71	0.19	0.12
2005	14.3	0.52	0.62	0.82	0.02	0.11	0.65	0.19	0.13
2006	11.4	0.57	0.69	0.82	0.03	0.09	0.60	0.18	0.11
2007	11.7	0.44	0.62	0.85	0.03	0.10	0.51	0.21	0.13
2008	11.9	0.38	0.52	0.69	0.03	0.10	0.43	0.13	0.12
2009	8.7	0.44	0.48	0.60	0.03	0.09	0.59	0.09	0.11
2010	17.5	0.74	0.80	0.57	0.03	0.08	0.67	0.10	0.10
2011	12.8	0.60	0.68	0.56	0.03	0.09	0.62	0.09	0.11
Mean	11.4	0.48	0.61	0.75	0.03	0.10	0.56	0.14	0.12
Median	11.5	0.44	0.62	0.79	0.03	0.10	0.58	0.12	0.12
Cumulative	136.6	5.73	7.31	8.94	0.36	1.17	6.68	1.68	1.43

Source: EPA 2013e

Notes:

Aggregated data for 4 sites: CAN407, GRC474, MEV405, PET427

Missing data compensated by aggregation (25 of 384 points = 6.5%)

Table 4.1-20 Historic Composite Deposition Rates - 4 CASTNET Sites

Year	Precipitation		Nitrogen Compounds		Sulfur Compounds	
	cm	dm	kg/ha	kg/ha-dm	kg/ha	kg/ha-dm
2000	23.6	2.36	2.06	0.87	0.84	0.36
2001	27.0	2.70	2.11	0.78	0.91	0.34
2002	19.2	1.92	2.06	1.07	0.74	0.38
2003	21.8	2.18	2.04	0.93	0.76	0.35
2004	31.1	3.11	2.52	0.81	1.14	0.37
2005	36.4	3.64	2.34	0.64	1.09	0.30
2006	28.9	2.89	2.46	0.85	1.01	0.35
2007	29.8	2.98	2.30	0.77	0.95	0.32
2008	30.2	3.02	1.93	0.64	0.77	0.25
2009	22.1	2.21	1.84	0.83	0.88	0.40
2010	44.5	4.45	2.50	0.56	0.97	0.22
2011	32.4	3.24	2.19	0.68	0.91	0.28
Trend	—	—	—	-0.28	—	-0.09
Change	—	—	—	-30%	—	-24%

Source: EPA 2013e

Notes:

Aggregated data for 4 sites: CAN407, GRC474, MEV405, PET427

Missing data compensated by aggregation (25 of 384 points = 6.5%)

Change and improvement calculated on normalized linear trend basis (see Figure 4.1-6)

Deposition is normalized in units of kilograms per hectare per decimeter precipitation (kg/ha-dm) to eliminate the variability of precipitation amounts and discern the actual deposition contents of precipitation (i.e., concentrations).

Figures 4.1-5 and 4.1-6 illustrate historic deposition trends as measured by the CASTNET monitoring program. Figure 4.1-5 shows absolute amounts of precipitation, total nitrogen compounds, and total sulfur compounds over the 12-year period. Since the amount of deposition is proportional to the amount of precipitation received, Figure 4.1-6 shows normalized total nitrogen compounds and total sulfur compounds where normalized precipitation is expressed as unity.

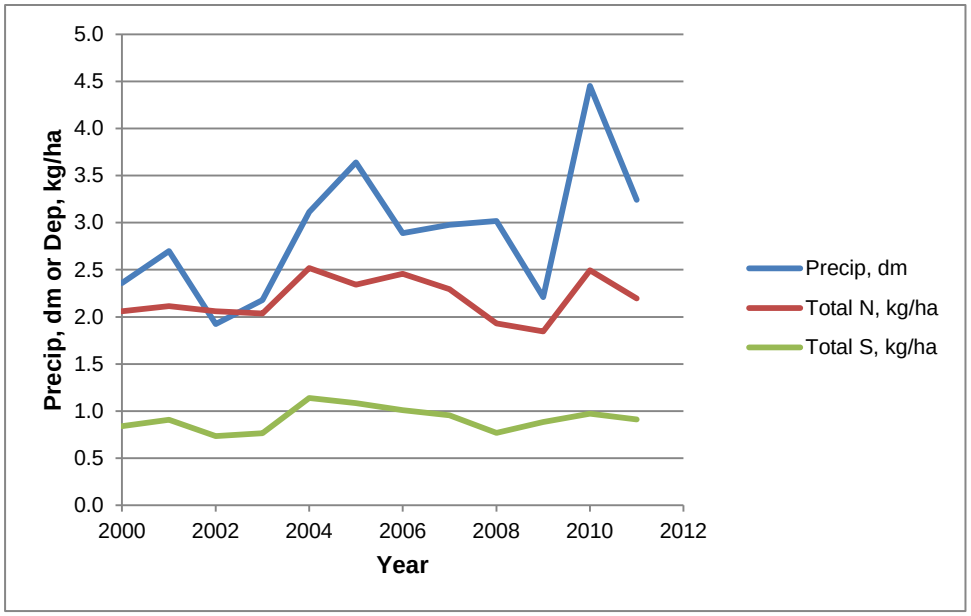

Figure 4.1-5 Historic CASTNET Precipitation and Deposition

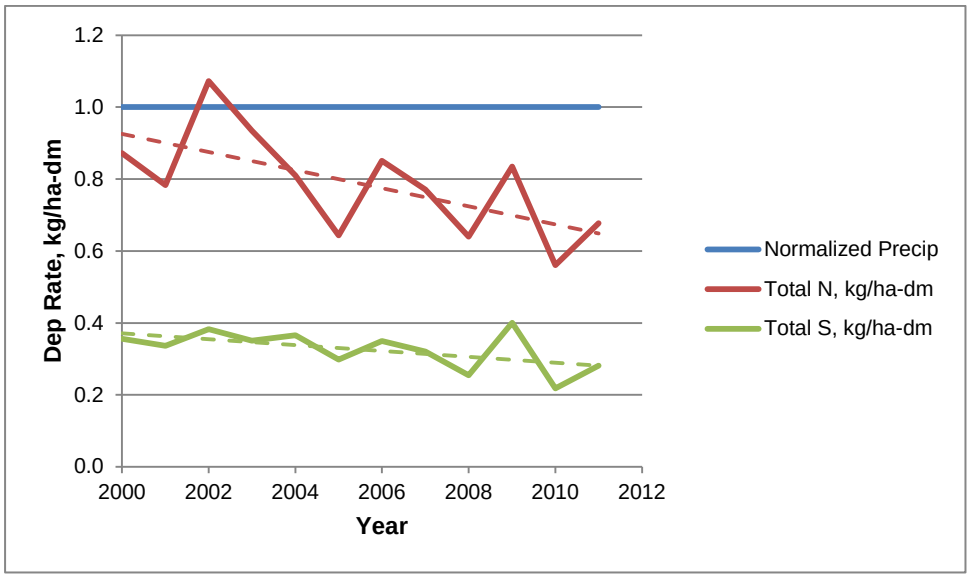

Figure 4.1-6 Historic CASTNET Deposition Rates - Normalized

As shown in Table 4.1-20 and Figure 4.1-7, the data suggests the average rate of nitrogen and sulfur deposition in the Four Corners region has been trending downward over the 12-year period. The data also suggests that total nitrogen compound deposition has decreased by about 30 percent and total sulfur compound deposition has decreased by about 24 percent, as measured by CASTNET from 2000 to 2011. These apparent downward trends suggest that regional emissions of NO_X and SO_2 from stationary and mobile sources may have decreased overall due to improved emission controls, lower-polluting fuels, and changes in economic activity, among other factors.

National Trends Network

Annual summary data from seven NTN sites located at Canyonlands, Grand Canyon, Mesa Verde, Petrified Forest, Alamosa, Bandelier, and Green River is aggregated to provide a general estimate of historic deposition in the Four Corners region. Deposition is calculated by NADP based on the NTN wet bucket method and measured precipitation. (NADP 2013)

For the historic 12-year period from 2000 through 2011, Tables 4.1-21a (metric units, kg/ha) and 4.1-21b (English units, lb/acre) show measured precipitation, free acidity (H^+ as pH), calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+), potassium (K^+), sulfate (SO_4^{2-}), nitrate (NO_3^-), chloride (Cl^-), and ammonium (NH_4^+) ions, also total inorganic nitrogen (N) as reported by NTN for cumulative annual periods (NADP 2013).

Table 4.1-22 shows absolute and normalized acid/base ion deposition rates in metric units for sulfate, nitrate, chloride, and ammonium. Table 4.1-23 shows absolute and normalized light metal ion deposition rates in metric units for calcium, magnesium, potassium, and sodium.

Table 4.1-21a Historic Speciated Deposition - 7 NTN Sites (metric units)

Year	Precip cm	Ca kg/ha	Mg kg/ha	K kg/ha	Na kg/ha	NH_4 kg/ha	NO_3 kg/ha	Inorg N kg/ha	Cl kg/ha	SO_4 kg/ha	H^+ kg/ha
2000	23.7	1.96	0.19	0.16	0.33	1.30	7.99	2.82	0.52	4.52	0.06
2001	25.9	2.34	0.25	0.14	0.42	1.64	8.59	3.22	0.60	5.10	0.05
2002	16.3	1.76	0.15	0.08	0.21	0.98	3.53	1.56	0.30	2.26	0.01
2003	18.7	1.56	0.15	0.10	0.17	1.04	4.37	1.80	0.27	2.41	0.02
2004	28.1	3.38	0.33	0.23	0.58	2.47	10.58	4.32	0.91	6.45	0.06
2005	33.6	3.30	0.30	0.23	0.52	2.66	10.43	4.42	0.72	7.65	0.09
2006	26.8	3.18	0.32	0.18	0.41	2.01	8.33	3.45	0.61	4.85	0.04
2007	26.6	3.49	0.31	0.20	0.50	1.99	8.32	3.43	0.77	5.10	0.05
2008	25.9	3.05	0.30	0.18	0.43	1.58	7.02	2.81	0.65	4.09	0.04
2009	21.1	5.87	0.34	0.29	0.48	1.35	5.10	2.20	0.61	4.19	0.02
2010	34.7	6.12	0.73	0.37	0.93	3.77	13.89	6.07	1.46	7.70	0.07
2011	25.0	3.79	0.38	0.21	0.52	2.05	7.80	3.36	0.72	4.76	0.03
Mean	25.5	3.32	0.31	0.20	0.46	1.91	8.00	3.29	0.68	4.92	0.05
Median	25.9	3.24	0.31	0.19	0.46	1.82	8.15	3.29	0.63	4.81	0.04
Cumulative	306.4	39.80	3.75	2.37	5.51	22.86	95.96	39.45	8.12	59.07	0.54

Source: NADP 2013

Notes:

Aggregated data for 7 sites: AZ03, AZ97, CO00, CO99, NM07, UT09, UT98; Site AZ97 commenced operation 2003 (no data for 2000, 2001, 2002)

Table 4.1-21b Historic Speciated Deposition - 7 NTN Sites (English units)

Year	Precip in	Ca lb/acre	Mg lb/acre	K lb/acre	Na lb/acre	NH_4 lb/acre	NO_3 lb/acre	Inorg N lb/acre	Cl lb/acre	SO_4 lb/acre	H^+ lb/acre
2000	9.3	1.75	0.17	0.14	0.30	1.16	7.13	2.52	0.46	4.03	0.06
2001	10.2	2.09	0.22	0.12	0.38	1.46	7.67	2.87	0.54	4.55	0.05
2002	6.4	1.57	0.14	0.07	0.19	0.87	3.15	1.39	0.27	2.01	0.01
2003	7.4	1.39	0.13	0.09	0.15	0.93	3.90	1.61	0.24	2.15	0.02
2004	11.0	3.02	0.30	0.20	0.52	2.21	9.44	3.85	0.81	5.75	0.05
2005	13.2	2.94	0.27	0.20	0.46	2.38	9.30	3.94	0.64	6.83	0.08
2006	10.6	2.84	0.29	0.16	0.36	1.79	7.44	3.07	0.55	4.33	0.04
2007	10.5	3.11	0.27	0.18	0.45	1.78	7.42	3.06	0.69	4.55	0.04
2008	10.2	2.72	0.27	0.16	0.38	1.41	6.27	2.51	0.58	3.65	0.04
2009	8.3	5.23	0.31	0.26	0.43	1.21	4.55	1.97	0.55	3.74	0.02
2010	13.7	5.46	0.65	0.33	0.83	3.36	12.40	5.42	1.30	6.87	0.06
2011	9.9	3.38	0.34	0.19	0.46	1.83	6.96	2.99	0.64	4.25	0.03
Mean	10.1	2.96	0.28	0.18	0.41	1.70	7.13	2.93	0.60	4.39	0.04
Median	10.2	2.89	0.27	0.17	0.41	1.62	7.28	2.93	0.56	4.29	0.04
Cumulative	120.6	35.50	3.34	2.11	4.91	20.40	85.62	35.20	7.25	52.70	0.49

Source: NADP 2013

Notes:

Aggregated data for 7 sites: AZ03, AZ97, CO00, CO99, NM07, UT09, UT98

Site AZ97 commenced operation 2003 (no data for 2000, 2001, 2002)

Table 4.1-22 Historic Acid/Base Ion Deposition Rates - 7 NTN Sites

Year	Precipitation		Sulfate Composite		Nitrate Composite		Chloride Composite		Ammonium Composite	
	cm	dm	kg/ha	kg/ha-dm	kg/ha	kg/ha-dm	kg/ha	kg/ha-dm	kg/ha	kg/ha-dm
2000	23.7	2.37	4.52	1.90	7.99	3.37	0.52	0.22	1.30	0.55
2001	25.9	2.59	5.10	1.97	8.59	3.32	0.60	0.23	1.64	0.63
2002	16.3	1.63	2.26	1.39	3.53	2.17	0.30	0.18	0.98	0.60
2003	18.7	1.87	2.41	1.29	4.37	2.33	0.27	0.14	1.04	0.56
2004	28.1	2.81	6.45	2.30	10.58	3.77	0.91	0.32	2.47	0.88
2005	33.6	3.36	7.65	2.28	10.43	3.10	0.72	0.21	2.66	0.79
2006	26.8	2.68	4.85	1.81	8.33	3.11	0.61	0.23	2.01	0.75
2007	26.6	2.66	5.10	1.92	8.32	3.13	0.77	0.29	1.99	0.75
2008	25.9	2.59	4.09	1.58	7.02	2.72	0.65	0.25	1.58	0.61
2009	21.1	2.11	4.19	1.98	5.10	2.41	0.61	0.29	1.35	0.64
2010	34.7	3.47	7.70	2.22	13.89	4.00	1.46	0.42	3.77	1.09
2011	25.0	2.50	4.76	1.90	7.80	3.12	0.72	0.29	2.05	0.82
Trend	—	—	—	0.24	—	0.19	—	0.14	—	0.27
Change	—	—	—	14%	—	7%	—	75%	—	47%

Source: NADP 2013

Notes:

Aggregated data for 7 sites: AZ03, AZ97, CO00, CO99, NM07, UT09, UT98; Site AZ97 commenced operation 2003 (no data for 2000, 2001, 2002)

Table 4.1-23 Historic Light Metal Ion Deposition Rates - 7 NTN Sites

	Precipitation		Calcium Composite		Magnesium Composite		Potassium Composite		Sodium Composite	
Year	cm	dm	kg/ha	kg/ha-dm	kg/ha	kg/ha-dm	kg/ha	kg/ha-dm	kg/ha	kg/ha-dm
2000	23.7	2.37	1.96	0.83	0.19	0.08	0.16	0.07	0.33	0.14
2001	25.9	2.59	2.34	0.90	0.25	0.09	0.14	0.05	0.42	0.16
2002	16.3	1.63	1.76	1.08	0.15	0.09	0.08	0.05	0.21	0.13
2003	18.7	1.87	1.56	0.83	0.15	0.08	0.10	0.05	0.17	0.09
2004	28.1	2.81	3.38	1.21	0.33	0.12	0.23	0.08	0.58	0.21
2005	33.6	3.36	3.30	0.98	0.30	0.09	0.23	0.07	0.52	0.15
2006	26.8	2.68	3.18	1.19	0.32	0.12	0.18	0.07	0.41	0.15
2007	26.6	2.66	3.49	1.31	0.31	0.12	0.20	0.08	0.50	0.19
2008	25.9	2.59	3.05	1.18	0.30	0.12	0.18	0.07	0.43	0.17
2009	21.1	2.11	5.87	2.77	0.34	0.16	0.29	0.14	0.48	0.23
2010	34.7	3.47	6.12	1.76	0.73	0.21	0.37	0.11	0.93	0.27
2011	25.0	2.50	3.79	1.51	0.38	0.15	0.21	0.09	0.52	0.21
Trend	—	—	—	1.13	—	0.10	—	0.05	—	0.10
Change	—	—	—	155%	—	139%	—	108%	—	84%

Source: NADP 2013

Notes:

Aggregated data for 7 sites: AZ03, AZ97, CO00, CO99, NM07, UT09, UT98; Site AZ97 commenced operation 2003 (no data for 2000, 2001, 2002)

Figures 4.1-7a, 4.1-7b, and 4.1-7c illustrate the normalized rates shown in Tables 4.1-22 and 4.1-23 using compatible Y-axis scales (i.e., 0-1, 0-2, 0-4). Figure 4.1-7a shows normalized magnesium, potassium, sodium, chloride, and acidity. Figure 4.1-7b shows ammonium and total inorganic nitrogen. Figure 4.1-7c shows calcium, nitrate, and sulfate. In each of these normalized figures, precipitation is expressed as unity.

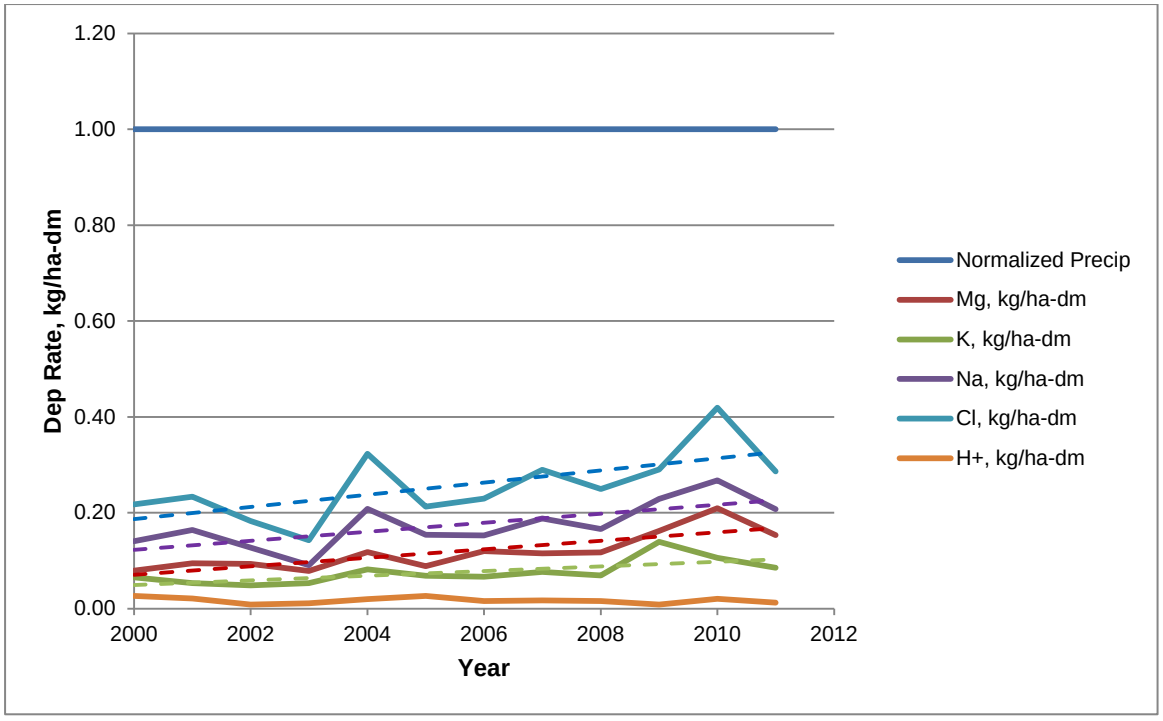

Figure 4.1-7a Historic NTN Deposition Rates – Normalized (Mg, K, Na, Cl, H+)

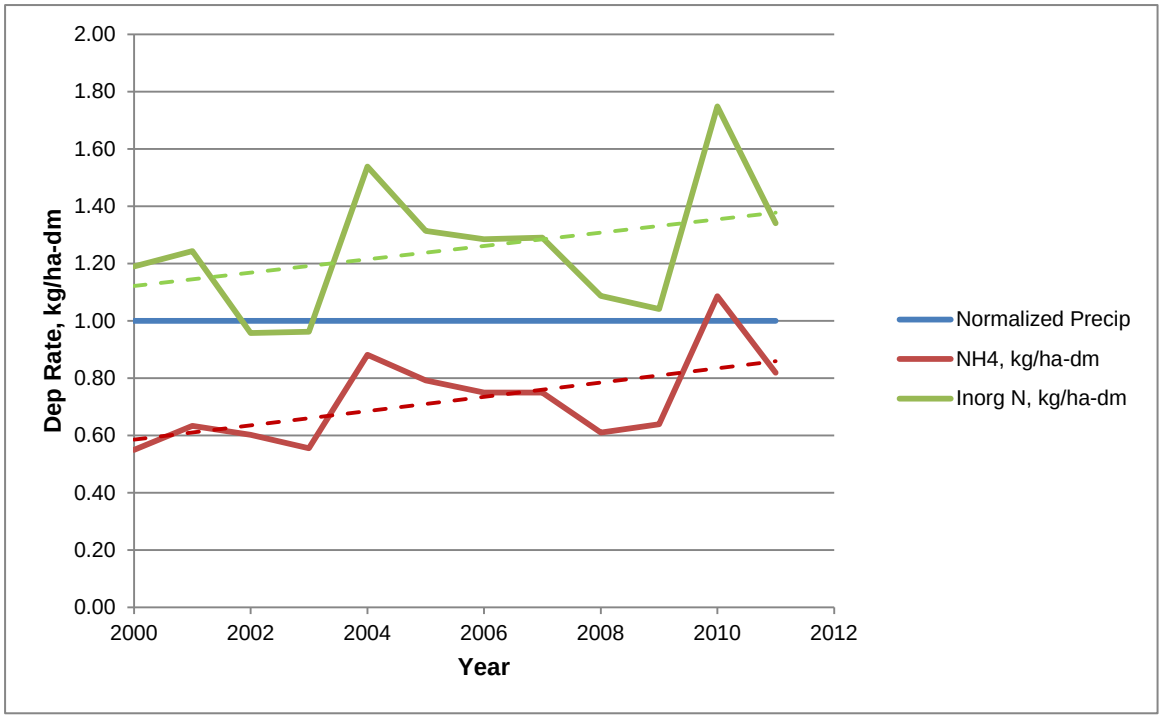

Figure 4.1-7b Historic NTN Deposition Rates – Normalized (Ammonia)

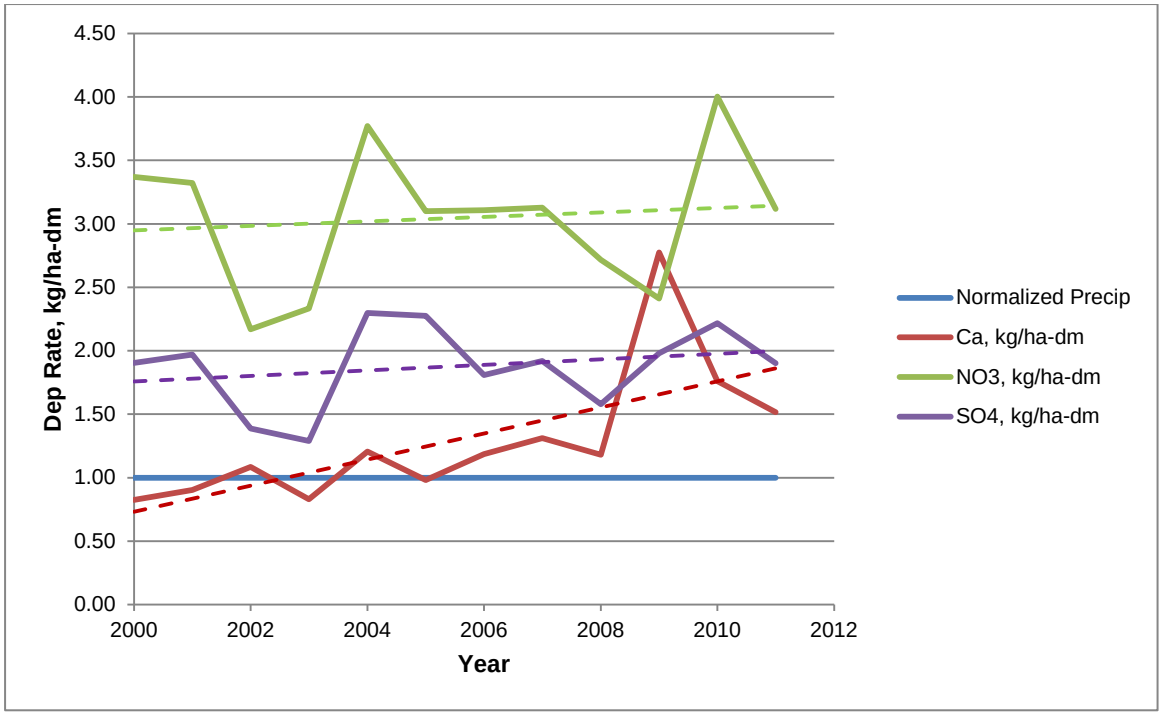

Figure 4.1-7c Historic NTN Deposition Rates – Normalized (Ca, NO_3, SO_4)

As shown in Tables 4.1-22 and 4.1-23 and Figures 4.1-7a, 4.1-7b, and 4.1-7c, NTN data suggests the average rate of deposition for all analytes in the Four Corners region has been trending upward over the 12-year period. The data also suggests that sulfate, nitrate, chloride, and ammonium deposition has increased by about 14 percent, 7 percent, 75 percent, and 47 percent, respectively, over the 12-year period. Further, calcium, magnesium, potassium, and sodium deposition has increased by an average of about 120 percent, as measured by NTN from 2000 to 2011.

The lower rates of increase for sulfate and nitrate suggests that regional emissions of NO_X and SO_2 from stationary and mobile sources may not be increasing as rapidly overall due to improved emission controls and lower-polluting fuels; however, these factors could be offset by use of agricultural chemicals such as fertilizers which can contain these compounds. The higher rate of increase for the metallic analytes (calcium, magnesium, potassium, sodium) suggests that drought conditions in the region could be responsible for increased airborne soil dusts which can contain these minerals. For the remaining analytes chloride and ammonium, increases are moderate, which suggests that while chloride could be attributable to soil dust, ammonium could be attributable to fertilizer application, animal husbandry, or NO_X emissions controls on stationary sources.

Because CASTNET and NTN employ very different measurement principles, results from the two networks are not directly comparable and differences in results and trends cannot be strictly viewed as inconsistent or contradictory. Rather, the two different methods should be considered complimentary as they each provide insight into the complexities of atmospheric deposition.

Mercury Deposition Network

Annual sampling data from four MDN sites located at Sycamore Canyon, Molas Pass, Mesa Verde, and Navajo Lake is compared and aggregated to provide a general estimate of historic mercury deposition in the Four Corners region. Total mercury (Hg) deposition (organic + elemental) is calculated by NADP in units of nanograms per square meter (ng/m^2) based on the amount of sample collected in the wet bottle in equivalent millimeters (mm) times its mercury concentration in nanograms per liter (ng/l). In contrast to

NTN, precipitation gage data are not used for data reduction since the bottle quantity is a more precise measurement for trace quantities (NADP 2013).

For the historic 10-year period from 2002 through 2011, individual site results are shown in Table 4.1-24 comprising absolute units of ng/m^2 and kg/ha, and normalized units of ng/m^2-mm as reported by MDN on a discrete sample basis (NADP 2013). Since the number of sites and samples is not large, absolute percent difference (variation) about the weighted arithmetic mean is shown to assess measurement variability (consistency) from year-to-year.

Table 4.1-24 Historic Mercury Deposition - 4 MDN Sites

Site ID Code	Year	Months Operation	Valid Samples	Precipitation Collected		Measured Mercury Deposition			
				mm	cm	ng/m^2	kg/ha	ng/m^2-mm	variation
AZ02*	2006	10	29	429	42.9	8,678	8.68E-05	20.2	13%
AZ02*	2007	12	21	401	40.1	10,358	1.04E-04	25.8	10%
AZ02*	2008	12	22	459	45.9	8,567	8.57E-05	18.7	20%
AZ02*	2009	12	25	178	17.8	5,384	5.38E-05	30.3	30%
AZ02*	2010	12	23	313	31.3	7,859	7.86E-05	25.1	8%
AZ02*	2011	12	28	287	28.7	7,436	7.44E-05	25.9	11%
AZ02 Cumulative			*148*	*2067*	*206.7*	*48,282*	*4.83E-04*	*23.4*	*14%*
NM98	2009	8	18	151	15.1	3,762	3.76E-05	24.9	5%
NM98	2010	12	20	241	24.1	7,126	7.13E-05	29.6	25%
NM98	2011	12	24	231	23.1	4,294	4.29E-05	18.6	22%
NM98	2012	9	18	152	15.2	3,179	3.18E-05	20.9	12%
NM98 Cumulative			*80*	*775*	*77.5*	*18,360*	*1.84E-04*	*23.7*	*16%*
CO96**	2009	6	22	331	33.1	4,928	4.93E-05	14.9	14%
CO96**	2010	12	39	614	61.4	8,475	8.47E-05	13.8	5%
CO96**	2011	12	44	790	79.0	9,307	9.31E-05	11.8	10%
CO96 Cumulative			*105*	*1735*	*173.5*	*22,709*	*2.27E-04*	*13.1*	*9%*
CO99	2002	11	23	190	19.0	3,471	3.47E-05	18.3	3%
CO99	2003	12	29	301	30.1	4,914	4.91E-05	16.3	8%
CO99	2004	12	27	327	32.7	3,161	3.16E-05	9.7	45%
CO99	2005	12	30	481	48.1	5,433	5.43E-05	11.3	36%
CO99	2006	12	30	310	31.0	4,963	4.96E-05	16.0	9%
CO99	2007	12	33	380	38.0	6,708	6.71E-05	17.6	0%
CO99	2008	12	28	404	40.4	6,021	6.02E-05	14.9	16%
CO99	2009	12	25	321	32.1	10,100	1.01E-04	31.5	79%
CO99	2010	12	30	458	45.8	10,583	1.06E-04	23.1	31%
CO99	2011	12	28	373	37.3	7,203	7.20E-05	19.3	9%
CO99 Cumulative			*283*	*3545*	*354.5*	*62,558*	*6.26E-04*	*17.6*	*24%*

Source: NADP 2013

Notes:

* Indicates location is outside 300 km radius of FCPP

** Indicates location is nondesert characteristic (mountains);

Site NM98 ceased operation September 2012;

Variation is absolute difference between annual value and cumulative mean of annual values

Table 4.1-25 aggregates the results shown in Table 4.1-24 to provide a general estimate of region-wide mercury deposition rates over the 10-year period. Figure 4.1-8 illustrates these normalized mercury deposition rates in units of ng/m^2-mm. For consistency with NTN precipitation data from multiple (7) rain gages over 12 years, Table 4.1-26 correlates MDN trending results against NTN precipitation amounts to obtain estimated mercury deposition as if it were an NTN parameter, as illustrated on Figure 4.1-9.

The normalized MDN results shown in Table 4.1-25 and Figure 4.1-8 suggest an upward trend in the rate of mercury deposition in the region over a decade. As shown in Table 4.1-26, from 2000 to 2011, the estimated average trending deposition rate increased by about 6 ng/m^2-mm or about 40 percent overall with an average annual variability of less than 20 percent, which indicates that results are reasonably consistent overall. The trending analysis suggests that mercury deposition in the Western region has been increasing.

While increases are due in part to trans-Pacific transport of mercury from sources in Asia (refer to Section 4.8, Special-Status Species for a more detailed discussion), coal-fired power plants are the largest source of mercury emissions in the United States. Mercury is emitted from EGUs in three forms; each of which has specific physical and chemical properties that determine how far it travels in the atmosphere before depositing to the landscape. Although gaseous oxidized mercury and particle-bound mercury are generally local/regional mercury deposition concerns, all forms of mercury may deposit to local or regional watersheds. U.S. coal-fired power plants account for over half of the U.S. controllable emissions of the quickly depositing forms of mercury (Federal Register 2012).According to the EPRI baseline scenario modeling results, the maximum contribution of FCPP mercury emissions to mercury total deposition is about 28 percent in San Juan County near the FCPP and contributions from FCPP range from 2 to 28 percent in the vicinity of the plant; however, the contributions from FCPP are less than 2 percent over the remainder of the San Juan basin (EPRI 2013).

Table 4.1-25 Historic Annual Mercury Deposition - 4 MDN Sites

Year	Sites Operating	Valid Samples	Precipitation Collected		Deposition Rate	
			mm	cm	ng/m^2-mm	variation
2002	1	23	190	19.0	18.3	2%
2003	1	29	301	30.1	16.3	13%
2004	1	27	327	32.7	9.7	48%
2005	1	30	481	48.1	11.3	39%
2006	2	59	739	73.9	18.5	1%
2007	2	54	782	78.2	21.8	17%
2008	2	50	863	86.3	16.9	9%
2009	4	90	980	98.0	24.7	32%
2010	4	112	1,626	162.6	20.9	12%
2011	4	124	1,681	168.1	16.8	10%
Cumulative	**—**	**598**	**7,969**	**796.9**	**18.7**	**18%**
Trend	**—**	**—**	**—**	**—**	**6.2**	**—**
Change	**—**	**—**	**—**	**—**	**43%**	**—**

Source: NADP 2013

Notes: Aggregated data for 4 sites: AZ02, NM98, CO96, CO99; Site NM98 ceased operation September 2012. Variation is absolute difference between annual value and cumulative mean of annual values

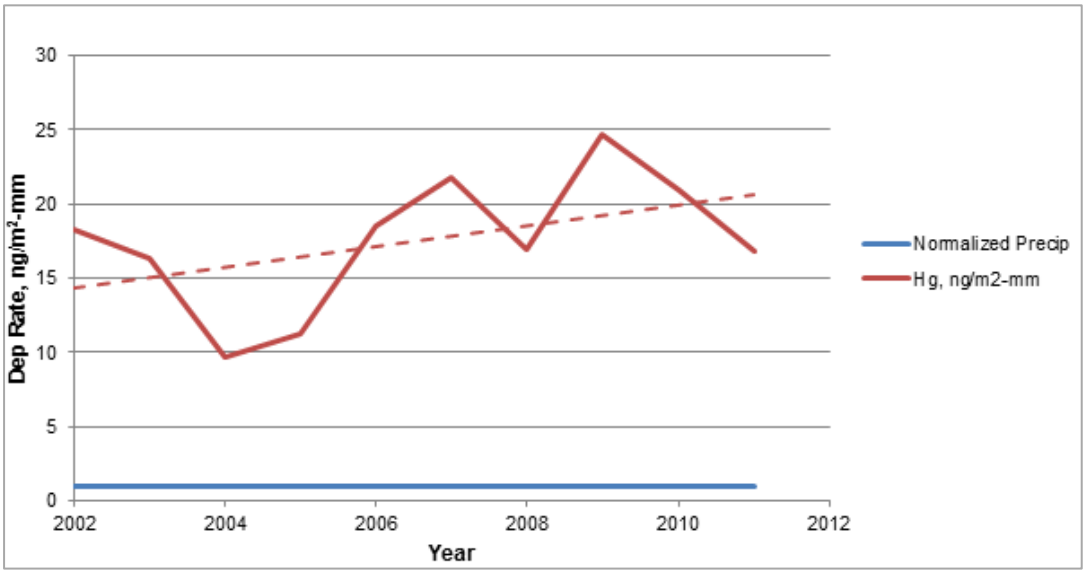

Figure 4.1-8 Historic MDN Deposition Rates – Normalized

Table 4.1-26 Estimated NTN-Correlated Annual Mercury Deposition

Year	NTN Precipitation		Average Deposition		
	cm	mm	ng/m^2-mm	ng/m^2	kg/ha
2000	23.7	237	13.0	3,086	3.09E-05
2001	25.9	259	13.7	3,546	3.55E-05
2002	16.3	163	14.4	2,341	2.34E-05
2003	18.7	187	15.1	2,827	2.83E-05
2004	28.1	281	15.8	4,430	4.43E-05
2005	33.6	336	16.5	5,540	5.54E-05
2006	26.8	268	17.2	4,604	4.60E-05
2007	26.6	266	17.9	4,751	4.75E-05
2008	25.9	259	18.6	4,798	4.80E-05
2009	21.1	211	19.2	4,070	4.07E-05
2010	34.7	347	19.9	6,923	6.92E-05
2011	25.0	250	20.6	5,165	5.16E-05
Mean	**25.5**	**255**	**—**	**4,340**	**4.34E-05**
Median	**25.9**	**259**	**—**	**4,517**	**4.52E-05**
Cumulative	**306.4**	**3064**	**—**	**52,080**	**5.21E-04**

Source: NADP 2013

Notes:

Aggregated precip data for 7 NTN sites: AZ03, AZ97, CO00, CO99, NM07, UT09, UT98; Aggregated Hg dep data for 4 MDN sites: AZ02, NM98, CO96, CO99; Average deposition rate determined from 10-year trend line

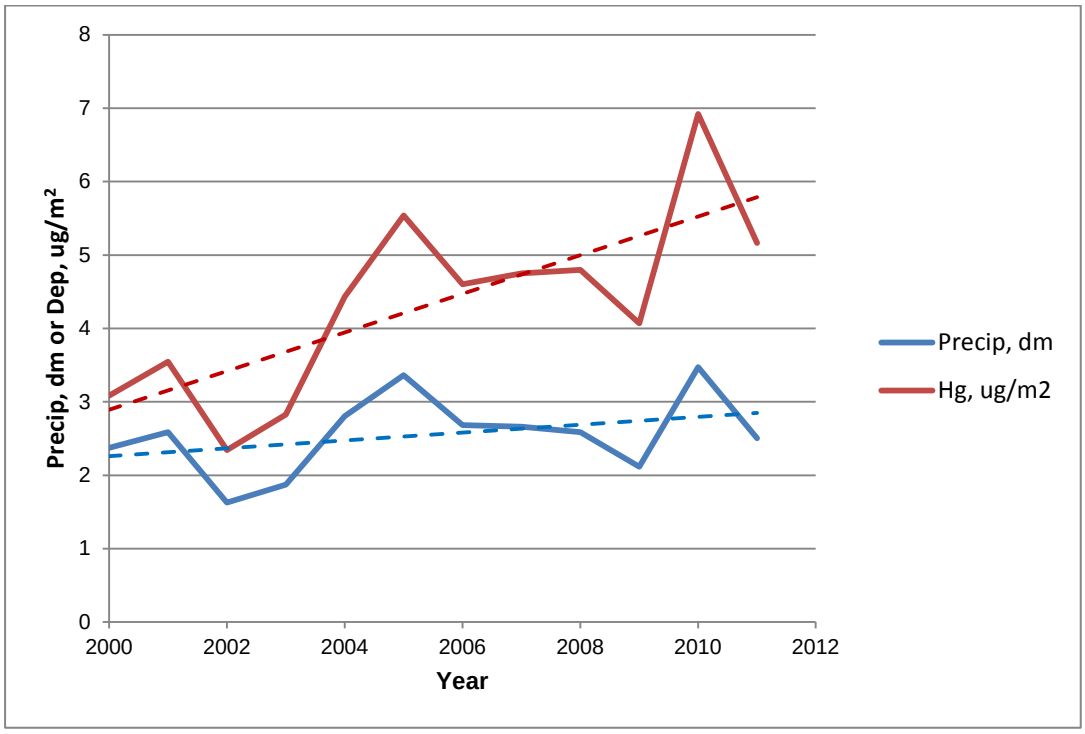

Figure 4.1-9 Estimated NTN-Correlated Annual Mercury Deposition

Ammonia Monitoring Network

Annual sampling data from two AMoN sites located in Navajo Lake and Farmington are compared and aggregated to provide a general estimate of historic ambient ammonia concentrations in the Four Corners region. Concentrations are calculated by NADP based on the AMoN diffusion filter method and measured air flow rates (NADP 2013).

For the historic 4-year 8-month period from January 2008 through August 2012, individual and aggregated site results are shown in Table 4.1-27 comprising units of nanograms per cubic meter (ng/m^3) and parts per billion by volume (ppbv) as reported by AMoN on a discrete sample basis (NADP 2013). Since the number of sites and samples is not large, absolute percent difference (variation) about the weighted arithmetic means are shown to assess measurement variability (consistency) from year-to-year. Figure 4.1-10 illustrates the results shown in Table 4.1-27 and contrasts them against the overall mean value obtained by averaging all samples overall years at both sites.

The trending results shown in Table 4.1-27 and Figure 4.1-10 indicate an apparent rise in mean ambient ammonia concentration of about 240 µg/m^3 or about 0.3 ppbv, which is about a 40 percent increase, with an average annual variability of 15 percent over the course of the active monitoring period. This suggests that changes in ambient ammonia concentrations could be attributable to changes in fertilizer application, animal husbandry, or NO_X emissions controls on stationary sources. Another possible explanation for these changes is overall improvement in the relatively new measurement technique over time, from field procedures to laboratory analysis. This could have resulted in better sensitivity and data capture as the program progressed, which would tend to detect an analyte, which may have previously been under-detected or undetected; i.e., a lowering of the method detection limit (MDL).

Table 4.1-27 Historic Ambient Ammonia Concentration - 2 AMoN Sites

Site ID Code	Year	Months Operation	Valid Samples	Days of Data	Measured Ammonia		
					ng/m^3	ppbv	variation
NM98	2008	12	18	246	331	0.48	14%
NM98	2009	12	26	356	354	0.51	8%
NM98	2010	10	20	270	463	0.67	20%
NM98	2011	12	26	348	330	0.47	14%
NM98	2012	8	17	236	483	0.70	25%
NM98 Weighted Average			**107**	**1456**	**385**	**0.55**	**17%**
Trend			—	—	**112**	**0.16**	—
Change			—	—	**33%**	**33%**	—
NM99	2008	12	18	253	844	1.21	22%
NM99	2009	12	24	309	1,008	1.45	7%
NM99	2010	12	26	354	1,213	1.75	12%
NM99	2011	12	26	356	1,054	1.52	3%
NM99	2012	8	14	195	1,341	1.93	24%
NM99 Weighted Average			**108**	**1467**	**1,084**	**1.56**	**14%**
Trend			—	—	**416**	**0.60**	—
Change			—	—	**47%**	**47%**	—

Site ID Code	Year	Months Operation	Valid Samples	Days of Data	Measured Ammonia		
					ng/m^3	ppbv	variation
NM98/99	2008	24	36	499	592	0.85	20%
NM98/99	2009	24	50	665	658	0.95	11%
NM98/99	2010	22	46	624	887	1.28	21%
NM98/99	2011	24	52	704	696	1.00	5%
NM98/99	2012	16	31	431	870	1.25	18%
NM98/99 Composite Average			**215**	**2923**	**736**	**1.06**	**15%**
Trend			—	—	**238**	**0.34**	—
Change			—	—	**38%**	**38%**	—

Source: NADP 2013

Note:

Variation is absolute difference between annual value and cumulative mean of annual values

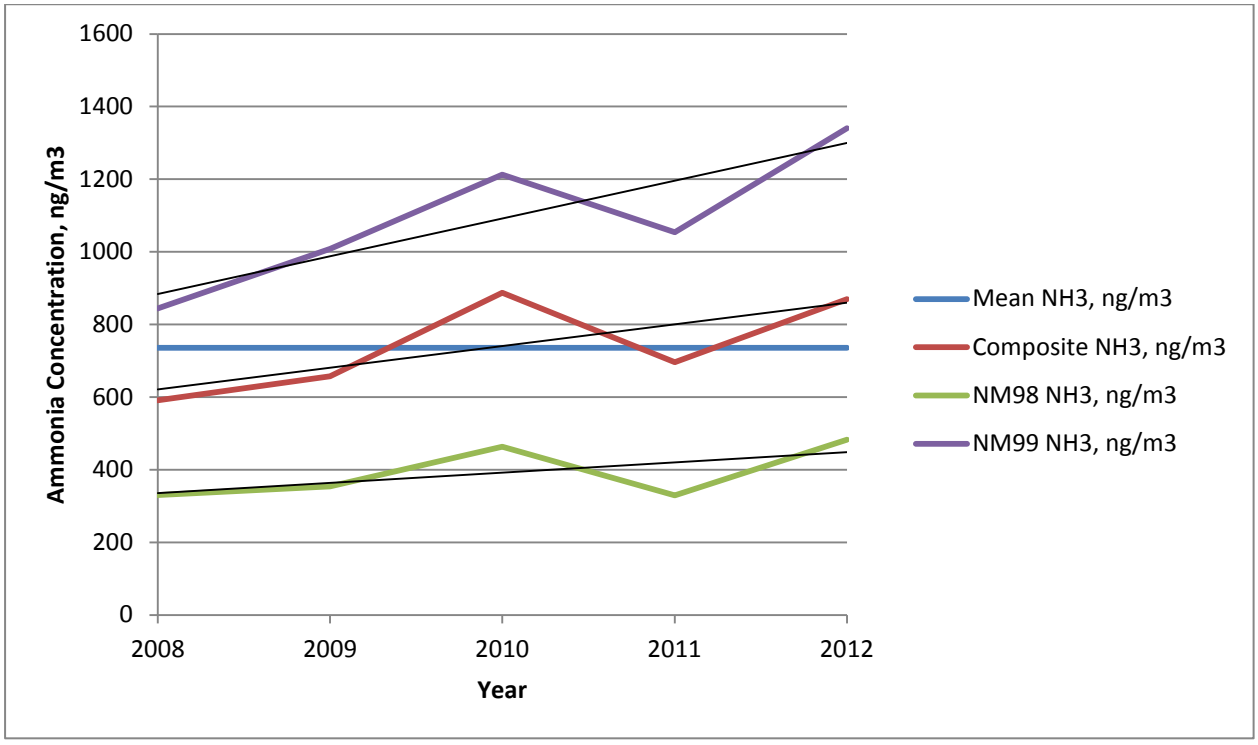

Figure 4.1-10 Historic Ambient Ammonia – Northwest New Mexico

4.1.2.7 Sensitive Receptors

Certain population groups are considered more sensitive to air pollution and odors than others; those that are particularly sensitive include children, elderly, and acutely ill and chronically ill persons, especially those with cardio respiratory diseases such as asthma and bronchitis. Sensitive receptors (land uses) indicate locations where such individuals are typically found, namely schools, daycare centers, hospitals, senior citizen centers, residences of sensitive persons, and parks with active recreational uses, such as youth sports.

Persons engaged in strenuous work or physical exercise also have increased sensitivity to poor air quality. Residential areas are considered more sensitive to air quality conditions than commercial and industrial areas, because people generally spend longer periods of time at their residences, resulting in greater exposure to ambient air quality conditions. Recreational uses such as parks are also considered sensitive, due to the greater exposure to ambient air quality conditions and because the presence of pollution detracts from the recreational experience.

Four Corners Power Plant

The FCPP generating units are located more than ½ mile from any sensitive land uses such as schools, hospitals, and senior citizen centers. The nearest sensitive receptors are homes located greater than 1 mile from the FCPP (see Figure 4.14-2).

Navajo Mine

Five residences are within ½ mile (800 meters) of the Pinabete Permit Area. Of these five residences, three are located within the Area IV boundary. Navajo Mine has begun negotiations with two of these residents to relocate out of the proposed mining area. Several other isolated single-family residences are in the vicinity of the proposed mining disturbance zone of Area IV North, the nearest of which is about 4,500 feet (1,370 meters) away. Three residences are within 1 mile (1,600 meters) of the edge of the disturbance area. Four additional residences lie within 1 mile (1,600 meters) of the mining disturbance zone of Area III within the Navajo Mine Permit Area. The nearest structure is approximately 3,900 feet (1,190 meters) north of Area III (see Figure 4.14-2).

Transmission Lines

Numerous residences and other sensitive receptors, including parks, and schools, are located in close proximity (within ½ mile) to the transmission line ROWs.

4.1.3 Changes to Air Quality Affected Environment Post-2014

Two completed federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions; and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared in the following Section.

The transfer of the SMCRA permit for the Navajo Mine from BNCC to NTEC would not affect the air quality baseline.

The implementation of BART at FCPP would cause a substantial change to the environmental baseline. As part of a separate action, Southern California Edison divested its 48 percent share of Units 4 and 5 to APS. The sale was finalized December 30 2013. APS notified EPA that the alternative emissions control strategy is preferred and subsequently APS shut down Units 1, 2, and 3 on December 30, 2013. Thus, emissions from Units 1, 2, and 3 have permanently ceased as of that date. As a result, there would be a transition period from 2014 to mid-2018 after which Units 1, 2, and 3 have been shut down and during which Units 4 and 5 would operate without SCR. This interim air quality baseline is presented in this

section. Once BART is fully implemented, the reduction in air emissions from FCPP would decrease substantially. Table 4.1-28 summarizes the reductions.

Table 4.1-28 Summary of Air Emission Reductions from BART Compliance at FCPP

Criteria Pollutants, Greenhouse Gases and Target Metals	Historic Pre-2014 Baseline Emissions Units 1, 2, 3, 4, 5 tons/yr	Estimated Post-2014 Baseline Emissions Units 4 & 5 tons/yr	Post-2014 versus Pre-2014 Baseline Reduction Percent
Sulfur Dioxide (SO_2)	11,971	9,800	18%
Nitrogen Oxides (NO_X)	41,121	5,420	87%
Carbon Monoxide (CO)	2,096	1,580	25%
Filterable Particulate (PM)	1,976	830	58%
Carbon Dioxide Equivalents (CO_2e)	15,439,236	11,396,710	26%
Arsenic (As)	1.78	0.06	96%
Lead (Pb)	1.82	0.07	96%
Mercury (Hg)	0.36	0.07	81%
Selenium (Se)	5.63	0.28	95%

4.1.3.1 Stationary Source Emissions

Pursuant to 40 CFR 49, Source Specific Federal Implementation Plan for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation, the primary goal of controlling NO_x emissions from FCPP is to reduce $PM_{2.5}$ precursors and thereby improve visibility in the region. Table 4.1-29 shows historic generation (kilograms per megawatt/hour, same as grams per kilowatt-hour) from Units 1, 2, and 3 for the representative 12-year period 2000-2011; and Table 4.1-28 shows historic generation from Units 4 and 5. These two tables split SO_2, NO_x and PM data illustrate the relative contributions of the older, less efficient generating units (1, 2, and 3) and the newer, more efficient generating units (4 and 5).

Table 4.1-29 Historic Grouped Part 75 Emissions - ORISPL 2442 Units 1, 2, and 3 (to be decommissioned)

	Generation	Sulfur Dioxide		Nitrogen Oxides		Particulate Matter	
Year	MW-hrs/yr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr
2000	4,550,595	11,387	2.27	15,201	3.03	1,240	0.25
2001	4,642,272	12,779	2.50	16,997	3.32	1,299	0.25
2002	4,664,651	10,783	2.10	16,403	3.19	1,256	0.24
2003	4,503,798	9,887	1.99	15,316	3.09	1,152	0.23
2004	4,799,830	4,966	0.94	16,798	3.17	1,227	0.23
2005	4,936,157	3,501	0.64	16,743	3.08	1,254	0.23
2006	4,683,715	3,170	0.61	16,722	3.24	1,202	0.23
2007	4,851,740	2,643	0.49	17,079	3.19	1,252	0.23
2008	4,823,075	2,853	0.54	16,390	3.08	1,245	0.23
2009	4,780,246	2,736	0.52	16,008	3.04	1,220	0.23
2010	4,646,445	2,914	0.57	16,301	3.18	1,221	0.24

Year	Generation	Sulfur Dioxide		Nitrogen Oxides		Particulate Matter	
	MW-hrs/yr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr
2011	4,258,209	3,052	0.65	15,315	3.26	1,133	0.24
Historic Baseline	4,711,369	2,981	0.57	16,365	3.15	1,218	0.23
Plantwide Share	29%	25%	—	40%	—	62%	—

Source: EPA 2012h

Notes:

PM calculated per AP-42 Chapter 1.1 support document Tables 4-7 and A-3; Title V permit condition (Units 1, 2, and 3)

Baseline period is 2005-11 (flue gas desulfurization, FGD, installed on Units 4 and 5)

Table 4.1-30 Historic Grouped Part 75 Emissions - ORISPL 2442 Units 4 and 5

Year	Generation	Sulfur Dioxide		Nitrogen Oxides		Particulate Matter	
	MW-hrs/yr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr
2000	11,558,538	26,945	2.11	31,312	2.46	867	0.07
2001	11,829,836	26,785	2.05	30,303	2.32	870	0.07
2002	10,104,338	22,064	1.98	25,174	2.26	715	0.06
2003	12,354,084	25,207	1.85	29,880	2.19	846	0.06
2004	11,334,289	15,976	1.28	23,944	1.92	737	0.06
2005	11,892,933	9,152	0.70	25,000	1.91	796	0.06
2006	12,478,900	12,022	0.87	27,927	2.03	838	0.06
2007	10,848,702	7,596	0.64	24,004	2.01	728	0.06
2008	10,998,224	7,546	0.62	23,922	1.97	724	0.06
2009	12,024,518	9,714	0.73	26,503	2.00	810	0.06
2010	10,308,601	8,129	0.72	22,536	1.98	687	0.06
2011	10,808,075	8,770	0.74	23,397	1.96	719	0.06
Historic Baseline	11,337,136	8,990	0.72	24,756	1.98	757	0.06
Plantwide Share	71%	75%	—	60%	—	38%	—

Source: EPA 2012h

Notes:

PM calculated per AP-42 Chapter 1.1 support document Tables 4-7 and A-3; 40 CFR 49 final rule (Units 4, 5)

Baseline period is 2005-11 (flue gas desulfurization, FGD, installed on Units 4 and 5)

As shown in Tables 4.1-29 and 4.1-30, Units 1, 2, and 3 generated 29 percent of electric power at FCPP during the baseline period but emitted 40 percent of NO_X and 62 percent of PM while Units 4 and 5 generated 71 percent of electric power but emitted 60 percent of NO_X and 38 percent of PM. Emissions of SO_2 are about on-par with generation percentages. This demonstrates that Units 4 and 5 are more efficient and have lower NO_X and PM emission rates in units of kilograms per megawatt-hour (kg/MW-hr).

4.1.3.2 Hazardous Air Pollutants

Coal combustion in power plant boilers emits a wide variety of inorganic and organic HAPs. Tables 4.1-31 and 4.1-32 show estimated average annual HAP emissions from FCPP based on historic (pre-2014) operating data prior to implementation of 40 CFR 63 Subpart UUUUU for Units 1, 2, 3, 4, and 5, and projected (post-2014) average annual HAP emissions from Units 4 and 5 operating in compliance with 40

CFR 63 Subpart UUUUU. For the pre-2014 condition, emissions are totaled for Units 1 through 5, Units 1, 2, and 3 (decommissioned in 2013), and Units 4 and 5 to show the relative contributions of the grouped units. Estimated HAP emissions are based on historic operating data, projected operating data, and regulatory default emission factors published by the EPA (EPA 2011a, 40 CFR 63 Subpart UUUUU).

As shown in Table 4.1-31, the shutdown of Units 1, 2, and 3 and compliance with 40 CFR 63 Subpart UUUUU for Units 4 and 5 would reduce estimated annual metal HAP emissions by about 91 percent overall compared to estimated historic regulatory default emissions. As shown in Table 4.1-32, except for hydrogen chloride (an acid gas), estimated emissions of nonmetal HAPs would be reduced by about 26 percent overall compared to estimated historic emissions. However, beginning in 2014, nonmetal inorganic and organic HAP emissions from Units 4 and 5 specifically may increase about 9 percent compared to recent 12-year historic levels for these Units due to the potential for increased generation following the shutdown of Units 1, 2, and 3.

Table 4.1-31 Estimated Historic and Future HAP Metals Emissions - ORISPL 2442

HAP (Metals)	2000-11 Units 1 - 5 Average lbs/yr	2000-11 Units 1, 2, and 3 Average lbs/yr	2000-11 Units 4 and 5 Average lbs/yr	2014 Units 4 and 5 Average lbs/yr	Comparison of Historic Levels to Baseline Reduction Percent
Antimony (Sb)	156	50	106	91	42%
Arsenic (As)	3,552	1,140	2,412	124	96%
Beryllium (Be)	182	58	124	23	88%
Cadmium (Cd)	442	142	300	34	92%
Chromium (Cr)	2,252	723	1,530	317	86%
Cobalt (Co)	866	278	588	91	90%
Copper (Cu)	4,938	1,584	3,354	702	86%
Lead (Pb)	3,639	1,167	2,471	136	96%
Manganese (Mn)	4,245	1,362	2,883	453	89%
Mercury (Hg)	719	231	488	136	81%
Nickel (Ni)	2,426	778	1,648	396	84%
Selenium (Se)	11,262	3,613	7,649	566	95%
Overall Reduction (all metals)					**91%**
Average FCPP Generation (MW-hrs/yr)	**16,056,814**	**4,678,394**	**11,378,420**	**12,410,900**	**23%**

Sources: 77 FR 32 Tables 3 and 5; 40 CFR 63 Subpart UUUUU Table 2; EPA 2011a (AP-42 Tables 1.1-13, -14, -15, -18)

Notes:

For metals, pre-Project (2000-11) AP-42 Table 1.1-18, post-Project (2014-25) Part 63 Subpart UUUUU Table 2

For coal-fired units not low rank virgin coal

Megawatts (MW) gross electric power output

Part 63 regulation assumes heat rate = 10,000 BTU/KW-hr = 34.13% conversion efficiency

Higher heating value (HHV) of Navajo coal = 17.632 mmBTU/ton (AP-42 Section 1.1 Background Table A-3)

AP-42 emission factors rated “E” (poor) not used

Assumed future annual gross heat input based on 2000-11 historic actual capacity factors plus contingency margin

Capacity factor contingency margin = 9%

Copper not a 40 CFR 63 Subpart UUUUU metal; included here for consistency with ERA modeling protocol

Copper estimated based on chromium (metal with closest boiling point) and 2010 FCPP TRI Cu/Cr ratio of 2.21

Table 4.1-32 Estimated Historic and Future HAP Nonmetals Emissions - ORISPL 2442

HAP (Organics and Inorganics)	2000-11			2014	Comparison of Historic Levels to Baseline
	Units 1 - 5 Average lbs/yr	Units 1, 2, and 3 Average lbs/yr	Units 4 and 5 Average lbs/yr	Units 4 and 5 Average lbs/yr	Reduction Percent
Acetaldehyde	4,938	1,584	3,354	3,658	26%
Acetophenone	130	42	88	96	26%
Acrolein	2,512	806	1,706	1,861	26%
Benzene	11,262	3,613	7,649	8,343	26%
Benzyl chloride	6,064	1,946	4,119	4,493	26%
Bis (2-ethylhexyl)phthalate (DEHP)	632	203	430	469	26%
Carbon disulfide	1,126	361	765	834	26%
Chlorobenzene	191	61	129	141	26%
Chloroform	511	164	347	379	26%
Cyanide	21,659	6,949	14,710	16,045	26%
2,4-Dinitrotoluene	3	1	2	2	26%
Ethyl benzene	814	261	553	603	26%
Ethyl chloride	364	117	247	270	26%
Formaldehyde	2,079	667	1,412	1,540	26%
Hexane	580	186	394	430	26%
Hydrogen chloride	10,396,140	3,335,293	7,060,847	226,323	98%
Hydrogen fluoride	1,299,518	416,912	882,606	962,694	26%
Isophorone	5,025	1,612	3,413	3,722	26%
Methyl bromide	1,386	445	941	1,027	26%
Methyl chloride	4,592	1,473	3,119	3,402	26%
Methyl ethyl ketone	3,379	1,084	2,295	2,503	26%
Methylene chloride	2,512	806	1,706	1,861	26%
PAHs (composite total)	180	58	122	133	26%
Phenol	139	44	94	103	26%
Propionaldehyde	3,292	1,056	2,236	2,439	26%
Tetrachloroethylene	373	120	253	276	26%

HAP (Organics and Inorganics)	2000-11 Units 1 - 5 Average lbs/yr	2000-11 Units 1, 2, and 3 Average lbs/yr	2000-11 Units 4 and 5 Average lbs/yr	2014 Units 4 and 5 Average lbs/yr	Comparison of Historic Levels to Baseline Reduction Percent
Toluene	2,079	667	1,412	1,540	26%
Styrene	217	69	147	160	26%
Xylenes (o,m,p)	321	103	218	237	26%
Average Generation (MW-hrs/yr)	**16,056,814**	**4,678,394**	**11,378,420**	**12,410,900**	**23%**

Sources: 77 FR 32 Tables 3 and 5; 40 CFR 63 Subpart UUUUU Table 2; EPA 2011a (AP-42 Tables 1.1-13, -14, -15, -18)

Notes:

For HCl, pre-Project (2000-11) AP-42 Table 1.1-15, post-Project (2014-25) Part 63 Subpart UUUUU Table 2

For coal-fired units not low rank virgin coal

MW gross electric power output

Part 63 regulation assumes heat rate = 10,000 BTU/KW-hr = 34.13% conversion efficiency

Higher heating value (HHV) of Navajo coal = 17.632 mmBTU/ton (AP-42 Section 1.1 Background Table A-3)

AP-42 emission factors rated "E" (poor) not used

Assumed future annual gross heat input based on 2000-11 historic actual capacity factors plus contingency margin

Capacity factor contingency margin = 9%

4.1.3.3 Visibility/Regional Haze

Closure of Units 1, 2, and 3 and implementation of SCR on Units 4 and 5 would yield a compound NO_X reduction of about 87 percent on a plantwide basis. Because NO_X is an ozone precursor, elimination of up to 35,700 tons per year (98 tons per day) of NO_X emissions[8] would result in a clean air benefit for the region in addition to an incremental improvement in regional haze and visibility.

An assessment of ozone emissions from the FCPP was conducted to show the predicted fourth-highest maximum 8-hour impacts for PSD Class I and affected sensitive Class II areas. Tables 4.1-33 through 4.1-35 summarize the decrease in ozone levels at Class I and Class II areas in the region that would occur by the end of the baseline period, in comparison to historic levels.

Table 4.1-33 Fourth-Highest Maximum 8-Hour Ozone Impacts - PSD Class I Areas

Sixteen Class I Areas	Historic Ozone[1] ppbv	Baseline Ozone[2] ppbv	Endpoint NAAQS status
Petrified Forest National Park (AZ)	69.9	67.9	Meet
Grand Canyon National Park (AZ)	—	—	—
Capitol Reef National Park (UT)	—	—	—
Canyonlands National Park (UT)	62.4	61.0	Meet
Arches National Park (UT)	—	—	—
Mesa Verde National Park (CO)	67.3	65.0	Meet
Black Canyon of the Gunnison Wilderness (CO)	—	—	—
Weminuche Wilderness (CO)	**75.5**	74.7	Meet

[8] Potential reduction from 41,100 tons per year (pre-Project) to 5,400 tons per year (post-Project).

Sixteen Class I Areas	Historic Ozone[1] ppbv	Baseline Ozone[2] ppbv	Endpoint NAAQS status
La Garita Wilderness (CO)	**76.2**	**75.4**	Exceed
West Elk Wilderness (CO)	—	—	—
Maroon Bells – Snowmass Wilderness (CO)	—	—	—
Great Sand Dunes National Monument (CO)	—	—	—
Wheeler Peak Wilderness (NM)	—	—	—
Pecos Wilderness (NM)	69.0	66.8	Meet
Bandelier National Monument (NM)	69.1	66.8	Meet
San Pedro Parks Wilderness (NM)	70.0	67.5	Meet

Note: bolded values indicate exceedances

[1] Year 2005

[2] Year 2018 (note that modeling results were not available for 2013. 2018 represents the period wherein Units 1, 2, and 3 have been shut-down and SCR has been installed on Units 4 and 5.

Table 4.1-34 Fourth-Highest Maximum 8-Hour Ozone Impacts - Affected Sensitive Class II Areas

Affected Sensitive Class II Areas	Historic Ozone[1] ppbv	Baseline Ozone[2] ppbv	Endpoint NAAQS status
Carson National Forest	**75.2**	72.0	Meet
Grand Mesa, Uncompahgre, and Gunnison National Forests	**76.2**	**75.4**	Exceed
Handies Peak Wilderness Study Area	**75.1**	74.3	Meet
Jicarilla Apache Indian Reservation	**75.2**	72.3	Meet
Navajo Nation	**78.7**	74.9	Meet
Redcloud Peak Wilderness Study Area	**74.9**	74.0	Meet
Rio Grande National Forest	**76.0**	**75.2**	Exceed
San Juan National Forest	**75.1**	74.2	Meet
Uncompahgre Wilderness Area (BLM managed)	**75.0**	74.1	Meet
Uncompahgre Wilderness Area (USFS managed)	**74.9**	74.1	Meet

Note: bolded values indicate exceedances

[1] Year 2005

[2] Year 2018 (note that modeling results were not available for 2013. 2018 represents the period wherein Units 1, 2, and 3 have been shut-down and SCR has been installed on Units 4 and 5.

Table 4.1-35 Attainment Test 8-Hour Ozone Design Values - Four Corners Region

Areas and Monitoring Sites	Historic Ozone[1]	Baseline Action Ozone[2]	Endpoint NAAQS
	ppbv	ppbv	status
San Juan County, New Mexico (35-45-0009)	69.7	66.5	Meet
San Juan County, New Mexico (35-45-1005)	71.3	68.1	Meet
La Plata County, Colorado (08-67-1004)	72.0	69.8	Meet
La Plata County, Colorado (08-67-7003)	63.7	60.3	Meet
Montezuma County, Colorado (08-83-0101)	72.0	65.1	Meet

Source: AECOM 2013b

Notes:

[1] Year 2005

[2] Year 2018 (note that modeling results were not available for 2013. 2018 represents the period wherein Units 1, 2, and 3 have been shut-down and SCR has been installed on Units 4 and 5.

The 2005 Baseline simulation was conducted using the 2005 FCAQS regional emissions inventory from SLAMS and NADP sites Part 75 data for FCPP (AECOM 2013b). The report is also the source of the two future year 2018 scenarios developed to assess the impacts of the proposed FCPP proposed action. Regional comparisons show an overall decrease in cumulative ozone concentrations for the 2018 year simulations relative to the 2005 baseline. The largest changes occur in the western and central areas of the 4-km domain where the model-predicted fourth-highest daily maximum 8-hour average ozone concentrations decrease to 7 ppbv. The only locations where ozone is observed to increase are in San Juan County in New Mexico, in an area immediately downwind of the FCPP. The maximum increase in the fourth-highest 8-hour ozone occurs in a region where ozone concentrations do not exceed the NAAQS. These impacts occur almost entirely in San Juan County, New Mexico about 11 miles southeast of the FCPP and about 16 miles southwest of Farmington.

In 2005, four Class I and Class II areas exceeded the NAAQS; La Garita Wilderness Area, Grand Mesa National Forest, Navajo Nation, and Rio Grande National Forest. The 2018 model-predicted results indicate none of these areas would exceed the NAAQS. The FCPP does not contribute to the ozone concentrations in any of these areas, as the FCPP contribution in these areas is 0.0 ppbv. The unmonitored area analysis indicated that in 2005 there was one sensitive Class II area, Sandia Mountain Wilderness Area, with modeled ozone exceedences. By 2018 the ozone concentrations in this area will decrease but ozone exceedences may still occur episodically. The FCPP contributes 0.1 ppbv at Sandia Mountain.

The model-predicted FCPP ozone contribution at the Navajo Nation is 0.6 ppb. The monitored area analysis indicates that in 2005 one monitor exceeded the NAAQS, but by 2018, no monitors in the 4-km modeling domain would exceed the NAAQS. Using this method to predict future ozone concentrations, the ozone levels at the Navajo Nation are notably lower than the absolute model impacts and the contribution of the FCPP to this area is between 0.0 and 0.1 ppbv.

Ozone concentrations are predicted to decrease in 2018 throughout the 4-km modeling domain relative to conditions in 2005. Overall, the model-predicted future ozone concentrations are similar regardless of the methods used to analyze the results. Modeled ozone impacts from the FCPP in 2018 under the Proposed Action do not contribute to areas that may continue to have ozone concentrations that exceed the NAAQS.

The analysis indicates that under baseline conditions, after implementation of the new BART upgrades to FCPP, no monitoring sites are expected to exceed the 8-hour ozone NAAQS. Five ozone monitors are in the vicinity with predicted nonzero impacts ranging from 0.2 to 1.0 ppbv. In general, ambient ozone concentrations are predicted to decrease under baseline conditions relative to historic conditions in 2005 (AECOM 2013b).

4.1.3.4 Atmospheric Deposition

Under the FIP for FCPP, APS shut down Units 1, 2 and 3 on December 30, 2013. As shown in Table 4.1-29, the shut-down of these units reduced the SO_2 and NO_X emissions by 18 and 87 percent, respectively, on a plantwide basis, and 4 and 34 percent, respectively, on a regional basis. In general, these emissions reductions could incrementally lower acid deposition impacts downwind of FCPP to some extent, subject to assessment through long-term monitoring.

As shown in Table 4.1-29, shut-down of Units 1, 2, and 3 resulted in an approximate 90 percent overall reduction in metals emissions, when considered in combination with Units 4 and 5 operating in compliance with 40 CFR 63 Subpart UUUUU and Part 71 permit conditions. In particular, emissions of mercury are about 80 percent lower than uncontrolled regulatory default levels. Similarly, other large emissions reductions (over 90 percent) would include arsenic, cadmium, lead, and selenium.

As shown in Table 4.1-13, there is an approximate 25 percent overall reduction in nonmetal inorganic and organic HAP emissions due to closure of Units 1, 2, and 3 in combination with Units 4 and 5 operating in compliance with 40 CFR 63 Subpart UUUUU and Part 71 permit conditions. Subpart UUUUU hydrogen chloride acid gas (a precursor to chloride ion, Cl^-) emissions are over 90 percent lower than uncontrolled regulatory default levels due to absorption in the caustic wet scrubbers used to control SO_2 emissions from Units 4 and 5.

4.1.4 Environmental Consequences

The following sections present the results of the quantitative assessment of emissions from FCPP and the Navajo Mine from 2016 to 2041. Emissions from continued operation of the transmission lines would have minor impact compared to any potential impact from the FCPP and Navajo Mine; therefore, these are described qualitatively. Predicted emissions from FCPP are based on historic operating data reported to the EPA and estimated mining emissions are cited from the recent *Area IV North EA/Finding of No Significant Impact* (OSMRE 2012b). For FCPP, projected PM emissions are calculated based on EPA data, permit conditions, and process rates. In addition to criteria pollutants, estimated future emissions of noncriteria HAPs from FCPP are based on historic operating data and regulatory air emission factors published by the EPA.

Modeling

Extensive modeling efforts were conducted in order to assess the potential effects to air quality. This includes a NAAQS Modeling Study (2013a) and an Ozone Impact Assessment (2013b). Also conducted was a plume visibility assessment to evaluate the potential contributions of the Proposed Action on regional haze. The results of these models have been critically reviewed by federal agencies (e.g., NPS, EPA), and where applicable, are incorporated into the impact analyses for each alternative. A brief summary description of the methodology of each model is provided below.

NAAQS Modeling Study Summary

The *NAAQS Modeling Study* (2013a) evaluated the effects of criteria emissions from FCPP Units 4 and 5 on local ambient air quality, along with fugitive dust emissions from mining, coal handling, lime handling, ash placement, and vehicle traffic on mine and plant roads, including employee vehicles. The objective of the study was to determine whether criteria emissions from FCPP and Navajo Mine would cause an

exceedance of NAAQS. This is particularly important for SO_2 and NO_2 because current NAAQS are more stringent (lower) than when prior air quality studies (NMED 2009) were performed.

The modeling analyses for the power plant and mine were based on procedures contained in the *Guideline on Air Quality Models*, which is codified in 40 CFR Part 51, Appendix W (EPA 2005a). The guideline asserts that the suitability of an air quality dispersion model for a particular application is dependent upon several criteria, which include (1) stack height relative to nearby structures, (2) dispersion environment, (3) local terrain, and (4) availability of representative meteorological data. Based on a review of these factors, the most current version of the AERMOD[9] program was used to quantify emissions from the FCPP and Navajo Mine (AECOM 2013a).

The NAAQS Modeling Study was performed using EPA's AERMOD dispersion model. Upon review, the NPS commented on the applicability of certain meteorological data pre-processing options available in AERMOD and used in the study. In response to these comments and with the EPA's concurrence: 1) the model will be re-run using EPA's newest version of the pre-processing software when it becomes available; 2) a sensitivity analysis will be performed that compared the previous (old) modeling results to the new modeling results; 3) a conclusion will be formed on the significance of the differences in modeling results; and 4) the NAAQS Modeling Study report will be amended to include a discussion of the differences and their relevance to the results of the study. While the EPA determined that the model could not be used with certain options for permitting, a distinction was made between modeling for an EIS versus modeling for a permit application. Thus, since there should be no significant differences in the modeling results between the old and new versions, the NAAQS modeling methodology should be deemed acceptable by the NPS and EPA.

Ozone Impact Assessment Summary

As part of the NAAQS assessment, APS conducted photochemical modeling on a regional level to assess the effects of NO_X emissions from FCPP. The assessment was conducted by modeling FCPP emissions in combination with other regional sources and comparing the resulting ozone concentrations to the current 8-hour ozone NAAQS and also the former (1979-97) 1-hour ozone NAAQS. Ozone impacts were assessed near FCPP (maxima), in nearby PSD Class I and sensitive Class II areas, and at existing ozone monitoring sites (AECOM 2013b).

For consistency and economy, APS utilized input data, configurations, and supporting information for the CAMx (Comprehensive Air Quality Model with eXtensions) modeling program[10], which was used for the Four Corners Air Quality Study (NMED 2009). As part of the modeling procedure, the Four Corners Air Quality Study regional emissions inventory was updated with current data for other sources in the 4-km domain, and APS provided updated emissions for FCPP consistent with the final BART rule. The modeling period spanned May through August because monitored ozone concentrations are highest during the summer months due to stronger sunlight, which drives photochemical reactions.

Impacts on regional ozone concentrations were evaluated by using CAMx to simulate three scenarios for the years 2005 and 2018:

1. The 2005 Baseline simulation used the updated Four Corners Air Quality Study 2005 emissions inventory for an analysis of current air quality conditions. Modeling emissions for 2005 established historic air quality levels against which the alternatives were evaluated.
2. The 2018 No Action Alternative simulation was based on Four Corners Air Quality Study 2018 Mitigation Scenario No. 4 and included impacts for all regional emissions except those from FCPP. This scenario hypothetically applied aggressive NO_X and SO_2 control measures at coal-

[9] AERMOD is a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources and both simple and complex terrain. It is the regulatory default model required to be used for SIP revisions for existing sources, and for NSR and PSD programs.

[10] The CAMx modeling system includes a meteorological model, an emissions data processor, and a photochemical grid model.

fired power plants in the region as well as new controls on oil and gas industry NO_X and VOC sources in San Juan and Rio Arriba counties.

3. The 2018 Proposed Action was also based on Four Corners Air Quality Study 2018 Mitigation Scenario No. 4 and includes contributions from estimated future emissions from Units 4 and 5.

The outputs of the three CAMx simulations were post-processed to perform the following analyses: (1) assessment of maximum ozone impacts due to the Proposed Action; (2) comparison of modeled concentrations to the 8-hour ozone NAAQS; and (3) attainment tests for monitored and unmonitored areas, including PSD Class I and sensitive Class II areas.

The NPS has expressed concern that a 5-year old estimated regional future emissions scenario developed as part of the Four Corners Air Quality Study (NMED 2009) and used to predict ozone levels for 2018 may have overestimated future NO_X emissions from FCPP and San Juan Generating Station while possibly underestimating future VOC emissions from the oil & gas industry in the region. This suggested that the 2018 emissions scenario may not have been totally credible with respect to today's view of the near future (i.e., generating unit shutdowns and slower growth in the oil and gas industry). However, due to conservative assumptions made for the ozone impact modeling, any re-modeled ozone impacts would not be significantly different from the original impacts and overall conclusions would remain the same.

Deposition Effects – Monitoring Networks

Estimates or assumptions used to predict future conditions can introduce some level of uncertainty into forecasts. In *Guidelines for Ecological Risk Assessment*, the EPA notes that a major source of uncertainty is extrapolation (i.e., the greater [or longer]) the extrapolation, the greater the uncertainty) (EPA 1998a). This point is particularly true for screening-level forecasts or assessments, where assumptions are generally intended to provide conservative upper-bound estimates. However, it is important to recognize that findings made using these techniques do not necessarily mean that predicted conditions would actually occur under real circumstances. The following predictions of deposition monitoring network observations are based on extrapolation of historic data while taking into account the anticipated effects of the alternatives and other changes in the region (i.e., emissions reductions). Thus, the results are somewhat uncertain, but provide an upper bound to the impacts.

To delineate the area to be evaluated in the Ecological Risk Assessment (discussed in detail in Section 4.8, Threatened and Endangered Species), deposition modeling was conducted using the CALPUFF[11] model. A screening procedure was applied to estimate potential changes to soil concentrations of selected metals associated with 25 years of cumulative deposition from future FCPP operations. The estimated concentrations of emitted metals in ambient air and the amount deposited to surface soil were calculated and compared to measured soil concentrations within San Juan County (AECOM 2013c).

Eight metals were selected for initial modeling in the FCPP/Navajo screening procedure: arsenic, cadmium, chromium, mercury, antimony, lead, copper, and selenium (AECOM 2013c). The CALPUFF model was applied within a 300-km (186-mile) radius of FCPP to simulate dispersion and deposition of the eight metals due to continuous full load (99th percentile) operation of FCPP for 25 years. The deposition area was determined by predicting where incremental increases in soil concentrations of any of the eight metals was more than 1 percent of present-day concentrations per data provided by the U.S. Geological Survey (USGS). This procedure determined that the deposition area extended less than 50 km (31 miles) from FCPP; therefore, more detailed air dispersion and deposition modeling was performed using AERMOD[12] and refined emissions estimates. The same comparative procedures were used to estimate impacted soil concentrations against the USGS data, and it was found that the deposition

[11] CALPUFF is the EPA-approved model to simulate dispersion and deposition over a large area for long-range transport and complex terrain on scales of tens to hundreds of kilometers. The 300 km (186-mile) radius was selected to encompass a large distance from FCPP for screening purposes.

[12] AERMOD is the EPA-approved steady-state plume model that incorporates air dispersion for simple and complex terrains and is designed for short-range modeling up to 50 km (31 miles).

patterns of the CALPUFF and AERMOD analyses were similar in shape and overlapped significantly, thus providing a validation of the modeling results (AECOM 2013c).

Significance Thresholds

Significance thresholds for evaluating air quality impacts with regard to criteria pollutants are defined in the Clean Air Act. With regard to visibility, significance thresholds have been defined by the EPA. In terms of potential impacts of HAPs on sensitive receptors, no EPA, NNEPA or other local regulatory threshold has been defined; therefore, the threshold used by air quality agencies outside of the Four Corners region is used to evaluate potential impacts. No significance thresholds are defined with regard to deposition of air emissions. This information is presented within this impacts chapter to provide data regarding the area of deposition under each alternative; however, impacts of deposition are assessed in Section 4.5, Water Resources, and Section 4.8, Special-Status Species, as applicable.

Criteria Emissions

Pursuant to 40 CFR 51.166(23)(i), PSD significance thresholds related to NAAQS are shown below. Per the regulatory definition, *significant* means a net emissions increase at an existing source (e.g., FCPP) or the potential of a new source to emit air pollutants that would equal or exceed any of the mass rates in units of short tons per year (tpy) as listed in Table 4.1-36.

Table 4.1-36 Criteria Emission Significance Thresholds

Criteria Pollutant	Significance Threshold
Carbon monoxide	100 tpy
Nitrogen oxides	40 tpy
Sulfur dioxide	40 tpy
Particulate matter	25 tpy (total) or 15 tpy of PM_{10}
$PM_{2.5}$	10 tpy of direct $PM_{2.5}$ emissions; 40 tpy of SO_2 emissions; 40 tpy of NO_X emissions unless demonstrated not to be a $PM_{2.5}$ precursor
Ozone	40 tpy VOCs or NO_X precursors
Lead	0.6 tpy
Fluorides	3 tpy
Sulfuric acid mist (H_2SO_4)	7 tpy
Hydrogen sulphide	10 tpy
Total reduced sulphur (including H_2S)	10 tpy
Reduced sulphur compounds (including H_2S)	10 tpy

Key concepts in projecting future emissions are capacity factor and potential-to-emit (PTE), as defined below:

- Capacity factor is defined as actual utilization divided by theoretical design capacity. For generating units, this factor is typically expressed as actual megawatt-hours (MW-hrs) generated in a year versus design rating in megawatts times 8,760 hours per year (maximum theoretical MW-hrs). Since generating units must be periodically shut down for maintenance and seldom operate at full design rating (load) to extend equipment life, capacity factor is always less than 100 percent, typically in the range of 80 to 95 percent for base load generating units, depending on overall reliability.
- PTE is defined as maximum theoretical emissions for a pollutant at permitted operating conditions. Traditionally, PTE is determined assuming maximum allowable emission rate at 100 percent capacity factor; however, since actual capacity factor is less than 100 percent, theoretical PTE is never normally achieved unless limited by permit condition.

Four Corners Power Plant

Stack Emissions – SO_2 , NO_X, CO, Pb, Filterable PM_{10}, and $PM_{2.5}$, Condensable H_2SO_4, and Organics

Modeled mass emission rates from the Units 4 and 5 stacks were based on historic hourly data, Title V permit conditions, EPA emission estimation techniques (EETs), and BART limits for NO_X and PM. Modeled stack temperature and exhaust velocity were based on actual hourly data recorded from 2009 through 2011. Per guidance received from the EPA, APS modeled 3 years of actual 1-hour SO_2 emissions from Units 4 and 5. Since the BART emission rate for NO_X is based on a 30-day rolling average, which is appropriate for visibility impacts, both 30-day and 1-hour average emission rates for NO_X were modeled. In addition, modeled PM_{10} and $PM_{2.5}$ emission rates included condensable emissions consistent with increased sulfuric acid mist (H_2SO_4) conversion, a byproduct of SCR operation. Table 4.1-37 reproduces the mass emission rates used for modeling future operations of Units 4 and 5 assuming an average historic annual capacity factor of 86 percent.[13] Surface meteorological data comprised 5 years (2006 through 2010) from Navajo Met Towers 1 and 3 along with concurrent upper air data from Albuquerque International Airport.

Table 4.1-37 Modeled Future Criteria Pollutant Emissions Rates - ORISPL 2442 Units 4 and 5

Criteria Pollutant	Factor lb/mmBTU	Factor Reference Notes	Units 4 and 5 Combined		
			mmBTU/hr	lbs/hr	g/sec
Sulfur Dioxide (SO_2)	0.190	40 CFR 75 historic average (1-hour)	14,822	2,816	354.83
Nitrogen Oxides (NO_X), average	0.098	40 CFR 49 BART Rule (30-day rolling average)	14,822	1,453	183.02
Nitrogen Oxides (NO_X), maximum	0.190	1-hour average	14,822	2,816	354.83
Carbon Monoxide (CO)	0.028	AP-42 Table 1.1-3; 17.632 mmBTU/ton	14,822	415	52.29
Lead (Pb)	1.2E-06	40 CFR 63 Subpart UUUUU Table 2	14,822	0.02	0.0022
Filterable Particulate (PM)	0.01500	40 CFR 49 BART Rule	14,822	222.33	28.01
Total Filterable PM_{10}	0.01380	AP-42 Table 1.1-6; 92% of filterable PM	14,822	204.54	25.77

[13] Expressed as a continuous heat input of 7,411 mmBTU/hr for each generating unit rated at 8,612 mmBTU/hr, determined as the 99th percentile of boiler operating data for the 3-year period 2009 through 2011.

Criteria Pollutant	Factor lb/mmBTU	Factor Reference Notes	Units 4 and 5 Combined		
			mmBTU/hr	lbs/hr	g/sec
"Coarse" Filterable PM_{10}	0.00585	difference (total filterable - fine filterable)	14,822	86.71	10.93
Fine Filterable $PM_{2.5}$	0.00795	AP-42 Table 1.1-6; 53% of filterable PM	14,822	117.83	14.85
Fine "Soil" $PM_{2.5}$	0.00766	difference (fine filterable - fine elemental carbon)	14,822	113.48	14.30
Fine Elemental Carbon $PM_{2.5}$	0.00029	EPA 68-D-98-046 Table 6; 3.7% of $PM_{2.5}$	14,822	4.36	0.55
Total Condensable PM_{10} / $PM_{2.5}$	0.00835	sum (sulfuric acid + organics)	14,822	123.81	15.60
Condensable Sulfuric Acid (H_2SO_4)	0.00435	Stack test and EPRI removal efficiency (%)	14,822	64.52	8.13
Condensable Organics	0.00400	AP-42 Table 1.1-5; 20% of 0.02 lb/mmBTU	14,822	59.29	7.47
Grand Total PM_{10}	0.02215	Total Filterable + Total Condensable	14,822	328.35	41.37
Grand Total $PM_{2.5}$	0.01630	Fine Filterable + Total Condensable	14,822	241.64	30.45

Source: AECOM 2013a

Materials Handing Emissions – PM_{10} and $PM_{2.5}$

For the two lime silos equipped with baghouses for dust control, PM emissions were estimated using the permissible outlet loading in units of grains[14] per cubic foot of exhaust air from the baghouses and the volumetric displacement of air when lime is loaded into a silo. The fly ash waste disposal area has five silos, all equipped with baghouses, and three pug mills with scrubbers for processing fly ash. Fly ash baghouse and scrubber emissions were estimated and modeled using the outlet grain loading and air flowrate for each control device. For the lime slurry mixing process, fugitive droplets were modeled as volume sources. Open transfer points within the coal transport system were also modeled as volume sources.

Plant Traffic – PM_{10} and $PM_{2.5}$

Paved and unpaved road source characteristics were developed to represent vehicular traffic at FCPP. Based on EPA guidance, roads were represented by lines of volume sources. For daytime operations, fly ash disposal trucks, fly ash sales trucks, lime delivery trucks, SCR reagent (ammonia or urea) delivery trucks, road-watering trucks, and company and employee vehicles (autos, pickups, SUVs, vans) were included. Vehicular traffic during overnight hours was assumed to be minimal, and roads are watered several times a day. Fugitive dust from paved and unpaved roads was calculated using EETs published by the EPA, taking into account road watering as an effective dust control method. Fugitive dust controls can cut emissions by at least 50 percent and up to 90 percent if applied copiously (EPA 2006).

Lime and Ash Piles – PM_{10} and $PM_{2.5}$

Area sources at FCPP consist of stockpiles located at the lime processing area and the ash disposal area. Wind erosion of stockpiles is highly intermittent due to the relatively high threshold wind speeds needed to entrain lime and ash. To facilitate modeling, triggered wind events were evaluated by reviewing on-site wind speed data correlated to threshold friction velocity guidance and EETs published by the EPA. The fly ash has high moisture content when transported and unloaded by the haul trucks. Over time, it

[14] One pound of material has 7,000 grains , or 1 gram of material has 15.432 grains.

dries into a cement-like solid. Surfactant is applied regularly to reduce the amount of fugitive dust that can become airborne during triggering wind events.

Navajo Mine

Navajo Mine North – PM_{10} and $PM_{2.5}$

The Navajo Mine coal preparation plant is in the northern portion of the lease area and adjacent to FCPP on the eastern side. A train transports coal from Lowe Stockpile to the processing area where the railcars are unloaded into one of two hoppers, displacing air upward, which entrains some coal dust. Water sprays inside each receiving hopper are activated when a railcar is unloaded, reducing entrained coal dust by about 50 percent. For modeling, particulate emissions from the coal hoppers were estimated by APS per published EPA guidance taking into account site-specific factors such as drop distance. Other principal components of the coal preparation plant modeled by APS include towers silos, crushers, and conveyors. Coal stockpiles were evaluated in a similar manner to lime and ash stockpiles described above (AECOM 2013a).

Navajo Mine South (Area IV) – NO_X, SO_2, CO, PM_{10}, and $PM_{2.5}$

Sources in the southern portion of the Navajo Mine include the Pinabete Permit Area, transport of coal from the Pinabete Permit Area to Lowe Stockpile, unloading at the pile and loading into railcars, blasting, and overburden replacement. Emission factors, control efficiencies, and equipment lists were provided to APS by Navajo Mine. Mining emissions comprise diesel engine exhaust and fugitive dust. Mobile sources modeled by APS included shot hole drilling, dragline activity, bulldozing, loading coal into trucks with front-end loaders, scraping, and road grading.

Coal and overburden blasting emits CO, NO_2, and SO_2 from detonation of ANFO explosive. Emission factors published by the EPA were used to calculate emissions of CO and NO_2. Since Navajo Mine uses ultralow sulfur diesel fuel in its ANFO mixture, SO_2 emissions are significantly less than cited in the EPA emission factors, which were adjusted accordingly. Coal blasting routinely occurs 3 days per week about mid-day within a 4-hour time window; however, the ANFO emission rate was conservatively modeled for 4 hours per day, 5 days per week, for a total of 20 hours per week to simplify the modeling. Each blast is in a different location and meteorological conditions vary; therefore, the modeled concentrations were conservative. In contrast, overburden blasting occurs only once per month over a larger area and never occurs in the same location twice. Due to the transient and temporal nature of overburden blasting, it was not included in the NAAQS modeling based on specific EPA guidance for intermittent sources (EPA 2011a).

Mine Traffic – PM_{10} and $PM_{2.5}$

Traffic impacts from coal haul trucks, watering trucks, scrapers, end dump trucks, and pickups on the roads between the active mining areas and Lowe Stockpile were characterized by modeling activities occurring 24 hours per day (AECOM 2013a). Fugitive dust was calculated using EETs published by the EPA, taking into account road watering as an effective dust control method, supplemented by a nontoxic chemical dust suppressant applied to major unpaved roads annually.

Mine Coal Stockpiles – PM_{10} and $PM_{2.5}$

Coal from the active mining areas is transported and unloaded onto Lowe Stockpile and compacted using bulldozers. As modeled by APS, unloading and bulldozing activities occur 24 hours per day, and coal is loaded from the pile into railcars for transport to the coal preparation plant. Wind erosion of stockpiles was modeled by APS by evaluating triggering wind events correlated to threshold friction velocity guidance and EETs published by the EPA. Wind erosion of overburden reclaim piles was modeled in the same manner (AECOM 2013a).

HAPs

Air toxics are pollutants that may result in an increase in mortality or serious illness, or that may pose a present or potential hazard to human health. Health effects of air toxics include cancer, birth defects, neurological damage, damage to the body's natural defense system, and diseases that can lead to premature death.

A screening-level Health Risk Assessment (HRA) for DPM was performed using conservative methodology for upper-bound mining activity levels and timeframes. Detailed results of the HRA are provided in Section 4.17, Public Health. In general, due to the broad geographic dispersion of mining activities, their short-term temporary nature at any particular location, and lack of proximate receptors within 1,000 feet (300 meters), no significant risk to sensitive receptors or the general public would be posed by mining-related HAP emissions.

Plume Visibility

The screening analysis was conducted per guidance contained in the *Workbook for Plume Visual Impact Screening and Analysis* (EPA 1992a), with additional recommendations provided by the NPS. EPA's screening-level plume visibility model VISCREEN was used with site-specific meteorological data to calculate plume visibility parameters corresponding to worst-case conditions. As a screening model, VISCREEN does not calculate plume height above the ground, but hypothetically places the observer at plume height, looking horizontally at various sun-time intervals through the plume centerline. VISCREEN then computes the combinations of sun-plume-observer geometry that the result in the largest degree of plume visual impact. Because of this simplified line-of-sight geometry, the results from VISCREEN are conservative; thus, actual visual impacts would be less than otherwise predicted.

The model calculates linear Gaussian[15] dispersion of PM and NO_2, the two pollutants known to contribute most to visible plumes, notwithstanding condensing water vapor in cold weather. However, as a near-field model, VISCREEN does not address the secondary formation of nitrate (NO_3^-) and sulfate (SO_4^{2-}) particles which are known to contribute to regional haze at longer distances. The model outputs two visual impact parameters: plume contrast and plume perceptibility. According to the EPA, plume contrast (Cp) values exceeding an absolute value of 0.05 should be used as a screening threshold, inferring that a 5 percent change in intensity is likely to be noticed by a casual observer,[16] Plume perceptibility (ΔE) evaluates the degree to which a plume can be seen either against a background sky or terrain. The EPA has established a ΔE threshold of 2.0 to indicate the presence of a visible plume against a background sky or terrain (EPA 1992a).

The EPA has determined that plume contrast (Cp) values exceeding an absolute value of 0.05 should be used as a screening threshold for sources located within federally-designated Class I areas, inferring that a 5 percent change in intensity is likely to be noticed by a casual observer,[17] Plume perceptibility (ΔE) evaluates the degree to which a plume can be seen either against a background sky or terrain. The EPA has established a ΔE threshold of 2.0 to indicate the presence of a visible plume against a background sky or terrain (EPA 1992a). Therefore, for the purposes of this analysis, a vista is significantly improved if the baseline ΔE exceeds 2.0 and the future ΔE is less than 2.0. Conversely, a vista is significantly degraded if the baseline ΔE is less than 2.0 and the future ΔE exceeds 2.0.

No criteria exist for evaluating visible plumes from sources beyond the boundaries of Federal Class I areas; therefore, this criteria was used to determine if emissions from the Proposed Action would affect visibility within Class I areas.

[15] Normal functions developed by German mathematician Karl Friedrich Gauss (1777-1855) that express natural phenomena.
[16] A positive Cp means the plume is a lighter color than the sky, a negative Cp means the plume looks darker than the sky.
[17] A positive Cp means the plume is a lighter color than the sky, a negative Cp means the plume looks darker than the sky.

4.1.4.1 Alternative A – Proposed Action

Future Criteria Emissions

Under the Proposed Action, Units 4 and 5 at the FCPP and the Navajo Mine would continue to operate and emit criteria and noncriteria pollutants, including HAPs, for the duration of the 25-year lease agreement, with the required installation and commissioning of SCR equipment by July 2018. Since SCR requires ammonia reagent (either anhydrous, aqueous, or from urea) to reduce NO_X to nitrogen (N_2) and water vapor (H_2O), some unreacted (residual) ammonia (NH_3) would be emitted from the boiler stacks as "ammonia slip," typically 5 to 10 ppmv for BART installations.

Onroad vehicles and offroad equipment owned by FCPP are used for plant and switchyard maintenance. Segments of the transmission lines nearest FCPP are also maintained using plant vehicles and equipment. These vehicles and equipment emit air contaminants in engine exhaust during normal use. All equipment and vehicle engines used at the plant meet Federal emissions standards applicable on the date of manufacture.

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Emissions from Units 4 and 5 would continue through 2041, supplied with coal from the Navajo Mine. Table 4.1-38 shows estimated future (2014 through 2026) potential criteria emissions (SO_2, NO_X' and calculated PM) from Units 4 and 5 assuming a maximum annual generation capacity factor of 92 percent based on the 7-year period from 2005 to 2011 when FGD became active on Units 4 and 5. Pre-project metals emissions are based on historical capacity factor of 84 percent and AP-42 regulatory default emission factors as "uncontrolled" emissions. Post-project metal emissions are based on projected maximum capacity factor of 92 percent and 40 CFR 63 Subpart UUUUU emission factors as "controlled" emissions. The large reductions in metals emissions are because the Subpart UUUUU controlled factors are much lower than the AP-42 uncontrolled factors. For nonmetal HAPs, the same set of AP-42 regulatory default emission factors are used for both pre- and post-project emissions estimates as these are not subject to Subpart UUUUU (except HCl). Because the maximum annual capacity factor (92 percent) is 9 percent higher than the historic capacity factor (84 percent), the nonmetal HAPs potential-to-emit is also 9 percent higher. To be conservative, this 92 percent capacity factor is 9 percent higher than the historic average of 84 percent for the same period. For the 12-year period beginning in 2000, a 92 percent capacity factor was achieved only during 2 years, 2003 and 2006, all other years were less. Thus, the probability of achieving 92 percent capacity factor is estimated to be 1 in 6 or about 17 percent overall, which is a reasonable contingency over the long run. Projected annual emissions for years 2027 through 2041 are assumed to be the same as year 2026 (12 years from now) due to potential load-demand maturity over the long-term.

Table 4.1-38 Estimated Future Maximum Part 75 Emissions - ORISPL 2442 Units 4 and 5 (with phased SCR controls)

	Generation	Sulfur Dioxide		Nitrogen Oxides		Particulate Matter	
Year	MW-hrs/yr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr
2014	12,410,900	9,800	0.72	27,100	1.98	830	0.06
2015	12,410,900	9,800	0.72	27,100	1.98	830	0.06
2016	12,410,900	9,800	0.72	27,100	1.98	830	0.06
2017	12,410,900	9,800	0.72	19,870	1.45	830	0.06
2018	12,410,900	9,800	0.72	12,640	0.92	830	0.06
2019	12,410,900	9,800	0.72	5,420	0.40	830	0.06
2020	12,410,900	9,800	0.72	5,420	0.40	830	0.06
2021	12,410,900	9,800	0.72	5,420	0.40	830	0.06

Year	Generation	Sulfur Dioxide		Nitrogen Oxides		Particulate Matter	
	MW-hrs/yr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr
2022	12,410,900	9,800	0.72	5,420	0.40	830	0.06
2023	12,410,900	9,800	0.72	5,420	0.40	830	0.06
2024	12,410,900	9,800	0.72	5,420	0.40	830	0.06
2025	12,410,900	9,800	0.72	5,420	0.40	830	0.06
2026	**12,410,900**	**9,800**	**0.72**	**5,420**	**0.40**	**830**	**0.06**

Source: EPA 2012h Notes: Projected emissions for years 2027 through 2041 same as year 2026 (flat extrapolation assumed)
PM calculated per AP-42 Chapter 1.1 support document Tables 4-7 and A-3; 40 CFR 49 final rule (Units 4 and 5)
Maximum annual capacity factor = 92% based on historic operations (average historic annual capacity factor = 84%)

All air emissions from FCPP would remain as described in the baseline, which accounts for the decreased emissions due to the shutdown of Units 1, 2, and 3 and application of BART. PSD thresholds for sulfuric acid mist would be exceeded by the Proposed Action; ammonia slip emissions from SCR operation do not fall under PSD because ammonia is not a regulated criteria pollutant.

Table 4.1-39 shows estimated criteria emissions from FCPP vehicles and mobile equipment (APS 2012a), a very small portion of which is attributable to transmission line maintenance. In comparison to boiler (stack) emissions, FCPP mobile source NO_X emissions are only 0.05 percent, which would result minor impact in the short- or long-term.

Table 4.1-39 Estimated Criteria Emissions from FCPP Mobile Sources

Mobile Sources	VOC	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr
Power Plant Offroad Equipment	0.31	3.69	2.05	0.004	0.13	0.11
Power Plant Onroad Vehicles	0.11	0.76	0.86	0.002	0.04	0.03
Annual Totals	**0.42**	**4.46**	**2.90**	**0.006**	**0.16**	**0.14**

Sources: APS 2012a, EPA 2011a, SCAQMD 2008
Note:
PM_{10} and $PM_{2.5}$ for exhaust only, fugitive dust accounted for in OSMRE 2012b

Navajo Mine

Development of the Pinabete Permit Area (Area IV North and South) and associated coal reserves under the Proposed Action would use best-practice surface mining methods and equipment to supply coal to FCPP for up to 25 years beginning in 2016 and ending in 2041. Mining activity would cause emissions from diesel-powered offroad equipment and onroad vehicles, explosives detonation, fugitive methane liberated from coal seams, and fugitive dust. All equipment and vehicle engines used at the mine meet Federal emissions standards applicable on the date of manufacture.

Table 4.1-40 shows estimated criteria emissions and DPM from Navajo mining operations in the existing Navajo Mine Permit Area and the proposed Pinabete Permit Area and related activities. These quantifiable sources contribute about 6.8 percent of NO_X PTE and about 0.1 percent of SO_2 PTE. Reasonable variations in mining-related mobile source estimates for NO_X and SO_2 would have minor impact in the short- or long-term because a 10 percent change in mining-related NO_X or SO_2 emissions would represent only 0.7 percent of total project NO_X emissions and 0.01 percent of SO_2 emissions, which is well within EPA precision limits of -2 to +5 percent for fossil fuel combustion (EPA 2012b).

Fugitive dust emissions from coal mining and coal handling are estimated at 910 tons per year, which is about 10 percent greater than power plant stack emissions (830 tons per year). Mining PM emissions are mainly in the form of relatively uncontrolled fugitive dust; therefore, are highly variable. Power plant PM emissions are controlled using baghouses; therefore are highly controlled and less variable. Because of the variability, fugitive dust emissions cannot be directly compared to power plant stack PM emissions.

Table 4.1-40 Estimated Criteria and DPM Emissions from Navajo Mine Operations (both Navajo Mine and Pinabete Permit Areas)

	VOC	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$	DPM
Mobile and Fugitive Sources	**tons/yr**	**tons/yr**	**tons/yr**	**tons/yr**	**tons/yr**	**tons/yr**	**tons/yr**
Overburden Drilling and Blasting	—	19.67	4.99	0.59	3.36	0.97	—
Coal Seam Drilling and Blasting	—	241.96	61.39	7.22	4.82	1.40	—
Overburden Dragline Stripping	—	—	—	—	62.96	5.56	—
Mine Extraction Operations and Loading	15.44	65.57	141.75	0.20	183.59	20.58	5.11
Coal Hauling Trucks to Stockpiles	14.16	68.08	125.40	0.18	276.47	27.65	5.31
Mining Support Vehicle Travel	3.36	9.91	33.73	0.05	180.73	18.07	0.77
Unloading at Stockpiles and Railcar Loading	—	—	—	—	0.71	0.22	—
Reclamation	—	—	—	—	124.50	24.90	—
Coal Preparation Plant (except stockpile)	—	—	—	—	13.89	4.05	—
Wind Erosion (coal and spoils piles)	—	—	—	—	58.82	21.03	—
Annual Totals	**32.96**	**405.19**	**367.26**	**8.23**	**909.85**	**124.43**	**11.20**

Source: OSMRE 2012b

Notes:

SO_X emissions estimated from FONSI supporting data

PM_{10} and $PM_{2.5}$ includes exhaust and fugitive dust as determined in FONSI

For diesels, DPM estimated as 7.8% of CO emissions per offroad emissions factors (SCAQMD 2008)

Transmission Lines

Mobile source emissions from maintenance of transmission lines would include diesel exhaust from truck trips. Maintenance would occur at various points along each of the transmission lines, on less than an annual basis at each site. Therefore, emissions would have minor impact in the short- or long-term (less than 1 percent of aggregated mobile sources) and would not result in exceedances of any NAAQS.

Combined Emissions Summary

Table 4.1-41 summarizes the NAAQS modeling results for all pollutants with monitored (existing) ambient background concentrations added in. As shown in Table 4.1-41, future total concentrations for all pollutants and averaging times would be expected to meet current NAAQS (AECOM 2013a):

- Quarterly lead, 1-hour and 3-hour SO_2, 1-hour and annual NO_2 impacts would be from Units 4 and 5 stack emissions.
- Annual and 24-hour $PM_{2.5}$ impacts would be dominated by low elevation sources such as coal preparation, lime and ash handling, and road dust.
- Active mining and mine vehicle traffic emissions would dominate the impact for 24-hour PM_{10}.
- 1-hour and 8-hour CO impacts would be driven by the coal blasting emissions, which were modeled for 4 hours per day even though these emissions occur less than 1 hour per day.

Modeling using conservative assumptions for elevated stack or ground-level fugitive sources at FCPP or Navajo Mine show that NAAQS would not be exceeded (AECOM 2013d). Air quality regulations require that NAAQS be measured at the site boundary, where no densely populated areas exist near the plant or mine. In addition to stack emissions, modeling of fugitive dust emissions from road traffic, materials handling, and mining operations determined that the Proposed Action would not cause local exceedances of NAAQS for PM_{10} (respirable particulate) and $PM_{2.5}$ (fine particulate); however, the estimate of $PM_{2.5}$ emissions from the Proposed Action approaches the NAAQS (33.2 µg/m3 as compared with the 35 µg/m^3 NAAQS). Refer to Section 4.1.4 for the modeling assumptions, including operational control factors assumed in the modeling. For PM2.5, the guidance in the March 23, 2010 EPA/Stephen Page memo for adding modeled to background concentrations was followed. This guidance indicates that the peak 24-hour modeled concentration should be added to the 98th percentile background concentration. However, the new EPA draft procedure for $PM_{2.5}$ modeling released on March 4, 2013, indicates that the 98th percentile modeled 24-hour concentration should be added to the 98th percentile background concentration in certain situations. This proposed procedure would be applicable in the FCPP case due to the fact that the peak modeled concentration is due to fugitive emissions (no precursor emissions). Using the recent draft guidance, the 24-hour $PM_{2.5}$ design concentration would be reduced from about 33 µg/m^3 to about 26 µg/m^3. Therefore, for both SO and PM, the design concentrations are on the order of 75 percent of the NAAQS, leaving considerable room for uncertainties in background concentrations. Attainment of primary NAAQS is protective of public health, including sensitive receptors (see also Section 4.17, Public Health, for justification that NAAQS are protective); therefore, impacts in the short- or long-term operation of the FCPP and Navajo Mine are estimated to be minor.

Table 4.1-41 NAAQS Modeling Results - FCPP & Navajo Mine Vicinity

Pollutant	Standard	Averaging Time	Modeled Impact	Monitored Background	Total Impact	NAAQS	
			µg/m^3	µg/m^3	µg/m^3	µg/m^3	status
Ozone (O_3)*	Primary & Secondary	8-hour	-6.3	139.7	133.5	147	Meet
Nitrogen Dioxide (NO_2)	Primary	1-hour	—	—	169.0	188	Meet
	Primary & Secondary	Annual	3.4	37.4	40.8	100	Meet
Sulfur Dioxide (SO_2)	Primary	1-hour	—	—	194.5	196.4	Meet
	Secondary	3-hour	186.1	44.5	230.6	1,309	Meet
Carbon Monoxide (CO)	Primary	1-hour	955	1610	2,565	40,072	Meet
		8-hour	181	1035	1,216	10,304	Meet
Particulates (as PM_{10})	Primary & Secondary	24-hour	43.4	44.0	87.4	150	Meet

Pollutant	Standard	Averaging Time	Modeled Impact	Monitored Background	Total Impact	NAAQS	
			µg/m^3	µg/m^3	µg/m^3	µg/m^3	status
Particulates (as $PM_{2.5}$)	Primary & Secondary	24-hour	19.6	13.6	33.2	35	Meet
	Primary	Annual	3.8	4.4	8.2	12	Meet
	Secondary	Annual	3.8	4.4	8.2	15	Meet
Lead (Pb)	Primary & Secondary	3-month rolling	0.001	0.006	0.007	0.15	Meet

Sources: AECOM 2013a, AECOM 2013b, EPA 2012f

Notes:

Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly.

Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

*Site 35-045-1005 (Farmington, San Juan County, New Mexico)

All NAAQS generally correspond to an Air Quality Index (AQI) of 100

µg/m^3 = micrograms per cubic meter (10^{-6} g/m^3)

Future HAP Emissions

Four Corners Power Plant

Coal combustion in power plant boilers emits a wide variety of inorganic and organic HAPs. Tables 4.1-42 and 4.1-43 show estimated average annual HAP emissions from FCPP under baseline conditions (Units 1, 2, and 3 shut-down) and projected average annual HAP emissions from Units 4 and 5 operating in compliance with 40 CFR 63 Subpart UUUUU. Estimated HAP emissions are based on historic operating data, projected operating data, and regulatory defined emission factors published by the EPA (EPA 2011a). As shown in the tables, compliance with 40 CFR 63 Subpart UUUUU for Units 4 and 5 would reduce estimated annual hydrogen chloride emissions by about 98 percent due to acid gas removal (absorption and neutralization) by the caustic wet scrubbers used to control SO_2 emissions. Emissions of metals from FCPP under the Proposed Action decrease substantially with the installation of SCR on Units 4 and 5. In contrast, non-metal emissions would increase by approximately 9 percent due to the projected increase in annual capacity factor applicable to HAPs not subject to Subpart UUUUU.

Table 4.1-42 Estimated Historic and Future HAP Metals Emissions - ORISPL 2442

Hazardous Air Pollutants Metals	2000-11 Units 4 and 5 Average lbs/yr	2014-25 Units 4 and 5 Average lbs/yr	Comparison of Baseline to Emissions under the Proposed Action Change Percent
Average Generation, MW-hrs/yr	*11,378,420*	*12,410,900*	*9%*
Antimony (Sb)	106	91	-16%
Arsenic (As)	2,412	124	-94%
Beryllium (Be)	124	23	-81%
Cadmium (Cd)	300	34	-89%
Chromium (Cr)	1,530	317	-79%
Cobalt (Co)	588	91	-85%
Copper (Cu)	3,354	702	-79%
Lead (Pb)	2,471	136	-94%
Manganese (Mn)	2,883	453	-84%
Mercury (Hg)	488	136	-72%
Nickel (Ni)	1,648	396	-76%
Selenium (Se)	7,649	566	-93%

Table 4.1-43 Estimated Historic and Future HAP Nonmetals Emissions - ORISPL 2442

Hazardous Air Pollutants (Organics and Inorganics)	2000-11 Units 4 and 5 Average lbs/yr	2014-25 Units 4 and 5 Average lbs/yr	Comparison of Baseline to Emissions under the Proposed Action Change Percent
Average Generation, MW-hrs/yr	*11,378,420*	*12,410,900*	*+9%*
Acetaldehyde	3,354	3,658	+9%
Acetophenone	88	96	+9%
Acrolein	1,706	1,861	+9%
Benzene	7,649	8,343	+9%
Benzyl chloride	4,119	4,493	+9%
Bis(2-ethylhexyl)phthalate (DEHP)	430	469	+9%
Carbon disulfide	765	834	+9%
Chlorobenzene	129	141	+9%
Chloroform	347	379	+9%
Cyanide	14,710	16,045	+9%
2,4-Dinitrotoluene	2	2	0%
Ethyl benzene	553	603	+9%
Ethyl chloride	247	270	+9%
Formaldehyde	1,412	1,540	+9%
Hexane	394	430	+9%
Hydrogen chloride	7,060,847	226,323	-96%

Hazardous Air Pollutants (Organics and Inorganics)	2000-11 Units 4 and 5 Average lbs/yr	2014-25 Units 4 and 5 Average lbs/yr	Comparison of Baseline to Emissions under the Proposed Action Change Percent
Hydrogen fluoride	882,606	962,694	+9%
Isophorone	3,413	3,722	+9%
Methyl bromide	941	1,027	+9%
Methyl chloride	3,119	3,402	+9%
Methyl ethyl ketone	2,295	2,503	+9%
Methylene chloride	1,706	1,861	+9%
PAHs (composite total)	122	133	+9%
Phenol	94	103	+9%
Propionaldehyde	2,236	2,439	+9%
Tetrachloroethylene	253	276	+9%
Toluene	1,412	1,540	+9%
Styrene	147	160	+9%
Xylenes (o,m,p)	218	237	+9%

Navajo Mine

As described in Sections 3.1.2.3 and 3.1.2.7, diesel particulate matter is considered a HAP; thus, larger and more persistent sources of DPM could present a health risk to nearby sensitive receptors. An example of this situation would be mining operations where large diesel-powered equipment and vehicles are used in active areas for extended lengths of time, months or years; however, such use does not meet the definition of a stationary source of air contaminants.

Any residences (i.e., sensitive receptors) in the vicinity of the Pinabete Permit Area could be affected by mining-related emissions such as DPM, fugitive dust, and blasting gases (NO_2, SO_2, and CO). As described above, the nearest sensitive receptor would be approximately ½ mile (800 meters) from proposed Area IV mining activities. However, no agency-published guidelines for significance criteria exist to assess these impacts. Further, due to the broad geographic dispersion of mining activities, their short-term temporary nature at any particular location, and lack of proximate receptors within 1,000 feet (300 meters), minor impacts to sensitive receptors or the general public would be posed by short- and long-term mining-related HAP emissions since the cited public health risk thresholds would not be exceeded (BAAQMD 1999, 2010).

Transmission Lines

No emissions of HAPs are anticipated to result from maintenance activities associated with continued operation of the subject transmission lines.

Deposition Modeling Results

The following discussion applies to emissions from the FCPP. No short- or long-term impacts related to deposition of air emissions would result from continued operation of the Navajo Mine or transmission lines since the principal source of long-range deposition pollutants is power plant stacks, not mining activities.

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The refined deposition area identified using AERMOD extended less than 50 km from FCPP in all directions. However, to allow the fate and transport modeling software to predict the contributions of

contaminants to water bodies within the deposition area from upstream watersheds, it was necessary to extend the AERMOD domain to a 50-km radius in all directions, the maximum distance recommended by the EPA. This extension was necessary because contributions to water bodies from upstream watersheds can enter the deposition area by leaching through the soil profile and entering the shallow groundwater system, or through soil erosion and surface water runoff into the San Juan River system (AECOM 2013c).

Clean Air Status and Trends Network

Continued operation of the FCPP under the Proposed Action would be expected to contribute to overall downward trends in regional deposition rates measured by CASTNET over the last decade because of the emission reductions required by BART (see Section 4.1.3). Assuming that these trends would be consistent over time, Table 4.1-44 and Figure 4.1-11 show projected sulfur and nitrogen compound deposition rates from 2014 to 2026, the same timeframe as projected by the IMPROVE program described in Section 4.1.2.5.

Table 4.1-44 Projected Normalized CASTNET Deposition Rates for Region

Year	Normalized Precipitation dm	Total Nitrogen kg/ha-dm	Total Sulfur kg/ha-dm
2014	1.0	0.57	0.26
2015	1.0	0.55	0.25
2016	1.0	0.52	0.24
2017	1.0	0.50	0.23
2018	1.0	0.47	0.22
2019	1.0	0.45	0.22
2020	1.0	0.42	0.21
2021	1.0	0.40	0.20
2022	1.0	0.37	0.19
2023	1.0	0.35	0.18
2024	1.0	0.32	0.18
2025	1.0	0.30	0.17
2026	1.0	0.27	0.16
Trend	**—**	**-0.30**	**-0.10**
Change	**—**	**-53%**	**-38%**

Source: EPA 2013e
Note:
Based on aggregated historic data for four existing sites: CAN407, GRC474, MEV405, PET427

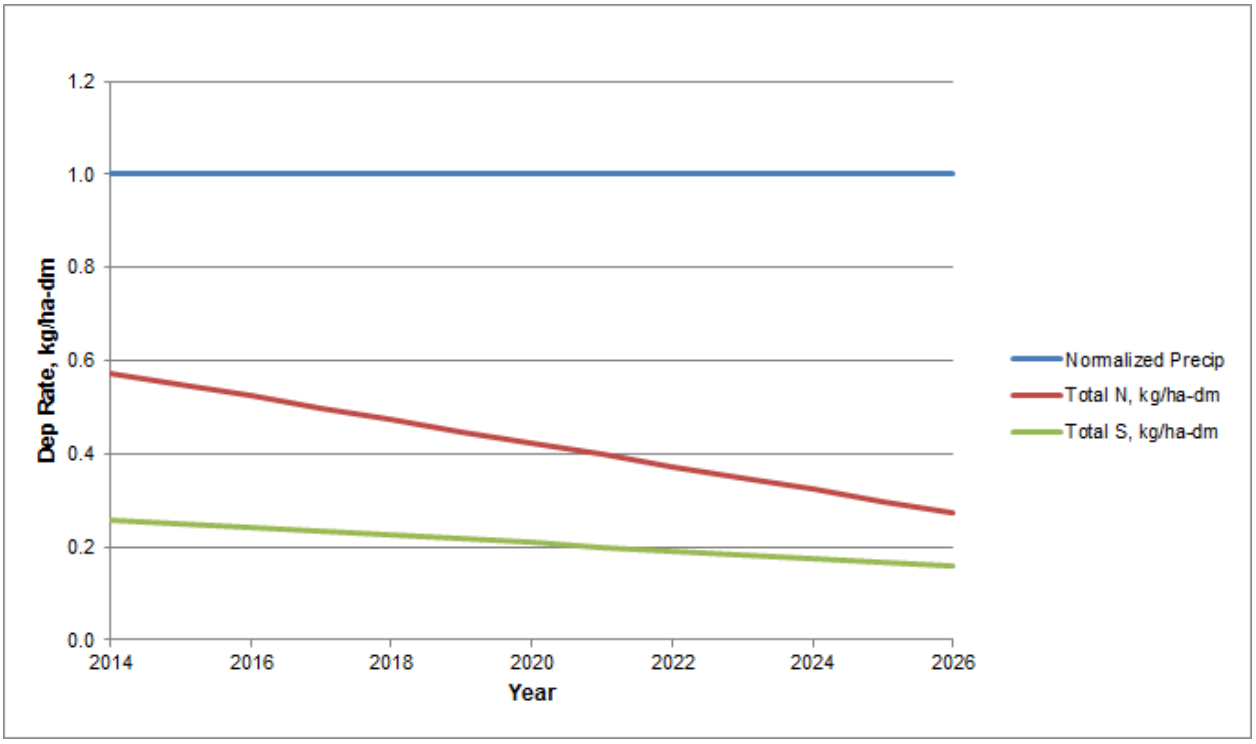

Figure 4.1-11 Projected Normalized CASTNET Deposition Rates

As shown in Table 4.1-44 and on Figure 4.1-11, projected nitrogen compounds deposition could decrease by about 0.3 kg/ha-dm and sulfur compounds deposition could decrease by about 0.1 kg/ha-dm. These projected changes in deposition rates could represent decreases of about 50 and 40 percent, respectively, from 2014 to 2026.

National Trends Network

As described in Section 4.1.2.6, the NTN measures free acidity (H^+ as pH), calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+), potassium (K^+), sulfate (SO_4^{2-}), nitrate (NO_3^-), chloride (Cl^-), and ammonium (NH_4^+) ions, also total inorganic nitrogen (N). As shown on Figures 4.1-7a, 4.1.7b, and 4.1.7c, these 10 analytes have been trending upward over the past 12 years; however, the lower rates of increase for sulfate and nitrate, 14 and 7 percent, respectively, suggests that regional emissions of SO_2 and NO_X from stationary and mobile sources may not be increasing as rapidly overall due to improved emission controls and lower-polluting fuels in the region which could reduce future NO_X emissions by about 20 percent (NMED 2009). Similarly, reduced NO_X and SO_2 emissions from FCPP (also San Juan and Navajo Generating Stations) not fully accounted for in the Four Corners Air Quality Study — as a result of compliance with BART— could also marginally contribute to lowering regional nitrogen and sulfur acid deposition rates measured by NTN by several percent, as conservatively projected in Table 4.1-45 and on Figure 4.1-12 for 2014 to 2026. However, the apparently increasing deposition of calcium, magnesium, sodium, potassium, and chloride may be attributable to increased soil dust transport brought on by drought conditions. Also, increased ammonia emissions from Units 4 and 5 due to SCR operation could increase deposition of ammonium ion and inorganic nitrogen to some extent (see AMoN discussion below for further context). Specifically, with respect to sulfate and nitrate deposition in the region, implementation of BART or approved alternatives would reduce nitrate precursor (NO_X) emissions by approximately 87 percent at FCPP, 62 percent at SJGS, and 84 percent at NGS. Similarly, BART or approved alternatives would reduce sulfate precursor (SO_2) emissions by approximately 18 percent at FCPP and 67 percent at SJGS. However, NGS is currently emitting approximately 90 percent less SO_2 than in the past due to installation and operation of FGD

scrubbers and no further reductions are planned. Thus, due to the potential for large decreases in future mass emissions of SO_2 and NO_X from power plants in the region, mass deposition rates of sulfates and nitrates in the region could nominally decrease by several percent with respect to the past (EPA 2012h, 2012i, 2013g; PNM 2013; NGS 2013).

Table 4.1-45 Projected Normalized NTN Deposition Rates for Region

Year	Normalized Precipitation dm	Total Nitrate kg/ha-dm	Total Sulfate kg/ha-dm
2014	1.0	3.12	2.02
2015	1.0	3.06	2.00
2016	1.0	3.00	1.98
2017	1.0	2.94	1.96
2018	1.0	2.88	1.94
2019	1.0	2.82	1.92
2020	1.0	2.76	1.90
2021	1.0	2.70	1.88
2022	1.0	2.64	1.86
2023	1.0	2.58	1.84
2024	1.0	2.52	1.82
2025	1.0	2.46	1.80
2026	1.0	2.40	1.78
Trend	**—**	**-0.72**	**-0.24**
Change	**—**	**-23%**	**-12%**

Sources: NADP 2013, EPA 2013e

Note:

Based on aggregated historic data for seven existing sites: AZ03, AZ97, CO00, CO99, NM07, UT09, UT98

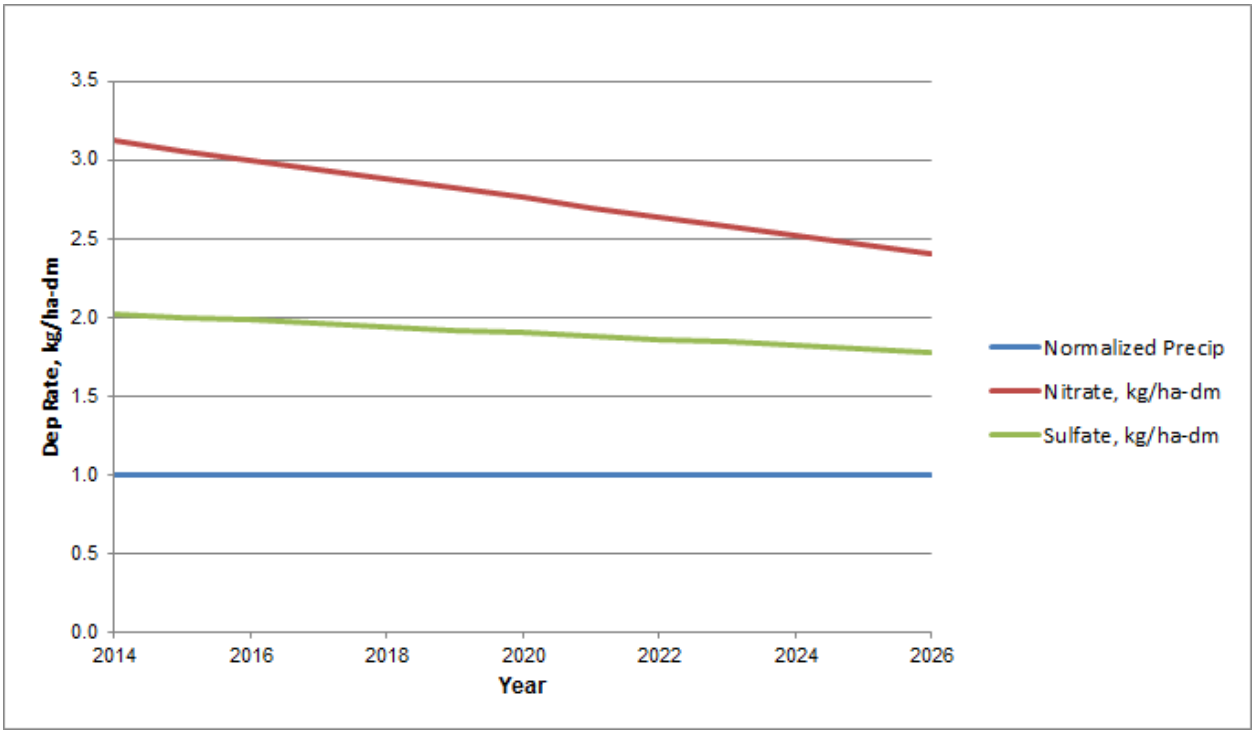

Figure 4.1-12 Projected Normalized NTN Deposition Rates

Mercury Deposition Network

As described in Section 4.1.2.6, normalized MDN results shown in Table 4.1-46 and on Figure 4.1-13 suggest an upward trend in the measured rate of mercury deposition in the region over a decade. The trending analysis suggests that mercury deposition measured in the western region has been increasing, due in large part to trans-Pacific transport from sources in Asia. EPRI (2013) indicate that "Baseline contributions of Hg emissions from non-U.S. sources to Hg deposition in the San Juan basin range from 70% to 98%. Hg emissions from China contribute from 13 to 16% to Hg deposition in the basin in the post-2014 scenario." Table 4.1-46 and Figure 4.1-13 show projected mercury deposition rates, which could be measured by MDN from 2014 to 2026 based on the following assumed conditions: (1) trans-Pacific transport continues historic trend due to economic growth in Asia, (2) regional power plants continue to emit proportionally, and (3) FCPP achieves MATS compliance in concert with the Proposed Action. The latter two conditions help define conservative upper and lower bounds for broadly estimating regional and local effects of reduced mercury emissions from FCPP against apparent transport from outside the region:

- The historic trend extrapolates historic data as described in Section 4.1.2.6, which could represent a worst-case scenario, however unlikely.
- The upper bounding estimate assumes an 80 percent reduction of 19 percent of emissions, the FCPP regional share.
- The lower bounding estimate assumes an 80 percent reduction of 45 percent of emissions, the FCPP state/local share.

Based on historic trends, the zone between the estimated upper and lower bounds could represent a range of normalized mercury deposition (µg/m^2-dm),[18] which could be measured in aggregate by MDN over the long term as a result of the Proposed Action.

Table 4.1-46 Projected Normalized MDN Deposition Rates for Region

Year	Normalized Precipitation dm	Historic Trend µg/m^2-dm	Proposed Action Range	
			Upper µg/m^2-dm	Lower µg/m^2-dm
2014	1.0	2.27	1.93	1.45
2015	1.0	2.34	1.98	1.50
2016	1.0	2.41	2.04	1.54
2017	1.0	2.48	2.10	1.59
2018	1.0	2.55	2.16	1.63
2019	1.0	2.62	2.22	1.68
2020	1.0	2.69	2.28	1.72
2021	1.0	2.76	2.34	1.76
2022	1.0	2.83	2.40	1.81
2023	1.0	2.90	2.46	1.85
2024	1.0	2.96	2.51	1.90
2025	1.0	3.03	2.57	1.94
2026	1.0	3.10	2.63	1.99
Trend	**—**	**0.83**	**0.36**	**-0.29**
Change	**—**	**37%**	**16%**	**-13%**

Sources: NADP 2013; EPA 2012a, 2011a; 40 CFR 63 Subpart UUUUU

Notes:

Based on aggregated historic data for 4 MDN sites: AZ02, NM98, CO96, CO99. Historic trend assumes ongoing status quo, including trans-Pacific transport. Estimated action assumes 80% reduction of Hg emissions from FCPP in compliance with MATS; upper and lower ranges reflecting regional and local shares.

[18] To convert µg/m^2-dm to ng/m^2-mm multiply by 10.

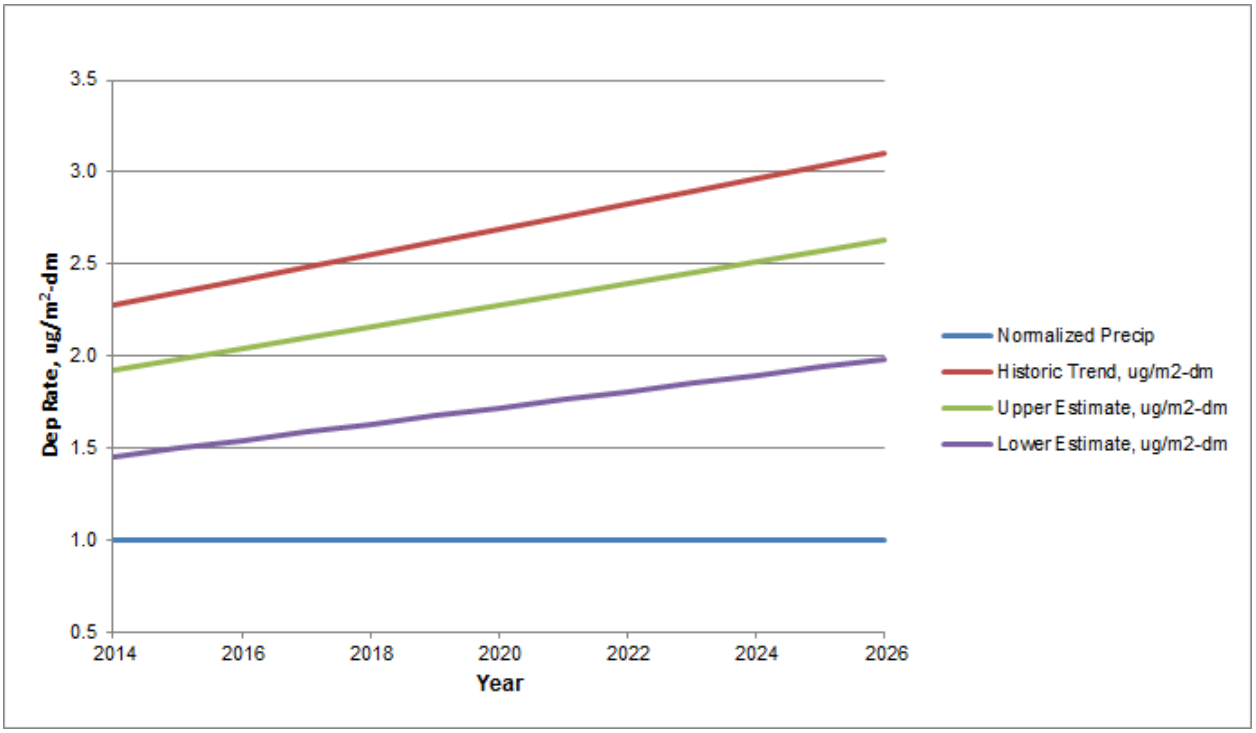

Figure 4.1-13 Projected Normalized MDN Deposition Rates

Ammonia Monitoring Network

The Proposed Action, by implementing SCR on Units 4 and 5 to reduce NO_X emissions, would increase emissions of ammonia (NH_3) as unreacted "ammonia slip" in stack gas by about 140 tons per year; however, there is no applicable significance criteria for ammonia mass emissions, only concentrations in ambient air, as discussed below[19]. In addition to ammonia slip, SCR operation would also cause formation of about 280 tons per year of sulfuric acid mist (H_2SO_4) in stack gas, which is significant pursuant to 40 CFR 51.166(23)(i) which defines the PSD significance threshold for sulfuric acid mist emissions as 7 tons per year. Under certain conditions, NH_3 and H_2SO_4 can combine to form ammonium sulfate ($[NH_4]_2SO_4$), a crystalline salt and a source of nitrogen nutrient deposition measured by NTN.

Table 4.1-47 and Figure 4.1-14 show projected ambient ammonia concentrations in northwestern New Mexico based on measurement data collected at AMoN sites in Navajo Lake (NM98) and Farmington (NM99) during the 2008 through 2012 timeframe, which is shorter than the 12-year data timeframes available for other deposition analytes.

[19] Assumes 5 ppmv ammonia slip at 3 percent oxygen in stack gas, to be determined by BART permit condition.

Table 4.1-47 Projected AMoN Ambient Concentrations - Northwestern New Mexico

Year	Historic Composite ng/m^3	Proposed Action Range	
		Upper ng/m^3	Lower ng/m^3
2014	979	1,509	504
2015	1,038	1,613	532
2016	1,098	1,717	560
2017	1,157	1,821	588
2018	1,217	1,925	617
2019	1,277	2,029	645
2020	1,336	2,133	673
2021	1,396	2,237	701
2022	1,455	2,341	729
2023	1,515	2,445	757
2024	1,574	2,549	785
2025	1,634	2,653	813
2026	1,693	2,757	841
Trend	**715**	**1,248**	**336**
Change	**73%**	**83%**	**67%**

Source: NADP 2013; EPA 2011b, 1992b; CDC 2013

Notes:

Based on aggregated historic data for 2 AMoN sites: NM98 Navajo Lake (lower), NM99 Farmington (upper).

Historic composite trend assumes ongoing status quo.

NIOSH Recommended Exposure Limit (REL) = 25 ppmv = 17,370 µg/m^3 = 17,370,000 ng/m^3.

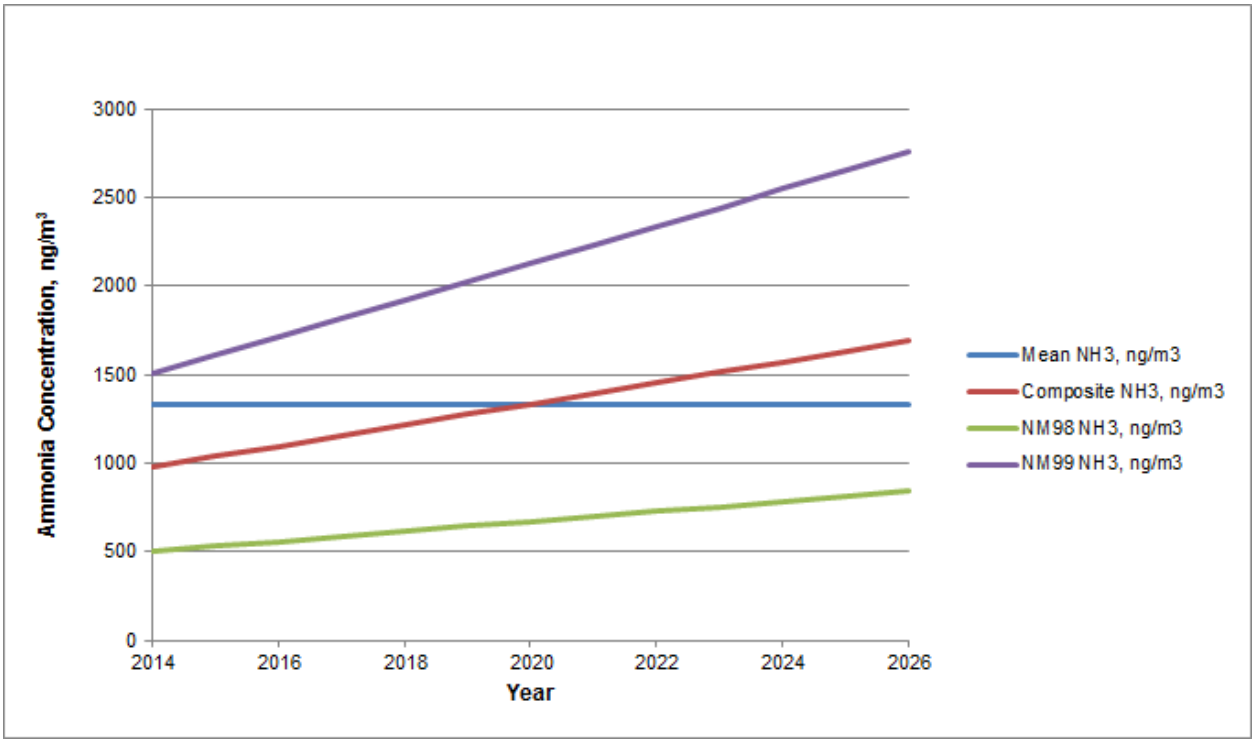

Figure 4.1-14 Projected AMoN Ambient Concentrations - Northwestern New Mexico

As discussed in Section 4.17, Public Health and Safety, in more detail, for occupational exposure to ammonia, the National Institute of Occupational Safety and Health (NIOSH) reference exposure level (REL) for ammonia (CAS No. 7664-41-7) is 25 ppmv or 17,300 µg/m^3 on a time-weighted average basis (CDC 2013). No EPA standard has been adopted for public exposure to ammonia; therefore, the California Office of Environmental Health and Hazard Assessment (2013) REL is provided as a conservative benchmark from which to compare the project concentrations. As such, acute (1 hour) REL is 3,200 µg/m^3 and the chronic (long-term) REL is 200 µg/m^3.

As shown on Figure 4.1-14, measured mean ambient ammonia concentrations range from about 0.74 µg/m^3 (historic) to about 1.34 µg/m^3 (projected). These airborne concentrations represent less than 1 percent of the 200 µg/m^3 chronic REL; thus, no significant risk to public health from airborne ammonia is indicated for northwestern New Mexico since the chronic REL is not exceeded.

Visibility Effects

The following discussion applies only to emissions from the FCPP. Because long-range visibility impacts are principally caused by emissions of NO_X and PM from power plant stacks (the regulatory aim of 40 CFR Part 49), visibility impacts from continued operation of the Navajo Mine (ground-level fugitive dust) and transmission lines (mobile sources) would be minor in comparison to the FCPP; therefore, implementation of these aspects (i.e., mine and transmission lines) of the Proposed Action would not have any effects on long-range regional visibility or ozone levels.

Four Corners Power Plant

Regional Haze

As discussed in Section 4.1.6, the *Source Specific Federal Implementation Plan for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation* (40 CFR 49) requires FCPP to reduce emissions of NO_X and defines emission limits for PM based on emission rates currently

achieved at FCPP. These pollutants contribute to visibility impairment (regional haze) in the 16 mandatory Class I Federal areas surrounding FCPP within a 300-km (186-mile) radius. Installation of SCR controls on Units 4 and 5 will reduce NO_X emissions 80 percent from 0.49 to 0.098 lb/mmBTU on a 30-day rolling average basis. For PM, Units 4 and 5 must meet an emission limit of 0.015 lb/mmBTU, while retaining the existing 20 percent opacity limit (77 FR 51620).

Compared to plantwide historic levels, implementation of 40 CFR 49 will reduce potential NO_X emissions 87 percent, from about 41,100 to 5,400 tons per year over the long term, and will reduce potential PM emissions 58 percent, from about 1,980 to 830 tons per year. While these reductions are very significant on a plantwide basis, they are somewhat less significant on a regional scale. Controlled NO_X emissions from FCPP would presumably comprise about 5 percent of regional NO_X emissions by 2020, and about 3 to 8 percent of regional PM emissions, depending on future control actions taken at other power plants. These regional percentages suggest that reducing emissions from FCPP would result in an incremental improvement in regional haze and visibility; however, a major improvement would also require effective control efforts at other power plants in the region.[20]

As described in Section 4.1.6.4 and shown on Figure 4.1-5, average visibility in the region has improved by about 15 percent over the 11-year period from 2000 to 2010, apparently due to improved control of air pollution from sources such as power plants. If this historic trend continues into the future, average deciviews could improve at a rate of about -0.12 per year. Thus, during the first half of the 25-year relicensure period (2014 to 2026), an average improvement of about -1.5 deciviews could be possible, as projected in Table 4.1-48 and illustrated on Figure 4.1-15 for the IMPROVE program (see Section 4.1.6.3).

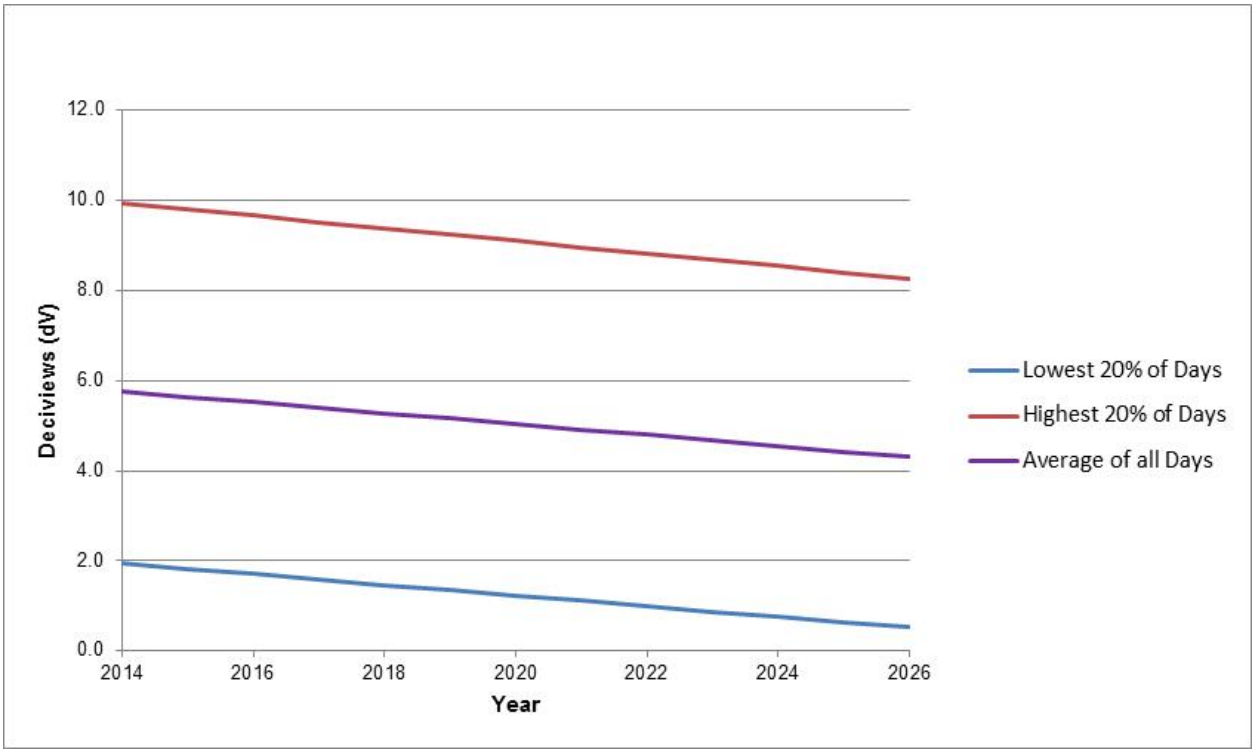

Figure 4.1-15 Projected Composite Visibility Trends

[20] Assessing future control strategies elsewhere is beyond the scope of this analysis.

Table 4.1-48 Projected Regional Visibility

Year	Lowest Mean dV	Highest Mean dV	Average Mean dV
2014	1.9	9.9	5.8
2015	1.8	9.8	5.6
2016	1.7	9.7	5.5
2017	1.6	9.5	5.4
2018	1.5	9.4	5.3
2019	1.3	9.2	5.2
2020	1.2	9.1	5.0
2021	1.1	9.0	4.9
2022	1.0	8.8	4.8
2023	0.9	8.7	4.7
2024	0.8	8.5	4.5
2025	0.6	8.4	4.4
2026	0.5	8.3	4.3
13-Year Trend Change	**-1.4**	**-1.7**	**-1.5**
Relative Improvement	**73%**	**17%**	**25%**

Source: CSU 2013c

Plume Visibility Assessment Summary

A screening-level plume visibility analysis for a land area within 50 km (31 miles) of FCPP was conducted (AECOM 2013d) to assess whether a plume from the Units 4 and 5 stack would be visible to casual observers during daylight hours in fair weather, and to what extent. For the study, 16 roadside viewpoints were identified that provide vistas of natural landmarks in the vicinity of FCPP:

1. Ford Butte West Viewpoint (US Route 491)
2. Bennet Rock East Viewpoint (US Route 491)
3. Barber Peak West Viewpoint (US Route 491)
4. Table Mesa East Viewpoint (US Route 491)
5. Cathedral Cliff South Viewpoint (US Route 491)
6. Shiprock South Viewpoint (Red Rock Highway/Indian Route 13)
7. Shiprock North Viewpoint (US Route 64)
8. Chimney Rock West Viewpoint (US Route 491)
9. Chimney Rock East Viewpoint (Mancos Canyon Road)
10. Hogback West Viewpoint (US Route 64)
11. Hogback East Viewpoint (US Route 64)
12. Piñon Mesa East Viewpoint (NM State Route 170)

13. Piñon Mesa South Viewpoint (NM State Route 170)
14. Angel Peak West Viewpoint (US Route 550)
15. Bisti Badlands West Viewpoint (County Road 7260)
16. Bisti Badlands West Viewpoint (NM State Route 371)

Tables 4.1-49 and 4.1-50 summarize the screening-level results in terms of the vistas with greatest change, the least change as a percent of significance threshold for each parameter, and the number of vistas for which the visibility parameters would be improved or be degraded.

Note that controlling emissions of PM and NO_X from Units 4 and 5 would not contribute proportionally to reductions in plume visibility for all viewpoints and vistas due to the predicted increase in sulfate emissions from Units 4 and 5 SCR operation, which would result in a slight increase in light scattering and minor degradation of some vistas (AECOM 2013e).

As shown in Tables 4.1-49 and 4.1-50, the assessment of plume visibility from Units 4 and 5 indicates likely times when a downwind plume would be perceptible from various viewpoints in the area. This indication is because maximum values of the plume visibility parameters Cp and ΔE for worst-case meteorological conditions would exceed the contrast and perceptibility thresholds established by the EPA. The overall results suggest that the Proposed Action would improve view aesthetics in the area surrounding FCPP due to reduced visible plumes compared to present-day conditions. However, at present, no criteria exist for evaluating visible plumes from sources beyond the boundaries of Federal Class I areas. (AECOM 2013e)

Table 4.1-49 Plume Perceptibility (ΔE) Modeling Results

Visual Parameter	Morning Plume Perceptibility (ΔE)[5]				Afternoon Plume Perceptibility (ΔE)[5]			
	Terrain Forward	Terrain Backward	Sky Forward	Sky Backward	Terrain Forward	Terrain Backward	Sky Forward	Sky Backward
Vista with Most Improvement[1]	-3.78	-11.85	-9.13	-5.30	-1.67	-16.73	-8.08	-6.73
Vista with Least Improvement[1]	0.25	-0.16	-3.62	-0.40	0.31	-0.41	-1.90	-0.55
EPA Significance Threshold (ΔE)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Number of Vistas Evaluated[2]	16	16	16	16	16	16	16	16
Number of Vistas Improved	7	16	16	16	7	16	16	16
Number of Vistas Degraded	9	0	0	0	9	0	0	0
Number of Vistas Significantly Improved[3]	0	5	0	0	0	11	0	0
Number of Vistas Significantly Degraded[4]	0	0	0	0	0	0	0	0

Source: AECOM 2013e

Notes:

[1] A negative value represents an improvement in visibility.

[2] From 16 viewpoints a sky background is observed and for 16 viewpoint-landmark combinations a terrain background is observed.

[3] A vista is significantly improved if the baseline ΔE exceeds 2.0 and the future ΔE is less than 2.0.

[4] A vista is significantly degraded if the baseline ΔE is less than 2.0 and the future ΔE exceeds 2.0.

[5] Two theta (Θ) angles represent the sun being in front of the observer (forward scatter) where Θ = 10° or behind the observer (backward scatter) where Θ = 140.°

Table 4.1-50 Plume Contrast (Cp) Modeling Results

Visual Parameter	Morning Plume Contrast (Cp)[5]				Afternoon Plume Contrast (Cp)[5]			
	Terrain Forward	Terrain Backward	Sky Forward	Sky Backward	Terrain Forward	Terrain Backward	Sky Forward	Sky Backward
Vista with Most Improvement[1]	-0.10	-0.19	0.06	-0.06	-0.07	-0.08	0.08	-0.05
Vista with Least Improvement[1]	0.00	0.00	0.35	-0.03	0.00	0.00	0.24	-0.03
EPA Significance Threshold [Cp]	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Number of Vistas Evaluated[2]	16	16	16	16	16	16	16	16
Number of Vistas Improved	15	16	0	16	15	16	1	16
Number of Vistas Degraded	0	0	16	0	0	0	15	0
Number of Vistas Significantly Improved[3]	0	0	0	0	0	0	0	0
Number of Vistas Significantly Degraded[4]	0	0	0	0	0	0	0	0

Source: AECOM 2013e

Notes:

[1] A negative value represents an improvement in visibility.

[2] From 16 viewpoints a sky background is observed and for 16 viewpoint-landmark combinations a terrain background is observed.

[3] A vista is significantly improved if the baseline Cp exceeds 0.05 and the future Cp is less than 0.05.

[4] A vista is significantly degraded if the baseline Cp is less than 0.05 and the future Cp exceeds 0.05.

[5] Two theta (Θ) angles represent the sun being in front of the observer (forward scatter) where Θ = 10° or behind the observer (backward scatter) where Θ = 140.

Ozone Effects

Upon implementation of the Proposed Action, local ozone would be expected to decrease by about 3 ppbv or 6 µg/m^3 on an 8-hour basis. Based on the Ozone Impact Assessment conducted for the project, ozone impacts under the Proposed Action would be the same as described for the baseline. As described in the environmental setting section, the primary reduction in ozone emissions would occur upon shut-down of Units 1, 2, 3, prior to implementation of the Proposed Action.

The Four Corners area is currently in NAAQS attainment for ozone. Decreasing or unchanged ozone levels would support continuing NAAQS attainment, notwithstanding unpredicted meteorological conditions or significant new sources of precursors NO_X and VOC originating elsewhere which is beyond the scope of the modeling study. Thus, effects on ozone are minor due to NAAQS attainment status remaining unchanged.

The analysis indicates that no monitoring sites would be expected to exceed the 8-hour ozone NAAQS under the Proposed Action. Five ozone monitors are in the vicinity with predicted nonzero impacts ranging from 0.2 to 1.0 ppbv. The largest impact of the Proposed Action at an existing monitor is 1.0 ppbv in Farmington (Site ID 35-45-1005). None of the monitoring sites predicted to have an increase in ozone concentrations under the Proposed Action would have design values that exceed NAAQS. Ozone impacts caused by FCPP emissions under the Proposed Action would not be the sole cause of NAAQS exceedances in those areas (i.e., La Garita Wilderness in Colorado; Grand Mesa in Uncompahgre and Gunnison National Forests; and Rio Grande National Forest) that may continue to exceed NAAQS in or after 2018 (possibly due to new precursor source contributions originating elsewhere or unpredicted meteorological conditions) (AECOM 2013b).

4.1.4.2 Alternative B – Navajo Mine Extension Project Plan

Under Alternative B with FIP Alternative A, impacts would be essentially the same as for the Proposed Action. Emissions and effects would be essentially the same as described in Section 4.1.1.2.

Four Corners Power Plant

Since the operating scenario would be the same, effects would be the same as described in Section 4.1.1.2, stack criteria emissions would be the same as shown in Tables 4.1-1 through 4.1-3 and HAP emissions would be the same as shown in Tables 4.1-4a and 4.1-4b.

Navajo Mine

The proposed mining area would be slightly altered from the Proposed Action, resulting in increased coal hauling distances and the associated emissions and dust would result in greater impacts on localized air quality. However, this increase in emissions and dust is within estimation and precision, therefore effects would be essentially the same as described in Section 4.1.1.2 (OSMRE 2011).

Transmission Lines

FCPP mobile source emissions would be essentially the same as shown in Table 4.1-39, within estimation precision (APS 2012). A very small portion of these emissions (less than 1 percent) would be associated with transmission line maintenance.

4.1.4.3 Alternative C – Alternative Pinabete Mine Plan

Under Alternative C, OSMRE would disapprove the Pinabete permit application and issue a new 10,094-acre SMCRA permit area for a proposed mining disturbance in approximately 6,492 acres. Mining would be located in both Areas IV North and South. The BIA would approve the lease amendment for FCPP, and FCPP would operate as described under the Proposed Action. Under Alternative C impacts would be

essentially the same as for the Proposed Action. Emissions and effects would be the same as described in Section 4.1.1.2.

Four Corners Power Plant

Effects would be the same as described in Section 4.1.1.2.

Navajo Mine

Although the mining area would be slightly altered from the Proposed Action, effects would be the same as described in Section 4.1.1.2.

Transmission Lines

FCPP mobile source emissions would be the same as shown in Table 4.1-39. A very small portion of these emissions (less than 1 percent) would be associated with transmission line maintenance.

4.1.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action. Impacts would be the same as described for the Proposed Action.

Four Corners Power Plant

Since the operating scenario would be the same, effects would be the same as described in the proposed action. Although the DFADA disturbance area would be slightly reduced from the Proposed Action, effects would be the same as described in the Proposed Action.

Transmission Lines

FCPP mobile source emissions would be essentially the same as Described for the Proposed Action. A very small portion of these emissions (less than 1 percent) would be associated with transmission line maintenance.

4.1.4.5 Alternative E – No Action Alternative

Under the No Action Alternative, criteria emissions would continue through 2015 until the FCPP shuts down. The following section provides a summary of estimated emissions under this alternative. Deposition effects under the No Action Alternative would be the same as described in the environmental setting; therefore, no additional analysis is provided. Ozone emissions from the FCPP would continue through 2015. An analysis of regional visibility as a result of the No Action Alternative is provided below.

Future Criteria Emissions

Table 4.1-51 below shows estimated stationary and mobile source emissions of SO_2, NO_X, and PM under this scenario during 2014 and 2015.

Table 4.1-51 Estimated No Action Criteria Emissions - FCPP and Navajo Mine

Year	Stationary Sources			Mobile Sources		
	SO_2 tons/yr	NO_X tons/yr	PM tons/yr	SO_2 tons/yr	NO_X tons/yr	PM tons/yr
2014	12,000	41,100	2,000	12	550	1,350
2015	12,000	41,100	2,000	12	550	1,350
2-Year Total	**24,000**	**82,200**	**4,000**	**24**	**1,100**	**2,700**

Sources: EPA 2012h, 2011a; OSMRE 2011; APS 2012; SCAQMD 2008

Notes:

Stationary - power plant emissions per 2005-11 baseline period (Units 1, 2, 3, 4, and 5)

Mobile - mining equipment and mine and power plant support vehicles (includes fugitive dust)

Stationary sources rounded to nearest 100 tons; mobile sources NO_X and PM rounded to nearest 10 tons

Four Corners Power Plant

Under the No Action Alternative, FCPP would continue to operate in 2014 and 2015. Beginning in 2016, power plant decommissioning would involve dismantling and salvage work. Estimated stationary source emissions for the preceding 2 years are shown in Table 4.1-51.

Navajo Mine

Beginning in 2016, mine closure would involve land reclamation and equipment removal activities, along with disposition of water rights. Reclamation would occur as described for the Proposed Action; however at an earlier time. Estimated mobile source emissions for the preceding 2 years are shown in Table 4.1-51.

Transmission Lines

Following shut-down of the FCPP in 2015, power from the FCPP would no longer be transported via the subject transmission lines. Beginning in 2016, transmission line decommissioning may involve dismantling and salvage work; however, these tasks are presently undefined and beyond the scope of this study. A very small portion of the mobile source emissions shown in Table 4.1-51 would be associated with transmission line maintenance.

Visibility Effects

Four Corners Power Plant

As discussed above, under the No Action Alternative, following 2015, all stationary source emissions from the FCPP would cease. The Ozone Impact Assessment conducted for the proposed Project included a comparison of the regional ozone emissions between the Proposed Action and the No Action Alternative. Table 4.1-52 shows the five largest differences in regional ozone levels between the Proposed Action and No Action scenarios for 1-hour averaging times. The maximum predicted ozone impacts attributable to FCPP would occur in July and August. The largest impact (16 ppbv) would be about 12 miles southeast of FCPP, while the fifth largest impact (13 ppbv) would be located about 29 miles southeast of FCPP.

Tables 4.1-53 and 4.1-54 show predicted fourth-highest maximum 8-hour impacts for PSD Class I and affected sensitive Class II areas as defined by the NAAQS. Table 4.1-55 shows 8-hour EPA design values for five ozone monitoring sites in the vicinity as predicted by the NAAQS attainment test methodology. For the No Action Alternative, regional average ozone concentrations decreased from 64 to 62 ppbv. The greatest changes occurred in the western and central areas of the region where predicted fourth-highest daily maximum 8-hour average ozone concentrations decreased by about 5 to 7 ppbv. In

contrast, under the Proposed Action, the only locations where ozone increased were immediately downwind of FCPP [possibly due in part to predicted meteorological conditions used for the modeling and increased utilization of Units 4 and 5]. The maximum increase in the fourth-highest 8-hour ozone concentrations was less than 4 ppbv (AECOM 2013b). Thus, since predicted ozone concentrations in the region are expected to decrease or remain about the same and the overall region is currently in NAAQS attainment, the Proposed Action would have minor impact on ambient ozone in the region in the short- or long-term.

Table 4.1-52 Maximum 1-Hour Ozone Impacts - Five Largest Differences

Difference Between Proposed Action and No Action[1]		Former NAAQS[2]	Nearest Local Maximum[3]	Furthest Local Maximum[4]	Former NAAQS
ppbv	month	ppbv	ppbv	ppbv	status
15.8	July	120	77	90	Meet
15.1	August	120	77	90	Meet
14.9	August	120	77	90	Meet
13.3	July	120	77	90	Meet
13.1	August	120	77	90	Meet

Source: AECOM 2013b

Notes:

1 Maxima occur between 12 and 29 miles (19 and 46 km) southeast of FCPP

2 The 1979 1-hour NAAQS for ozone was rescinded in 1997 (attainment was defined as one or fewer days per calendar year where the maximum hourly average ozone concentration was greater than 120 ppbv)

3 Site 35-45-0009: 28 miles (45 km) east of FCPP monitored maximum for 2011

4 Site 35-45-0018: 47 miles (75 km) east of FCPP monitored maximum for 2011

Table 4.1-53 Fourth-Highest Maximum 8-Hour Ozone Impacts - PSD Class I Areas

Sixteen Class I Areas	Proposed Action Ozone[1] ppbv	No Action Ozone[1] ppbv	Difference Between Proposed Action and No Action ppbv	Endpoint NAAQS status
Petrified Forest National Park (AZ)	67.9	67.9	0.0	Meet
Grand Canyon National Park (AZ)	–	–	–	–
Capitol Reef National Park (UT)	–	–	–	–
Canyonlands National Park (UT)	61.0	61.0	0.0	Meet
Arches National Park (UT)	–	–	–	–
Mesa Verde National Park (CO)	65.0	64.7	0.3	Meet
Black Canyon of the Gunnison Wilderness (CO)	–	–	–	–
Weminuche Wilderness (CO)	74.7	74.7	0.0	Meet
La Garita Wilderness (CO)	**75.4**	**75.4**	0.0	Exceed
West Elk Wilderness (CO)	–	–	–	–
Maroon Bells – Snowmass Wilderness (CO)	–	–	–	–
Great Sand Dunes National Monument (CO)	–	–	–	–
Wheeler Peak Wilderness (NM)	–	–	–	–

Sixteen Class I Areas	Proposed Action Ozone[1] ppbv	No Action Ozone[1] ppbv	Difference Between Proposed Action and No Action ppbv	Endpoint NAAQS status
Pecos Wilderness (NM)	66.8	66.8	0.0	Meet
Bandelier National Monument (NM)	66.8	66.3	0.5	Meet
San Pedro Parks Wilderness (NM)	67.5	67.4	0.1	Meet

[1] Year 2018

Table 4.1-54 Fourth-Highest Maximum 8-Hour Ozone Impacts - Affected Sensitive Class II Areas

Affected Sensitive Class II Areas	Proposed Action Ozone[1] ppbv	No Action Ozone[1] ppbv	Difference Between Proposed Action and No Action ppbv	Endpoint NAAQS status
Carson National Forest	72.0	71.9	0.1	Meet
Grand Mesa, Uncompahgre, and Gunnison National Forests	**75.4**	**75.4**	0.0	Exceed
Handies Peak Wilderness Study Area	74.3	74.3	0.0	Meet
Jicarilla Apache Indian Reservation	72.3	71.8	0.5	Meet
Navajo Nation	74.9	74.3	0.6	Exceed
Redcloud Peak Wilderness Study Area	74.0	74.0	0.0	Meet
Rio Grande National Forest	**75.2**	**75.2**	0.0	Exceed
San Juan National Forest	74.2	74.2	0.0	Meet
Uncompahgre Wilderness Area (BLM managed)	74.1	74.1	0.0	Meet
Uncompahgre Wilderness Area (USFS managed)	74.1	74.1	0.0	Meet

[1] Year 2018

Table 4.1-55 Attainment Test 8-Hour Ozone Design Values - Four Corners Region

Areas and Monitoring Sites	Proposed Action Ozone[1] ppbv	No Action Ozone[1] ppbv	Difference Between Proposed Action and No Action ppbv	Endpoint NAAQS status
San Juan County, New Mexico (35-45-0009)	66.5	66.2	0.3	Meet
San Juan County, New Mexico (35-45-1005)	68.1	67.1	1.0	Meet
La Plata County, Colorado (08-67-1004)	69.8	69.6	0.2	Meet
La Plata County, Colorado (08-67-7003)	60.3	60.1	0.2	Meet
Montezuma County, Colorado (08-83-0101)	65.1	64.7	0.4	Meet

Source: AECOM 2013b

[1] Year 2018

4.1.5 Air Quality Mitigation Measures

The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific mitigating measures for certain environmental impacts, standard operating procedures that reduce or avoid environmental impacts, and best management practices for specific activities. These are described in Section 3.2.6.1. These measures are part of their application materials and are enforceable through permit or lease conditions. In addition, the Project Applicants must comply with additional protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section for each resource category. Moreover, EPA issued its FIP for BART at FCPP to control air emissions, which led to changes in the affected environment. This completed federal action is considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared. As a result of the BART ruling, APS shut down Units 1, 2, and 3 on December 30, 2013, and will install SCR on the remaining Units 4 and 5. Although the BART rules specifically address NO_x and particulate matter, the implementation of BART would result in a decrease of all air pollutants emitted as shown in Table 4.1-39.

Where the environmental analysis in this EIS recommends additional protective measures, over and above the applicant proposed measures, regulatory compliance, and emissions reductions resulting from BART compliance, they are listed below as specific mitigation measures. In this instance, the Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects to air quality. Therefore, no additional mitigation is recommended.

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4.2 Climate Change

Climate change refers to any measurable alteration of climate lasting for an extended period of time – several decades or longer –and includes recordable changes in temperature, precipitation, or wind patterns. The Earth's average temperature increased about 0.7 to 1.5 degrees Fahrenheit (°F) (0.4 to 0.8 degrees Celsius [°C]) during the 1900s, and is projected to rise another 2 to 11.5°F (1.1 to 6.4°C) over the next 100 years (IPCC 2001, EPA 2012i). Seemingly, small changes in the average temperature of the planet can translate to large and potentially hazardous shifts in climate and weather. Climate change is suspected as the cause of changes in rainfall amounts and distribution that can result in flooding, droughts, or more frequent and severe heat waves. Also, oceans are warming and becoming more acidic, polar ice caps are melting, glaciers are receding, and sea levels are rising due to thermal expansion and ice loss. Long-term studies indicate that ocean surface temperatures have been rising at an average rate of 0.13°F (0.07°C) per decade and, since 1901, average sea level has increased by about 8 inches (20 cm). Average pH has decreased (acidified) by about 0.05 pH units since the mid-1980s. Late summer Arctic Ocean sea ice coverage has decreased by half since 1979, and glaciers have receded and lost significant mass since the 1970s (EPA 2012i). As climate change progresses in the coming decades, it will likely present challenges to society and the environment.

Over the past century, human activities have released large amounts of carbon dioxide (CO_2) and other greenhouse gases (GHGs) into the atmosphere. The majority of GHGs are the by-product of burning fossil fuels to release energy in the form of heat, although deforestation, industrial processes, and some agricultural practices also emit GHGs into the atmosphere. GHGs trap solar energy in the atmosphere and cause it to warm. This phenomenon is called the greenhouse effect and is necessary to support life on Earth; however, excessive buildup of GHGs can change Earth's climate and result in undesirable effects on ecosystems, which affects human health and welfare (EPA 2012i).

In its *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2011* (EPA 2012b), the EPA provides summary information on the work of the United Nations Framework Convention on Climate Change (2009) and the IPCC (1990-2007); key information from that report is summarized below.

The United Nations Framework Convention on Climate Change (2009) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." In its *Second Assessment Report* of the science of climate change, the IPCC concluded, "human activities are changing the atmospheric concentrations and distributions of greenhouse gases and aerosols" (IPCC 1995). These changes can produce a radiative forcing by changing either the reflection or absorption of solar radiation, or the emission and absorption of terrestrial radiation. Building on this conclusion, the IPCC *Third Assessment Report* asserted, "concentrations of atmospheric greenhouse gases and their radiative forcing have continued to increase as a result of human activities" (IPCC 2001).

The IPCC reports the Earth's global average surface temperature has increased by 1.1 ± 0.4°F (0.6 ± 0.2°C) over the 20th century. This value is about 0.27°F (0.15°C) larger than that estimated by the *Second Assessment Report,* which reported for the period up to 1994, "owing to the relatively high temperatures of the additional years (1995 to 2000) and improved methods of processing the data" (IPCC 2001). While the *Second Assessment Report* concluded "the balance of evidence suggests there is a discernible human influence on global climate" (IPCC 1995), the *Third Assessment Report* more directly connects the influence of human activities on climate. IPCC concluded, "In light of new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations" (IPCC 2001).

In its most recent *Fourth Assessment Report*, IPCC stated warming of Earth's climate is unequivocal, and that warming is very likely attributable to increases in atmospheric GHGs caused by human activities (IPCC 2007). IPCC further stated changes in many physical and biological systems, such as increases in

global temperatures, more frequent heat waves, rising sea levels, coastal flooding, loss of wildlife habitat, spread of infectious disease, and other potential environmental impacts, are linked to changes in the climate system, and some changes might be irreversible (IPCC 2007).

This section presents the regulatory framework for monitoring GHG emissions, as well as a detailed description of national and regional emission sources and trends. In addition, detailed accounts of GHG emissions from stationary and mobile sources at the FCPP and Navajo Mine are provided in the environmental setting. The environmental consequences of the Proposed Action and alternatives with regard to climate change are presented in comparison to the relative contribution of the subject facilities to GHG emissions overall.

4.2.1 Regulatory Compliance Framework

No Federal, tribal, or state rules or regulations currently limit or curtail GHG emissions from FCPP, Navajo Mine, or other sources in the State of New Mexico or Navajo Nation. Federal and tribal stationary source regulations require monitoring, record keeping, and reporting of GHG emissions from FCPP; however, they do not apply to Navajo Mine since it does not meet the definition of a stationary source (i.e., consists of mobile source equipment only). These regulations are briefly described below.

4.2.1.1 Federal Regulations

Mandatory Reporting of Greenhouse Gases Rule (40 CFR Part 98)

On October 30, 2009, the EPA issued the Mandatory Reporting of Greenhouse Gases rule (74 FR 56260, 40 CFR 98, effective December 29, 2009), which requires reporting of GHG data and other relevant information from large sources and suppliers in the US pursuant to Fiscal Year 2008 Consolidated Appropriations Act (HR 2764; Public Law 110-161).

The rule facilitates collection of accurate and comprehensive emissions data to provide a basis for future EPA policy decisions and regulatory initiatives. The rule requires specified industrial source categories and facilities with an aggregated heat input of 30 mmBTU or more per hour or that emit 25,000 metric tons or more per year (MT/yr) of GHGs to submit annual reports to the EPA. The gases covered by the rule are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and hydrofluorocarbons, perfluorocarbons, SF6, and other fluorinated gases including nitrogen trifluoride and hydrofluorinated ethers.

As a Title V Operating Permit (40 CFR Part 71) source and Title IV Acid Rain Permit (40 CFR Part 72) source, FCPP is also required to report GHG emissions to the tribal and Federal EPA under Part 98 Subpart D for privately and publicly owned fossil-fuel fired electric generating units, including units located on sovereign tribal lands.

Continuous Emissions Monitoring (40 CFR Part 75)

FCPP is subject to Part 75 requirements for the monitoring, record keeping, and reporting of SO_2, NO_X, and CO_2 emissions, volumetric flow, and opacity data from affected units under the Acid Rain Program pursuant to Sections 412 and 821 of the Clean Air Act, 42 USC 7401-7671 et seq. Part 75 also sets forth provisions for the monitoring, record keeping, and reporting of NO_X mass emissions, control of which is required to demonstrate compliance with a NO_X mass emission reduction program. For FCPP, this control is consistent with 40 CFR Part 49 – *Source Specific Federal Implementation Plan for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation,* described in detail in Section 4.1, Air Quality.

4.2.1.2 State Rules

Since FCPP and Navajo Mine are located on Navajo Nation sovereign tribal lands, they are not subject to state GHG reduction policies contained in or developed through Executive Orders. Similarly, state rules and regulations do not apply to FCPP or Navajo Mine due to tribal sovereignty. However, they do apply to

other sources of GHG in the region, which are described in Section 4.2.2.3, Emission Sources. As such, the state regulatory framework is described in the following.

Executive Order 2009-047

On December 7, 2009, the Governor of New Mexico signed Executive Order 2009-047 *Establishing New Mexico as a Leader in Addressing Climate Change* that directed new emission reduction strategies to address climate change in New Mexico (New Mexico Governor 2009). This order built on actions taken in 2006 pursuant to Executive Order 2006-069 *New Mexico Climate Change Action*, in which the Governor directed state agencies to follow several recommendations of the Climate Change Advisory Group (New Mexico Governor 2006). The 2009 Order maintains a state government implementation team that is tasked with ensuring policies from the order are carried out. Those policies include:

- Continuing to participate in the Western Climate Initiative to develop a regional GHG emission reduction program that addresses the unique characteristics of New Mexico;
- Working with the State's electrical utilities and stakeholders to develop recommendations for reducing GHG emissions from existing coal-fired power plants within the State's jurisdiction;
- Developing recommendations for establishing an emission performance standard for new fossil-fueled generating facilities and new long-term power purchase agreements;
- Developing recommendations for offset protocols that are consistent with the Western Climate Initiative;
- Evaluating mechanisms for quantifying and awarding GHG emission allowances for emission reductions that occur before mandatory state or Federal cap-and-trade programs require such reductions;
- Convening a Resilience Advisory Group to develop a plan for adapting to climate changes; and
- Strengthening state government efforts to reduce emissions associated with energy use and transportation in state government operations.

The 2009 and 2006 Executive Orders updated an initial 2005 Executive Order (05-33) establishing the New Mexico Climate Change Advisory Group and GHG emission reduction goals originally targeted to meet year 2000 levels by 2012, 10 percent below 2000 levels by 2020, and 75 percent below 2000 levels by 2050 (New Mexico Climate Change Advisory Group 2006).

GHG Reporting, Verification, Cap-and-Trade

On February 6, 2012, the New Mexico Environmental Improvement Board approved the repeal of 20.2.300 New Mexico Administrative Code (Reporting of Greenhouse Gas Emissions), 20.2.301 New Mexico Administrative Code (Greenhouse Gas Reporting Verification Requirements), and 20.2.350 New Mexico Administrative Code (Greenhouse Gas Cap-and-Trade Provisions). The effective date of these repeals was March 14, 2012. Due to the repeals, applicable stationary emissions sources are required to follow 20.2.73 New Mexico Administrative Code in reporting GHG emissions (NMED 2012a).

New Mexico Environment Department Title V GHG Reporting Requirements

Pursuant to 20.2.73 New Mexico Administrative Code – Notice of Intent and Emissions Inventory Requirements, GHG emissions data are required to be submitted to New Mexico Environment Department (NMED) from Title V sources subject to permit requirements under 20.2.70 New Mexico Administrative Code (NMED 2012a).

For Title V sources that are not oil and gas facilities, the existing rule requires CO_2 and CH_4 emissions to be quantified and reported in accordance with 40 CFR Part 98. The rule also requires applying EPA methods to facilities not subject to EPA reporting; NMED procedures; or Best Available Data only for

sources lacking quantification methods under EPA methods or NMED procedures. The NMED procedures specify or reference acceptable EPA calculation methods and emission factors that Title V source owners must use when preparing GHG emissions data reports for submission to NMED, as specified in 20.2.73 New Mexico Administrative Code (NMED 2012a).

Further, NMED accepts GHG emission reports submitted to EPA pursuant to 40 CFR Part 98 as a method of complying with 20.2.73 New Mexico Administrative Code GHG emissions reporting requirements. Part 98 Subpart D – Electricity Generation, applies to power plants.

4.2.2 Affected Environment Pre-2014

4.2.2.1 Atmospheric Composition

Air is a mixture of constituent gases and its composition varies slightly with location and altitude. For 20th century scientific and engineering purposes, it became necessary to define a standard composition known as the US Standard Atmosphere. In addition to the common gases (nitrogen, oxygen, CO_2, methane [CH_4], hydrogen, N_2O), the atmosphere contains noble or inert gases (argon, neon, helium, krypton, xenon). Radon is also present in low concentrations near ground level in limited geographic areas where it is naturally emitted from certain types of rock and soil. Table 4.2-1 shows the typical composition of dry standard air, which is over 99 percent nitrogen and oxygen (UIG 2008; EPA 2012b).

The atmosphere consists of five basic altitude zones: troposphere (sea level to 8 miles above the Earth's surface); stratosphere (8 to 32 miles); mesosphere (32 to 50 miles); thermosphere (50 to 350 miles); and exosphere (350 to 500 miles). Within the stratosphere is the ozone layer (9 to 22 miles), which absorbs ultraviolet wavelengths; and within the mesosphere is the ionosphere (62 to 190 miles), which reflects shortwave radio signals and produces auroras. These approximate altitude ranges vary with latitude, season, solar activity, and turbulence. GHGs persist mainly in the troposphere and stratosphere (some in the mesosphere) for different lengths of time, ranging from less than 5 years to over 50,000 years, which is long enough to become well-mixed, meaning that atmospheric concentrations are about the same all over the world, regardless of source locations (EPA 2012d). Thus, the homogeneous composition of the lower atmosphere is the global setting for climate change.

Table 4.2-1 Standard Composition of Dry Air

Principal Gas	Concentration in Air ppmv	Fraction percent
Nitrogen	780,805.00	78.080500
Oxygen	209,440.00	20.944000
Argon	9,340.00	0.934000
Carbon Dioxide	387.69	0.038769
Neon	18.21	0.001821
Helium	5.24	0.000524
Methane	1.81	0.000181
Krypton	1.14	0.000114
Hydrogen	0.50	0.000050
Nitrous Oxide	0.32	0.000032
Xenon	0.09	0.000009
Totals	**1,000,000.00**	**100.000**

4.2.2.2 Greenhouse Gases

Principal GHGs include CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride (SF_6), and other fluorinated gases, including nitrogen trifluoride and hydrofluorinated ethers. GHGs occur naturally because of volcanoes, forest fires, and biological processes such as enteric fermentation and aerobic decomposition. They are also produced by combustion of fuels, industrial processes, agricultural operations, waste management, and land use changes such as loss of farmland to urbanization. The most common GHG from human activity (fuel combustion) is CO_2, followed by CH_4 and N_2O (EPA 2012d).

Larger GHG emissions lead to higher concentrations of GHGs in the atmosphere. GHG concentrations are measured in units of parts per million (ppm), parts per billion (ppb), and parts per trillion (ppt). One ppm is equivalent to 1 cubic centimeter (cc) of pure gas diluted in 1 cubic meter of air. Similarly, 1 ppb is one cc diluted in 1,000 cubic meters, and 1 ppt is one cc diluted in 1,000,000 cubic meters (EPA 2012d).

Carbon Dioxide

CO_2 enters the atmosphere through burning fossil fuels (coal, natural gas, and petroleum products), decomposition of solid waste, trees and wood products, fermentation, and also as a result of certain chemical reactions, such as manufacture of cement. CO_2 is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biologic carbon cycle. In the carbon cycle, carbon in various molecular forms is cycled among atmospheric, oceanic, land and marine biotic, and mineral reservoirs. Atmospheric CO_2 is part of this global carbon cycle. CO_2 concentrations in the atmosphere have increased from about 280 ppm in pre-industrial times to about 390 ppm, a 39 percent increase. The IPCC notes that “this concentration has not been exceeded during the past 420,000 years, and likely not during the past 20 million years. The rate of increase over the past century is unprecedented, at least during the past 20,000 years.” The IPCC definitively states that “the present atmospheric CO_2 increase is caused by anthropogenic emissions of CO_2” (EPA 2012d, IPCC 2007).

Global Warming Potential (GWP) is a quantified measure of the globally averaged relative radiative forcing impacts of a particular GHG. It is defined as the cumulative radiative forcing both direct and indirect effects integrated over a period of time from the emission of a unit mass of gas relative to a reference gas. CO_2 is the reference gas with a GWP of unity (1). Carbon dioxide equivalents (CO_2e) are calculated by multiplying the mass emissions of each GHG species times its EPA official GWP coefficient, then adding the resultant products together to obtain a single value for CO_2e. The persistence of CO_2 in the atmosphere is estimated to be in the range of 50 to 200 years, depending on variations in the carbon cycle (EPA 2012b, d).

Methane

CH_4 is primarily produced through anaerobic decomposition of organic matter in biological systems. Agricultural processes such as wetland rice cultivation, enteric fermentation in ruminant animals (e.g., cows), and the decomposition of animal wastes emit CH_4, as does the decomposition of municipal solid wastes. CH_4 is also fugitively emitted during the production and distribution of natural gas and petroleum, and is released as a by-product of coal mining and incomplete fossil fuel combustion. Pipeline-quality natural gas is over 90 percent CH_4 by volume and is considered a “clean fuel” by industry with CO_2 and water vapor as its main combustion by-products. Atmospheric CH_4 concentrations have increased by about 160 percent since pre-industrial times, although the rate of increase has been declining. It has been estimated that slightly more than half of the current CH_4 flux to the atmosphere is anthropogenic, from human activities such as agriculture, fossil fuel use, and waste disposal. The EPA’s official GWP coefficient of CH_4 is 21, and its persistence in the atmosphere is estimated to be about 9 to 15 years (EPA 2012b, d).

Nitrous Oxide

N_2O is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste. Anthropogenic sources of N_2O emissions include agricultural soils, especially the use of synthetic and manure fertilizers; fossil fuel combustion, especially from mobile combustion; adipic (nylon)

and nitric acid production; wastewater treatment and waste combustion; and biomass burning. N_2O's atmospheric concentration has increased by about 19 percent since 1750, from a pre-industrial value of about 270 ppb to about 320 ppb today, a concentration that has not been exceeded during the last thousand years. The EPA's official GWP coefficient of N_2O is 310, and its persistence in the atmosphere is estimated to be about 110 to 120 years (EPA 2012b, d).

Fluorinated Gases

Hydrofluorocarbons, perfluorocarbons, and SF_6 are synthetic, powerful GHGs that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for ozone-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, and halons). In the electric utility industry, SF_6 is used as a dielectric gas in high-voltage equipment, such as switchgear and circuit breakers. As a man-made gas, SF_6 in the atmosphere has increased from 0 to about 7 ppt in modern times. Due to their expense, all of these fluorinated gases are typically emitted (lost) in small quantities relative to combustion by-products, but because they are potent GHGs, they are sometimes referred to as "High GWP gases" with estimated persistence in the atmosphere ranging from 1.5 to 50,000 years. Of these, SF_6 is the most potent, with an EPA official GWP of 23,900 and an estimated persistence of about 3,200 years (EPA 2012b, d).

4.2.2.3 Emission Sources

The EPA tracks GHG emissions in the US and publishes the *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, which is updated annually (EPA 2012b). This detailed report contains estimates of the total national GHG emissions and removals associated with human activities in all 50 states. From the current report, the main sources of GHG emissions in the US are described below (EPA 2012d):

- Electric power generation accounts for 34 percent of GHG emissions nationwide. Over 70 percent of electric power is generated by burning fossil fuels, mainly coal and natural gas. GHG emissions from electric power generation in the US have increased by about 24 percent since 1990 as demand for electric power has grown, and fossil fuels have remained the dominant energy source for generation due to their low cost and high reliability.
- Transportation accounts for 27 percent of GHG emissions nationwide. GHG emissions from transportation result from burning fossil fuels in automobiles, trucks, trains, ships, and aircraft. About 90 percent of the fuel used for transportation is petroleum-based, which includes gasoline, diesel, and jet fuel.
- Industry accounts for 21 percent of GHG emissions nationwide. GHG emissions from industry are associated mainly with burning fossil fuels (coal, natural gas) for heat energy as well as emissions from certain chemical reactions necessary to produce goods from raw materials.
- Commercial and Residential uses account for 11 percent of GHG emissions nationwide. GHG emissions from businesses and homes result primarily from fossil fuels burned for heat, the use of certain products that contain GHGs, and the handling and disposal of domestic wastes.
- Agriculture accounts for 7 percent of GHG emissions nationwide. GHG emissions from agriculture are primarily caused by livestock such as cows (enteric fermentation), soil management practices, and rice farming.
- Land Use and Forestry offsets (absorbs or sequesters) about 15 percent of GHG emissions nationwide. Land areas can act as GHG sinks (absorbing CO_2 from the atmosphere) or GHG sources. Since 1990, well-managed forests and other lands have absorbed more CO_2 from the atmosphere than they emit.

4.2.2.4 Emission Trends

Since 1990, GHG emissions in the US have increased by about 10 percent. However, from year-to-year emissions can increase or decrease due to changes in the economy, the price of fuel, weather, and other factors. In 2010, overall GHG emissions increased about 3 percent from 2009 levels. This increase was attributed to the improving economy, which increased energy consumption across all sectors. In addition, a hot summer caused an increase in electric power demand for air conditioning that was generated mainly by burning coal and natural gas in existing power plants (EPA 2012d).

4.2.2.5 Electric Power Generation

The electric utility sector involves the generation, transmission, and distribution of electricity. CO_2 comprises the vast majority (over 99 percent) of GHG emissions from this sector, but small amounts of CH_4 and N_2O are also emitted. These gases are released during the combustion of fossil fuels, such as coal, oil, and natural gas, to generate electricity. Less than 1 percent of GHGs from this sector is in the form of SF_6, a dielectric (insulating) gas used in high-voltage transmission and distribution equipment, such as circuit breakers and switches (EPA 2012b, d).

Coal combustion is much more carbon-intensive than burning natural gas or petroleum to generate electricity. While coal generates about 45 percent of electric power in the US, it accounts for 81 percent of CO_2 emissions from this sector. About 25 percent of electricity generated in 2010 was generated using natural gas, and this percentage has grown in recent years due to its reputation as a “clean” fuel and increased supply, which has driven down prices. Petroleum accounts for less than 1 percent of electricity generation, down significantly from the past. The remaining generation comes from nuclear plants (about 20 percent) and renewable sources (about 10 percent), which includes hydroelectric, geothermal, biomass (wood and agricultural wastes), wind, and solar (photovoltaic and thermal). Geothermal and biomass sources typically release fewer GHGs than fossil fuel combustion; and hydroelectric, wind, and solar emit no GHGs directly (EPA 2012d).

Table 4.2-2 presents a comparison of the GHG contents of various fuels used for electric power generation in units of kilograms per million BTU[10] (kg/mmBTU). Table 4.2-3 summarizes GHG emission rates for various generating resources in units of kilograms per megawatt-hour (kg/MW-hr) and pounds per megawatt-hour.

[10] BTU – British Thermal Unit, the amount of heat required to raise the temperature of 1 pound of water 1 degree Fahrenheit, from 39 to 40°F

Table 4.2-2 Comparison of Fuel GHG Contents - Thermal Electric Power Generation

Fuel / Heat Source	Generator Drive	GHG Emissions (all units kg/mmBTU)			
		CO_2	CH_4	N_2O	CO_2e
Bituminous Coal (electric utility)	ST	95.52	0.0011	0.0016	96.03
Biomass (wood waste cogeneration)	ST	88.45	0.0316	0.0042	90.42
Residual Fuel Oil No. 6	ST	75.09	0.0032	0.0006	75.36
Diesel Fuel No. 2	ICE, CT	73.96	0.0032	0.0006	74.22
Pipeline Natural Gas	ICE, CT, ST	53.02	0.0011	0.0001	53.07
Geothermal	ST	7.52	0.0000	0.0000	7.52
Solar Thermal	ST	0.00	0.0000	0.0000	0.00
Nuclear	ST	0.00	0.0000	0.0000	0.00

Sources: EPA 2012b, 2011a

Notes:

kg/mmBTU – kilogram(s) per million British Thermal Units

BTU = the amount of energy (heat) required to raise 1 pound of liquid water 1 degree Fahrenheit in temperature (39 to 40°F)

ICE = internal combustion engine (diesel compression ignition or gas spark ignition), also referred to as reciprocating engine

CT = combustion turbine (simple cycle or combined cycle), also referred to as gas turbine

ST = steam turbine (multistage), requires boiler

Table 4.2-3 Comparison of Electric Power Generation GHG Rates

Generating Units	CO_2e Rates		Percent of Standard
	kg/MW-hr	lb/MW-hr	
Conventional Gas-Fired Turbine[1]	533	1,175	107%
Interim Standard[2]	499	1,100	100%
Combined Cycle Gas-Fired[3]	377	832	76%
Geothermal[4]	107	236	21%
Solar Thermal or Nuclear	0	0	0%

Sources: EPA 2012b, h

Notes:

[1] Conventional gas-fired is steam turbine or simple-cycle gas turbine, 34% efficiency

[2] California PUC Decision No. 07-01-039, January 25, 2007 (SB 1368)

[3] Combined cycle is gas turbine with steam turbine, 48% composite efficiency

[4] Saturated steam, 24% efficiency (no superheat)

kg/MW-hr = kilogram(s) per megawatt-hour (same as grams per kilowatt-hour)

lb/MW-hr = pound(s) per megawatt-hour

4.2.2.6 Mobile Sources

While stationary sources such as power plants and oil refineries emit large quantities of GHGs due to their sheer numbers nationwide, mobile sources also emit substantial amounts. Mobile sources include onroad vehicles (e.g., automobiles, trucks, motorcycles), offroad equipment (e.g., earthmovers, cranes, portable pumps and generators), trains (e.g., freight, passenger, light rail), vessels (e.g., boats, ships, watercraft), and aircraft (e.g., general aviation, commercial, military). Mobile source fuels include gasoline, diesel, heavy fuel oil, and jet fuel, all of which emit GHGs when combusted.

Mobile sources associated with Navajo Mine include diesel-powered draglines, loaders, coal haul trucks, support vehicles, and explosives detonation. Mobile sources associated with FCPP include materials handling equipment, maintenance equipment, and support vehicles used at the plant and for transmission line upkeep. The dominant fuel used for mobile sources at Navajo Mine and FCPP is diesel fuel, also referred to as distillate fuel oil no. 2, with a calculated GHG content of 22.4 pounds per gallon CO_2e.

4.2.2.7 Regional and State GHG Emissions

There are 17 electric power-generating facilities in the Four Corners region (northeastern Arizona, southwestern Colorado, Navajo Nation, and northwestern New Mexico) including FCPP that report to Federal and tribal EPAs pursuant to Part 75 (Table 4.2-4). No generating facilities in southeastern Utah are within an equivalent distance of 400 km (248 miles). These sources are identified in order to provide context regarding regional GHG emissions and their portion of national GHG emissions resulting from electric power generation. Table 4.2-5 summarizes historic GHG emissions reported to, and published by, EPA for the most recent 6-year period (2005 to 2010) from electric power generation on national, regional (17 plants, including FCPP), and local (FCPP only) levels. At the New Mexico state level, Table 4.2-6 shows reported statewide industrial GHG emissions from all sources for 2008, 2009, and 2010, the most recent figures available, with FCPP Part 75 data included for geographic context.

Table 4.2-4 Regional Part 75 Sources - 17 Electric Power Generating Facilities

State	Facility Name	Facility Label	ORISPL	Fuel	County
Arizona	Cholla	Generating Station	113	Coal	Navajo
Arizona	Coronado	Generating Station	6177	Coal	Apache
Navajo Nation	Navajo	Generating Station	4941	Coal	Coconino
Arizona	Springerville	Generating Station	8223	Coal	Apache
Colorado	Comanche	Generating Station	470	Coal	Pueblo
Colorado	Fountain Valley	Power Plant	55453	Gas	El Paso
Colorado	Front Range	Power Plant	55283	Gas	El Paso
Colorado	Martin Drake	Generating Station	492	Coal	El Paso
Colorado	Nucla	Generating Station	527	Coal	Montrose
Navajo Nation	FCPP	Steam Electric Station	2442	Coal	San Juan
New Mexico	Bluffview	Power Plant	55977	Gas	San Juan
New Mexico	Escalante	Generating Station	87	Coal	McKinley
New Mexico	Milagro	Cogeneration and Gas Plant	54814	Gas	San Juan
New Mexico	Person	Generating Project	55039	Gas	Bernalillo
New Mexico	Reeves	Generating Station	2450	Gas	Bernalillo
New Mexico	San Juan	Generating Station	2451	Coal	San Juan
New Mexico	Valencia	Power Plant	55802	Gas	Valencia

Table 4.2-5 Historic GHG Emissions from Electric Power Generation

Summary Year	US Total (all emissions sources) MMT CO_2e	National Plants MMT CO_2e	Regional Plants MMT CO_2e	FCPP MMT CO_2e	FCPP Percent of National Emissions	FCPP Percent of Regional Emissions
2005	7,204	2,419	75.67	14.61	0.60%	19.3%
2006	7,159	2,363	76.79	14.96	0.63%	19.5%
2007	7,253	2,430	76.75	13.76	0.57%	17.9%
2008	7,048	2,378	76.67	13.70	0.58%	17.9%
2009	6,608	2,164	77.06	14.67	0.68%	19.0%
2010	6,822	2,277	76.78	13.14	0.58%	17.1%
6-Year Average	**7,016**	**2,339**	**76.62**	**14.14**	**0.60%**	**18.5%**
Annual Variation	**2.9%**	**3.4%**	**0.4%**	**4.3%**	**—**	**—**
Percent of Total US GHG Emissions	**100.0%**	**33.3%**	**1.1%**	**0.2%**	**—**	**—**

Sources: EPA 2012b, h

Notes:

Percentages represents the percent of electrical power generation emissions

MMT= million metric tonnes

1 metric tonne = 1,000 kilograms or 2,204.6 pounds

CO_2e = carbon dioxide equivalents

As shown in Table 4.2-5, the electric power generation sector emitted one-third of all GHG emissions nationally during the past 6 reporting years. Of these emissions, the 17 regional plants, which include FCPP, contributed an average of 1.1 and 0.2 percent of the US total GHG emissions, respectively. On the sector level, FCPP emitted 0.6 and 18.5 percent of national and regional electric power generation emissions, respectively. Thus, FCPP was an incremental contributor to the nationwide GHG emissions inventory during the reporting period.

Table 4.2-6 Reported Statewide Industrial GHG Emissions - New Mexico[1]

	2008	2009	2010	3-Year Average	
Standard Industrial Classification	**MMT CO_2e**	**MMT CO_2e**	**MMT CO_2e**	**MMT CO_2e**	**percent**
Electricity Generation - FCPP[2]	13.697	14.671	13.135	13.834	34.8%
Electricity Generation - San Juan[3]	10.797	12.167	10.731	11.232	28.2%
Electricity Generation - Other Plants[3]	4.899	5.632	5.665	5.398	13.6%
Electricity Generation - Subtotals	*29.393*	*32.470*	*29.531*	*30.465*	*76.6%*
Oil and Gas Extraction	1.001	1.220	1.043	1.088	2.7%
Oil and Gas Field Services	2.100	2.404	2.042	2.182	5.5%
Natural Gas Liquids	3.048	3.352	3.430	3.277	8.2%
Natural Gas Transmission	0.818	1.332	1.147	1.099	2.8%
Oil and Gas - Subtotals	*6.967*	*8.308*	*7.662*	*7.646*	*19.2%*
Petroleum Refining	1.086	0.995	1.190	1.090	2.7%
Petroleum Pipelines	0.066	0.069	0.059	0.065	0.2%
Refining and Pipelines - Subtotals	*1.152*	*1.064*	*1.249*	*1.155*	*2.9%*
Potash Mining	0.150	0.104	0.115	0.123	0.31%
Copper Mining	0.088	0.000	0.0002	0.029	0.07%
Gypsum Products	0.037	0.019	0.067	0.041	0.10%
Mining and Minerals - Subtotals	*0.275*	*0.123*	*0.182*	*0.193*	*0.5%*
Dry Dairy Products	0.051	0.037	0.030	0.039	0.10%
National Security	0.032	0.064	0.000	0.032	0.08%
Universities	0.027	0.032	0.036	0.032	0.08%
Landfills	0.006	0.248	0.398	0.217	0.55%
Plastic Foam Products	0.001	0.0004	0.0005	0.001	0.002%
Other Sources - Subtotals	*0.117*	*0.381*	*0.465*	*0.321*	*0.8%*
Annual Totals	37.904	42.346	39.089	39.780	100.00%

Source: NMED 2012b, EPA 2012b, d

Notes:

[1] Most recent state data available (June 2012)

[2] Navajo Nation, does not appear on state inventory (EPA data)

[3] Included in state inventory

MMT = million metric tonnes

1 metric tonne = 1,000 kilograms or 2,204.6 pounds

CO_2 e = carbon dioxide equivalents

As shown in Table 4.2-6, electric power generation, including FCPP, comprised 76 percent of GHG emissions in geographic New Mexico during the 2008 to 2010 reporting period. Of electrical power generation emissions, FCPP contributed 45 percent, the San Juan Generating Station contributed 37 percent, and other plants contributed 18 percent. Thus, FCPP was the largest emitter of GHGs in the geographic state during the reporting period.

4.2.2.8 FCPP Stationary Source GHG Emissions

For the representative 12-year[11] period 2000 to 2011, Table 4.2-7 shows historic plantwide generation (MW-hrs/yr), GHG emissions (MT/yr), and GHG rates (kg/MW-hr) from FCPP Units 1, 2, 3, 4, and 5, as reported to EPA pursuant to Part 75[12]. Similarly, Table 4.2-8 sums Units 1, 2, and 3 for the same period, and Table 4.2-9 sums Units 4 and 5. These split GHG data illustrate the relative contributions of the older, less-efficient generating units (1, 2, and 3) and the newer, more-efficient generating units (4 and 5). Table 4.2-10 displays the relative contribution of FCPP to regional electrical generation and GHG emissions.

As shown in Tables 4.2-8 and 4.2-9, historically, Units 1, 2, and 3 generated 29 percent of electric power at FCPP and emitted 33 percent of GHGs, while Units 4 and 5 generated 71 percent of electric power and emitted 67 percent of GHGs. This result demonstrates that Units 4 and 5 are more efficient and have lower GHG emission rates in units of kg/MW-hr.

Table 4.2-7 Historic Aggregated GHG Emissions - FCPP Units 1, 2, 3, 4, and 5

	Generation	CO_2e	
Year	MW-hrs/yr	MT/yr	kg/MW-hr
2000	16,109,134	15,452,300	959
2001	16,472,108	15,708,085	954
2002	14,768,989	13,619,193	922
2003	16,857,882	14,862,974	882
2004	16,134,118	13,779,824	854
2005	16,829,089	14,609,268	868
2006	17,162,615	14,956,107	871
2007	15,700,442	13,760,220	876
2008	15,821,299	13,697,313	866
2009	16,804,764	14,670,764	873
2010	14,955,046	13,135,014	878
2011	15,066,283	13,215,996	877
Historic Emissions	16,048,505	14,006,383	873
Plantwide Share	100%	100%	–

Source: EPA 2012b, h

Notes:

MW-hrs/yr = megawatt-hours per year

MT/yr = metric tonnes per year (MT = 1,000 kg or 2,204.6 lbs)

kg/MW-hr = kilograms per megawatt-hour (same as grams per kilowatt-hour)

Historic baseline period is 2005-11 (FGD installed on Units 4 and 5)

CO_2e = carbon dioxide equivalents

[11] The Title V record-keeping requirement is 5 years.

[12] Part 75 CO_2 emissions corrected to CO_2e by multiplying by 1.0055 (average) to account for CH_4 and N_2O emissions with EPA official GWPs applied (21 and 310, respectively).

Table 4.2-8 Historic GHG Emissions - FCPP Units 1, 2, and 3

Year	Generation	CO_2e	
	MW-hrs/yr	MT/yr	kg/MW-hr
2000	4,550,595	4,643,060	1020
2001	4,642,272	4,860,698	1047
2002	4,664,651	4,700,023	1008
2003	4,503,798	4,311,611	957
2004	4,799,830	4,588,422	956
2005	4,936,157	4,691,541	950
2006	4,683,715	4,500,030	961
2007	4,851,740	4,686,109	966
2008	4,823,075	4,661,488	966
2009	4,780,246	4,566,395	955
2010	4,646,445	4,571,064	984
2011	4,258,209	4,239,444	996
Historic Emissions	4,711,369	4,559,439	968
Plantwide Share	29%	33%	–

Source: EPA 2012b, h

Notes:

MW-hrs/yr = megawatt-hours per year

MT/yr = metric tonnes per year (MT = 1,000 kg or 2,204.6 lbs)

kg/MW-hr = kilograms per megawatt-hour (same as grams per kilowatt-hour)

Historic baseline period is 2005-11 (FGD installed on Units 4 and 5)

CO_2e = carbon dioxide equivalents

Table 4.2-9 Historic GHG Emissions - FCPP Units 4 and 5

Year	Generation	CO_2e	
	MW-hrs/yr	MT/yr	kg/MW-hr
2000	11,558,538	10,809,239	935
2001	11,829,836	10,847,388	917
2002	10,104,338	8,919,170	883
2003	12,354,084	10,551,363	854
2004	11,334,289	9,191,403	811
2005	11,892,933	9,917,727	834
2006	12,478,900	10,456,077	838
2007	10,848,702	9,074,111	836
2008	10,998,224	9,035,825	822
2009	12,024,518	10,104,369	840
2010	10,308,601	8,563,950	831
2011	10,808,075	8,976,552	831
Historic Baseline	11,337,136	9,446,944	833
Plantwide Share	71%	67%	—

Source: EPA 2012b, h

Notes:

MW-hrs/yr = megawatt-hours per year

MT/yr = metric tonnes per year (MT = 1,000 kg or 2,204.6 lbs)

kg/MW-hr = kilograms per megawatt-hour (same as grams per kilowatt-hour)

Historic baseline period is 2005-11 (FGD installed on Units 4 and 5)

CO_2e = carbon dioxide equivalents

Table 4.2-10 Historic Contribution of FCPP to Regional Electrical Generation and GHG Emissions

Year	Percent of Regional Generation	Percent of Regional CO_2e Emissions
2000	20.2%	20.3%
2001	20.8%	20.6%
2002	18.9%	18.2%
2003	21.1%	20.1%
2004	19.6%	18.6%
2005	20.0%	19.3%
2006	19.9%	19.5%
2007	18.1%	17.9%
2008	18.7%	17.9%
2009	20.0%	19.0%
2010	17.3%	17.1%
2011	17.1%	16.7%
2012	Data Not Available	
2013	Transition Period	

Sources: EPA 2012b, g, h

Notes: For 17 regional electric power producers in AZ, CO, Navajo Nation, and New Mexico, 2000-11 historic data, CO_2e = carbon dioxide equivalents

4.2.2.9 FCPP and Navajo Mine Mobile Source GHG Emissions

Mobile GHG emissions from the Navajo Mine and FCPP result from support vehicles and equipment in the form of fugitive CH_4 and engine exhaust. Table 4.2-11 summarizes these emissions. In comparison to stationary source GHG emissions from FCPP, mobile and fugitive source GHG emissions comprise a small fraction of total Project GHG emissions, only 0.5 percent of total GHG emissions.

Table 4.2-11 Estimated GHG Emissions from Navajo Mine and FCPP Mobile and Fugitive Sources

	CO_2	CH_4	N_2O	CO_2e
Mobile and Fugitive Sources	**MT/yr**	**MT/yr**	**MT/yr**	**MT/yr**
Mine Extraction Operations and Loading	7,557	5.18	2.32	8,385
Coal Hauling Trucks to Stockpiles	2,010	0.11	0.05	2,028
Mining Support Vehicle Travel	2,134	0.11	0.04	2,150
Mine Fugitive Methane Emissions	—	2,747	—	57,687
Power Plant Offroad Equipment	149	0.01	0.00	151
Power Plant Onroad Vehicles	160	0.01	0.01	162
Annual Totals (rounded)	12,010	2,750	2	70,560

Sources: OSMRE 2012a; APS 2012a; EPA 2012b, 2011; SCAQMD 2008

Notes: CO_2 = carbon dioxide, CH_4 = methane, N_2O = nitrous oxide, CO_2e = carbon dioxide equivalents, MT/yr = metric tonnes (MT = 1,000 kg or 2,204.6 lbs) per year

4.2.3 Changes to Climate Change Affected Environment Post-2014

4.2.3.1 FCPP Stationary Source Emissions

GHG Reductions Attributable to BART Compliance

In order to comply with EPA's Federal Implementation Plan specifying the Best Available Retrofit Technology for the FCPP, APS has selected to implement the following actions:

- Shut down Units 1, 2, and 3. This shutdown occurred December 30, 2013
- Continue to operate Units 4 and 5 for the duration of the lease agreement, with the addition of SCR equipment. APS will install "hot side/high dust" SCRs between the boiler economizer and secondary air preheater on Units 4 and 5.

These actions, considered in this EIS as part of the environmental baseline, will produce a substantial reduction in the GHG emissions from FCPP. The expected timing of the reduction is from January 2014 to July 2018. Under the baseline conditions, GHG emissions from the FCPP are reduced by 26 percent (Table 4.2-12). Tables 4.2-10 and 4.2-15 show that as a result of the GHG emission reductions from BART compliance, the percentage contribution of FCPP to regional GHG emissions will decrease from 16.7 percent to a little over 12 percent.

Table 4.2-12 Reduction in GHG Emissions as a Result of BART Compliance.

	CO_2e	
	MT/yr	**kg/MW-hr**
Units 1, 2, 3, 4, 5	14,006,383	873
Units 4 and 5 (with SCR, operating at maximum capacity)	10,339,030	833
Total Reduction	3,667,353	40
Percent Reduction	26%	5%

4.2.3.2 FCPP and Navajo Mine Mobile Source GHG Emissions

No changes to mobile source GHG emissions are anticipated to occur as a result of compliance with the Federal Implementation Plan.

4.2.4 Environmental Consequences

The Council on Environmental Quality (CEQ) provided draft guidance on addressing climate change in NEPA documents in 2010. In this guidance, the CEQ states that, "in the agency's analysis of direct effects, it would be appropriate to: 1) quantify cumulative emissions over the life of the project; 2) discuss measures to reduce GHG emissions…., and 3) qualitatively discuss the link between such GHG emissions and climate change." As such, this section presents the results of the quantitative assessment of potential future GHG emissions from FCPP, Navajo Mine (both the Navajo Mine Permit Area and proposed Pinabete Permit Area), and compares them to the emissions of the 16 other power plants in the region for the 25-year life of the lease from 2016 to 2041. This comparison is made in order to provide context for the GHG emissions from the action alternatives on a regional level.

In the assessment of environmental consequences, the analysis considers reductions in GHG emissions as a result of BART compliance as the environmental baseline. Consequences are evaluated based on the operation of Units 4 and 5 alone, as well as the mobile source emissions. The shutdown of Units 1, 2, and 3 represents a loss of about 4,711,000 MW-hrs of annual generation capacity from FCPP, based on

historic operating data. However, there would be no net reduction in the amount of generation capacity available to the owners of FCPP, because the purchase of SCE's share of Units 4 and 5 more than offsets the lost generation from shutting down Units 1, 2, and 3. Any replacement generation that SCE seeks to develop would be subject to California's Climate Change Law, AB 32. This law requires reductions in GHG emissions from generation sources that supply the state, and as such would address any consequences of replacement generation.

Predicted emissions from FCPP and 16 other regional plants are based on historic operating data reported to the EPA referencing the 7-year historic baseline period of 2005 to 2011 when flue-gas desulfurization (FGD) becomes active on Units 4 and 5. It is necessary to define this historic baseline period because FGD affects boiler performance by a small amount, mainly due to increased exhaust backpressure. In turn, turbine-generator output is affected by a small amount (CARB 2012).

The 40 CFR 98 Subpart D electricity generation source category comprises generating units (i.e., individual boiler-turbine-generator systems) that are required to monitor and report to EPA CO_2 emissions year-round, according to Part 75. Normally this monitoring is accomplished using a fuel emission factor. For FCPP, the Part 75 CO_2 emission factor is fixed at 205 pounds CO_2 per mmBTU heat input for the bituminous coal combusted in the boilers. For this analysis, an EPA-referenced correction factor is applied to account for CH_4 and N_2O and convert to CO_2e using GWPs. For FCPP, this correction factor is 1.0055, which means that 0.55 percent is added to reported Part 75 CO_2 emissions to obtain CO_2e.

Key concepts in projecting future emissions are capacity factor and potential-to-emit (PTE), as defined below:

- Capacity factor is defined as actual utilization divided by theoretical design capacity. For generating units, this factor is typically expressed as actual MW-hrs generated in a year versus design rating in megawatts times 8,760 hours per year (maximum theoretical MW-hrs). Since generating units must be periodically shut down for maintenance and seldom operate at full design rating (load) to extend equipment life, capacity factor is always less than 100 percent, typically in the range of 80 to 95 percent for base load generating units, depending on overall reliability.
- PTE is defined as maximum theoretical emissions for a pollutant at permitted operating conditions. Traditionally, PTE is determined assuming maximum allowable emission rate at 100 percent capacity factor; however, since actual capacity factor is less than 100 percent, theoretical PTE is never normally achieved unless limited by permit condition.

In addition, onroad vehicles and offroad equipment owned by FCPP are used for plant and switchyard maintenance. Segments of the transmission lines nearest FCPP are also maintained using plant vehicles and equipment. These vehicles and equipment emit air contaminants in engine exhaust during normal use. All equipment and vehicle engines used at the plant meet Federal emissions standards applicable on the date of manufacture.

Mining activity would also cause emissions from diesel-powered offroad equipment and onroad vehicles, explosives detonation, fugitive methane CH_4 liberated from coal seams, and fugitive dust. All equipment and vehicle engines used at the mine meet Federal emissions standards applicable on the date of manufacture. In comparison to stationary source GHG emissions from FCPP, mobile and fugitive source GHG emissions comprise a small fraction of total Project GHG emissions, only 0.5 percent of total GHG emissions. This percentage is within EPA limits of precision of -2 to +5 percent for fossil fuel combustion (EPA 2012b). Therefore, GHG emissions from power plant stacks such as FCPP and San Juan Generating Station can be used as a general measure of overall GHG emissions from all sources at such mine-and-plant facilities: mobile, fugitive, and stationary. This corollary enables general assessments and comparisons of facility-wide emissions based on Part 75 data without the need to conduct detailed emissions inventories of mining and support operations. Therefore, estimated mining emissions are cited from the referenced FONSI (OSMRE 2012b).

Finally, in response to comments received during scoping regarding the potential costs to society of future GHG emissions, a qualitative discussion is provided in the impact assessment below.

4.2.4.1 Alternative A - Proposed Action

FCPP and Navajo Mine emit GHGs and, therefore, contribute incrementally to climate change; however, as described in Section 4.2.1.2, these emissions comprise less than 1 percent of the US GHG inventory and the national electric power sector. This fact precludes meaningful quantification of the effects that FCPP and Navajo Mine operations may specifically have on climate, although taken together with regional, national, and worldwide GHG emissions, global effects are as described in Section 4.2.1.2.

Stationary Sources

Table 4.2-13 shows estimated future (2014 through 2041) potential GHG emissions from Units 4 and 5 assuming a maximum (worst-case) annual generation capacity factor of 92 percent based on the 7-year baseline period from 2005 to 2011 when FGD became active on Units 4 and 5. To be conservative, this 92 percent capacity factor is 8 percent higher than the historic average of 84 percent for the baseline period. For the 12-year period beginning in 2000, a 92 percent capacity factor was achieved only during two years, 2003 and 2006, all other years were less. Thus, the probability of achieving a 92 percent capacity factor is estimated to be 1 in 6 or about 17 percent overall, which is a reasonable contingency over the long run.

Table 4.2-14 shows estimated future regional GHG emissions and composite rates for the 17 regional electric power producers in Arizona, Colorado, Navajo Nation, and New Mexico, including FCPP. These projections for 2016 through 2041 are based on the following assumptions; however, actual future occurrences may differ from predictive estimates:

- *2014:* Regional emissions are about 3 percent greater than in 2011 based on the 95th percentile of historic rates and improving economic conditions.
- *2014 to 2016:* APS operates FCPP Units 4 and 5 at historic 84 percent annual capacity factor and regional GHG emissions grow due to load demand growth on underutilized capacity at an annual rate of 0.75 percent calculated from historic GHG emissions data during the 7-year baseline period 2005 to 2011.
- *2017:* APS installs the first SCR on Unit 4 or 5, thus reducing annual NO_X emissions by about 6,600 tons. Annual emissions are mainly from the other operating unit, which would be retrofitted the following year. Regional load demand growth continues.
- *2018:* APS installs the second SCR on Unit 4 or 5, thus reducing annual NO_X emissions by about another 6,600 tons, mainly from the other operating unit, which was retrofitted in the prior year. Regional load demand growth continues.
- *2019:* APS operates Units 4 and 5 at an historic 84 percent annual capacity factor, thus reducing annual NO_X emissions by an additional 6,600 tons from pre-Project levels since both retrofitted units would be operating full-time with lowered NO_X emissions. Total average annual NO_X reduction is about 19,800 tons in future years compared to typical pre-Project levels. Regional load demand growth continues.
- *2020 and beyond:* Regional load demand growth is assumed to “top out” at about 5 percent above the historic 95th percentile, which represents a “mature” system notwithstanding construction of new regional generating capacity in the future.

Table 4.2-14 shows the relative contribution of FCPP to regional generation and GHG emissions from 2014 to 2041 (estimated). As shown in the table, FCPP would contribute approximately 12 percent of GHG emissions in the region resulting from electrical power generation. This table does not account for GHG emissions from other sources in the region.

Table 4.2-13 Estimated Future Potential GHG Emissions - Units 4 and 5

Year	Generation	CO_2e	
	MW-hrs/yr	MT/yr	kg/MW-hr
2014	12,410,900	10,339,030	833
2015	12,410,900	10,339,030	833
2016	12,410,900	10,339,030	833
2017	12,410,900	10,339,030	833
2018	12,410,900	10,339,030	833
2019	12,410,900	10,339,030	833
2020	12,410,900	10,339,030	833
2021	12,410,900	10,339,030	833
2022	12,410,900	10,339,030	833
2023	12,410,900	10,339,030	833
2024	12,410,900	10,339,030	833
2025	12,410,900	10,339,030	833
2026	12,410,900	10,339,030	833
2027	12,410,900	10,339,030	833
2028	12,410,900	10,339,030	833
2029	12,410,900	10,339,030	833
2030	12,410,900	10,339,030	833
2031	12,410,900	10,339,030	833
2032	12,410,900	10,339,030	833
2033	12,410,900	10,339,030	833
2034	12,410,900	10,339,030	833
2035	12,410,900	10,339,030	833
2036	12,410,900	10,339,030	833
2037	12,410,900	10,339,030	833
2038	12,410,900	10,339,030	833
2039	12,410,900	10,339,030	833
2040	12,410,900	10,339,030	833
2041	12,410,900	10,339,030	833
25-Year Cumulative Emissions	**310,272,500**	**258,475,750**	**—**

Sources: EPA 2012b, g, h

Notes:

Assumes maximum future annual capacity factor for Units 4 and 5 based on historic operating data; Values rounded to nearest 100 metric tonnes (MT); 25-year cumulatives are for 2017-2041 (inclusive)

CO_2e = carbon dioxide equivalents

kg/MW-hr = kilograms per megawatt-hour (same as grams per kilowatt-hour)

MT/yr = metric tonnes per year (MT = 1,000 kg or 2,204.6 lbs)

MW-hrs/yr = megawatt-hours per year

Table 4.2-14 Estimated Future Regional GHG Emissions and Composite Rates

Year	Generation	CO_2e	
	MW-hrs/yr	MT/yr	kg/MW-hr
2014	90,385,600	81,290,800	899
2015	91,101,000	81,903,400	899
2016	91,822,100	82,520,700	899
2017	92,548,900	83,142,600	898
2018	93,281,500	83,769,200	898
2019	94,019,900	84,400,500	898
2020	94,764,100	85,036,600	897
2021	94,764,100	85,036,600	897
2022	94,764,100	85,036,600	897
2023	94,764,100	85,036,600	897
2024	94,764,100	85,036,600	897
2025	94,764,100	85,036,600	897
2026	94,764,100	85,036,600	897
2027	94,764,100	85,036,600	897
2028	94,764,100	85,036,600	897
2029	94,764,100	85,036,600	897
2030	94,764,100	85,036,600	897
2031	94,764,100	85,036,600	897
2032	94,764,100	85,036,600	897
2033	94,764,100	85,036,600	897
2034	94,764,100	85,036,600	897
2035	94,764,100	85,036,600	897
2036	94,764,100	85,036,600	897
2037	94,764,100	85,036,600	897
2038	94,764,100	85,036,600	897
2039	94,764,100	85,036,600	897
2040	94,764,100	85,036,600	897
2041	94,764,100	85,036,600	897
25-Year Cumulative Emissions	**2,364,660,500**	**2,122,117,500**	**—**

Sources: EPA 2012b, g, h

Notes:

For 17 regional electric power producers in Arizona, Colorado, Navajo Nation, and New Mexico, Aggregated values rounded to nearest 100 metric tonnes (MT). 25-year cumulatives are for 2017-2041 (inclusive).

CO_2e = carbon dioxide equivalents

kg/MW-hr = kilograms per megawatt-hour (same as grams per kilowatt-hour)

MT/yr = metric tonnes per year (MT = 1,000 kg or 2,204.6 lbs)

MW-hrs/yr = megawatt-hours per year

Table 4.2-15 Relative Regional Contribution of FCPP GHG Emissions (Future 2014 to 2041)

Year	Percent of Regional Electrical Power Generation	Percent of Regional CO_2e Emissions
2014	13.7%	12.7%
2015	13.6%	12.6%
2016	13.5%	12.5%
2017	13.4%	12.4%
2018	13.3%	12.3%
2019	13.2%	12.2%
2020	13.1%	12.2%
2021	13.1%	12.2%
2022	13.1%	12.2%
2023	13.1%	12.2%
2024	13.1%	12.2%
2025	13.1%	12.2%
2026	13.1%	12.2%
2027	13.1%	12.2%
2028	13.1%	12.2%
2029	13.1%	12.2%
2030	13.1%	12.2%
2031	13.1%	12.2%
2032	13.1%	12.2%
2033	13.1%	12.2%
2034	13.1%	12.2%
2035	13.1%	12.2%
2036	13.1%	12.2%
2037	13.1%	12.2%
2038	13.1%	12.2%
2039	13.1%	12.2%
2040	13.1%	12.2%
2041	13.1%	12.2%

Sources: EPA 2012b, g, h

Notes:

For 17 regional electric power producers in AZ, CO, Navajo Nation, and NM

2014-41 estimated values

CO_2e = carbon dioxide equivalents

Mobile Sources

Table 4.2-16 shows estimated GHG emissions from mining operations in the existing Navajo Mine Permit area and the proposed Pinabete Permit area and related activities, and Table 4.2-17 shows estimated GHG emissions from FCPP vehicles and mobile equipment. These mobile sources, although quantifiable, are relatively small compared to future power plant emissions, about 0.7 percent of the potential to emit, and well within EPA limits of precision of -2 to +5 percent for fossil fuel combustion (EPA 2012b).

Future operation of FCPP and the Navajo Mine would emit GHGs and, therefore, contribute incrementally to climate change; however, these emissions would continue to comprise a negligible fraction – less than 1 percent – of the US GHG inventory and the national electric power sector and about 12 percent of regional GHG emissions from electric power generation. This condition precludes meaningful quantification of the effects that FCPP mobile sources and mining operations may specifically have on climate change.

Table 4.2-16 Estimated GHG Emissions from Navajo Mining Operations

	CO_2	CH_4	N_2O	CO_2e
Mobile and Fugitive Sources	**MT/yr**	**MT/yr**	**MT/yr**	**MT/yr**
Mine Extraction Operations and Loading	7,557	5.18	2.32	8,385
Coal Hauling Trucks to Stockpiles	2,010	0.11	0.05	2,028
Mining Support Vehicle Travel	2,134	0.11	0.04	2,150
Mine Fugitive Methane Emissions	—	2,747	—	57,687
Annual Totals	**11,701**	**2,752**	**2.42**	**70,251**
25-Year Cumulative Emissions	**292,531**	**68,810**	**60**	**1,756,263**

Source: OSMRE 2012a

Notes:

CH_4 = methane
CO_2 = carbon dioxide
CO_2e = carbon dioxide equivalents
MT = metric tonnes (MT = 1,000 kg or 2,204.6 lbs)
N_2O = nitrous oxide

Table 4.2-17 Estimated GHG Emissions from FCPP Mobile Sources

	CO_2	CH_4	N_2O	CO_2e
Mobile Sources	**MT/yr**	**MT/yr**	**MT/yr**	**MT/yr**
Power Plant Offroad Equipment	149	0.01	0.00	151
Power Plant Onroad Vehicles	160	0.01	0.01	162
Annual Totals	309	0.01	0.01	313
25-Year Cumulative Emissions	7,727	0.34	0.27	7,817

Sources: APS 2012a; EPA 2012b,2011a; SCAQMD 2008

Notes:

MT = metric tonnes (MT = 1,000 kg or 2,204.6 lbs)
CO_2 = carbon dioxide
CH_4 = methane
N_2O = nitrous oxide
CO_2e = carbon dioxide equivalents

Emissions Monetization

As described in Section 4.2.1.1 no Federal, tribal or state rules or regulations currently limit or curtail emissions of GHGs from FCPP, Navajo Mine, or other sources in the State of New Mexico or Navajo Nation. Also, notwithstanding the GHG reporting rule, no Federal regulations currently limit or curtail GHG emissions of CO_2 and CH_4, and EPA cap-and-trade programs currently apply only to acid rain precursors SO_2 and NO_X (EPA 2012i). Therefore, at present no regulatory mechanism exists for assessing the significance of the GHG emissions. Comments received during scoping requested that the analysis place a tangible monetary value on GHG emissions from FCPP and Navajo Mine. At present, the regulatory framework does not support quantification of these costs. However, qualitatively, the societal costs of GHG emissions and climate change generally refer to the financial, environmental, and societal costs resulting from sea level rise, diminishing water supplies, loss of plant and wildlife species, changes in ecosystems, increased wildfires, etc. These issues are addressed in detail in reports prepared by the IPCC referenced in the beginning of this chapter. As described above, the Proposed Action would comprise approximately 12 percent of GHG emissions resulting from electrical power generation in the region through 2041. Electrical power generation accounts for just 34 percent of GHG emissions nationwide. Owing to compliance with EPA's FIP for BART, GHG emissions at FCPP would be reduced by 26 percent. Therefore, while the Proposed Action would contribute to the effects of climate change, its contribution relative to other sources would be minor in the short- and long-term (i.e., within EPA precision limits of -2 to +5 percent) since FCPP contributes about 0.6 percent of GHG emissions from electric power generation nationwide and about 0.2 percent of all GHG emissions nationwide, as shown in Table 4.2-5.

4.2.4.2 Alternative B – Navajo Mine Extension Project

Under Alternative B, Units 4 and 5 would operate as described for the Proposed Action. Although mining operations at the Navajo Mine would be conducted under a different mine plan, because Navajo Mine only contributes mobile sources GHG emissions and these are so small in comparison to the GHG emissions from FCPP, impacts would be essentially the same as for the Proposed Action.

4.2.4.3 Alternative C – Alternative Pinabete Mine Plan

Under Alternative C, Units 4 and 5 would operate as described for the Proposed Action. Although mining operations at the Navajo Mine would be conducted under a different mine plan, because Navajo Mine only contributes mobile sources GHG emissions and these are so small in comparison to the GHG emissions from FCPP, impacts would be essentially the same as for the Proposed Action.

4.2.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Under Alternative D, mining operations at the Navajo Mine would be conducted as described under the Proposed Action. Units 4 and 5 would operate as described for the Proposed Action. The 10% reduction in surface area of the DFADAs would not impact GHG emissions because any mobile source emissions reduction would be small in comparison to the GHG emissions from FCPP. Impacts would be the same as described for the Proposed Action.

4.2.4.5 Alternative E – No Action Alternative

Under the No Action Alternative, the currently permitted supply of coal from Navajo Mine would run out in 2016, and mining operations and resultant emissions would permanently cease. Since the mine is the sole supplier of coal to FCPP, power plant operation and resultant emissions would also permanently cease in 2016. Navajo Mine would be closed and FCPP would be decommissioned. Table 4.2-18 shows estimated stationary and mobile source emissions under this scenario during 2014 and 2015. Beginning in 2016, mine closure would involve reclamation and conservation work, and power plant decommissioning would involve dismantling and salvage work; however, not all of these tasks are presently undefined, therefore this analysis is beyond the scope of this study.

Table 4.2-18 Estimated GHG Emissions under the No Action Alternative – FCPP and Navajo Mine

Year	CO_2e Sources		
	Stationary	Mobile	Combined
	MT/yr	MT/yr	MT/yr
2014	14,006,400	104,400	14,110,800
2015	14,006,400	104,400	14,110,800
2-Year Total	28,012,800	208,800	28,221,600

Sources: EPA 2012b, h

Notes:

Values rounded to nearest 100 metric tonnes (MT)

MT/yr = metric tonnes per year (MT = 1,000 kg or 2,204.6 lbs)

Stationary = power plant emissions per 2005-11 baseline period (Units 1, 2, 3, 4, and 5)

Mobile = mining equipment and mine and power plant support vehicles

CO_2e = carbon dioxide equivalents

4.2.5 Climate Change Mitigation Measures

EPA issued its FIP for BART at FCPP to control air emissions, which led to changes in the affected environment. This completed federal action is considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared. As a result of the BART ruling, APS shut down Units 1, 2, and 3 on December 30, 2013, and will install SCR on the remaining Units 4 and 5. These steps result in a substantial reduction in the GHG emissions from FCPP. The expected timing of the reduction is from January 2014 to July 2018. As a result of implanting the steps required for BART compliance, GHG emissions from the FCPP would be reduced by 26 percent, and as a result of the GHG emission reductions from BART compliance, the percentage contribution of FCPP to regional GHG emissions will decrease from 16.7 percent to approximately 12 percent.

The Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, by itself, would not result in a major contribution to adverse effects associated with climate change. Therefore, no additional mitigation is recommended.

4.3 Earth Resources

The ROI for earth resources (geology, soils, minerals, and paleontological resources) includes the immediate areas of disturbance at the Navajo Mine and the FCPP, both of which are situated on the western flank of the San Juan Basin within the Navajo Section of the Colorado Plateau in northwestern New Mexico. In addition, the ROI extends along the maintained ROWs for four transmission lines. The Navajo Mine and the FCPP are situated within the same geographical area; therefore, the geology and soils of each location are similar and are therefore discussed together. The Pinabete Permit Area is composed of portions of the current Navajo Mine Permit Area (BNCC 2009) and unpermitted areas of the Navajo Mine lease, located south of the Navajo Mine Permit Area (BNCC 2012). The planned land disturbances would occur only within the previously unmined areas of the Navajo Mine Permit Area (Area III) and Pinabete Permit Area (Areas IV North and IV South) and the FCPP. No land disturbances are planned within other portions of the Navajo Mine Lease Area, or beneath the four transmission lines, with the exception of on-going reclamation activities.

4.3.1 Regulatory Compliance Framework

No specific federal, state, or local regulations regarding geology and soils are applicable to the Project. Paleontological resources are the fossilized remains of plants and animals contained within geological formations. They are a fragile and nonrenewable scientific record of past life on earth extending back in time millions of years. Paleontological resources are protected on public lands by certain laws. The federal laws that protect paleontological resources on public lands include the Antiquities Act of 1906 (16 USC 431-433), and the Paleontological Resources Preservation Act of 2009. No specific regulatory requirements are known for the Navajo Nation lands. Fossils found on Navajo Nation lands are considered the property of the Navajo Nation, and a permit is required to conduct paleontological salvage and collection on the Navajo Reservation (BNCC 2012b).

4.3.2 Affected Environment Pre-2014

4.3.2.1 Geology, Landforms, and Topography

Geology

The Navajo Mine and the FCPP are situated in the Colorado Plateau on the western flank of the San Juan Basin. The Colorado Plateau covers an area of approximately 130,000 square miles in western Colorado, northwestern New Mexico, southeastern Utah, and northern Arizona. The San Juan Basin is a physiographic subdivision of the Colorado Plateau within the northwestern portion of New Mexico; it covers approximately 7,500 square miles across the Colorado/New Mexico border and measures approximately 100 miles from north to south and 90 miles from east to west. The land surface elevations within the basin range from 5,100 feet above msl on the western side to over 8,000 feet on the northern side (BNCC 2012c). Nearly all the hydrocarbon production within the Colorado Plateau is restricted to the San Juan Basin (Huffman 1987). The San Juan Basin is an asymmetrical, Rocky Mountain basin that formed sometime between 55 and 70 million years ago (S.S. Papadopoulos 2006). The structural San Juan Basin is bordered on the east, west, and north by both uplifts and downward sloping geologic structures. The western rim is formed by the Defiance Uplift and Four Corners Platform, and the eastern rim is formed by the Brazos Uplift and the Nacimiento Uplift. The northern boundary of the San Juan Basin is defined by the prominent Hogback outcrop of the Cretaceous Pictured Cliffs Sandstone. The southern boundary of the San Juan Basin is loosely defined by the Zuni Uplift and northern limit of the Chaco Slope. The interior of the San Juan Basin is defined by gently dipping to flat-lying sedimentary rocks and a few widely distributed low-relief anticlinal structures (Fassett 2000). Very few faults have been mapped at the surface of the San Juan Basin (Huffman 1987). Faulting within the northern area of the San Juan Basin has been identified in a few locations; however, geologic maps of the area do not indicate large-scale faulting. The lack of widespread faulting indicates the San Juan Basin is relatively

unbroken. While small-scale faults may exist in the San Juan Basin, they have yet to be identified and/or published (S.S. Papadopoulos 2006).

The San Juan Basin contains many sedimentary formations deposited over millions of years, extending from the Upper Cambrian approximately 500 million years ago through the middle Paleocene (approximately 40 million years ago) (S.S. Papadopoulos 2006). The principal source rocks in the San Juan Basin include marine black shale, marine limestone, and coal (Huffman 1987). The stratigraphic section beneath the existing Navajo Mine Permit Area and the FCPP reflects the change from the Late Cretaceous shallow marine depositional environment to a terrestrial fluvial depositional environment. The four rock sequences within this depositional environment change are (in descending order): Kirtland Shale, Fruitland Formation, Pictured Cliffs Sandstone, and Lewis Shale (Figure 2-2). The rock strata in the geology ROI strike north-south. The units are almost flat-lying with an average dip of two degrees to the east. The Fruitland Formation is the primary coal-bearing unit of the San Juan Basin and the target of most coalbed methane and coal production. The target geological formation beneath the Navajo Mine and the FCPP is the lower 250 feet of the Fruitland Formation (BNCC 2012c).

The Upper Cretaceous Fruitland Formation and Kirtland Shale have a maximum combined thickness of more than 2,000 feet. The Fruitland Formation is composed of interbedded sandstone, siltstone, shale, carbonaceous shale, and coal. Sandstone is primarily in northerly trending channel deposits in the lower part of the unit. The lower portion of the overlying Kirtland Shale is predominantly siltstone and shale, and differs from the upper Fruitland Formation mainly in its lack of carbonaceous shale and coal. The upper two-thirds or more of the Farmington Sandstone Member of the Kirtland Shale is composed of interbedded sandstone lenses and shale (Huffman 1987). Fruitland Formation coal seams tend to be lens-shaped, and most are only minable in localized areas.

The Pictured Cliffs Sandstone consists of alternating sandstone, gray siltstone, and interlacing mudstone beds within the Lewis Shale Formation. The Lewis Shale Formation consists of silty marine shale with interbedded limestone, sandstones, and clays. Other surface material present within the geological resources ROI includes several deposits of Quaternary period alluvium and eolian sands. They are important sources of topdressing material for reclamation from mining disturbance in the Navajo Mine.

Landforms

The most prominent physiographic feature surrounding the Navajo Mine Lease Area and the FCPP is the relatively steep, horseshoe-shaped Hogback monocline, which borders the western, northwestern, northern, and eastern sides of the San Juan Basin. The San Juan Basin is an asymmetric basin with a gently dipping southern flank and steeply dipping northern flank. It has two axes in the northeastern part of the basin, which are separated by the Ignacio Anticline (Huffman 1987).

The northeastern and eastern flanks of the San Juan Basin are characterized by high mesas made of resistant sandstone and shale, ranging in elevation from 6,500 to 8,000 feet. The fragmented land of the San Juan Basin is full of steep slopes and canyons with narrow valley floors (Bierei 1977). The southwestern portion of the San Juan Basin is relatively featureless. The southwestern region is defined by rolling plains where elevations range from 5,500 to 6,500 feet. This plain is cut extensively by badlands developed in soft sands and shales. The badlands in this area usually exist along established drainages. Relief along the badlands is abrupt, commonly with up to 100-foot elevation changes. Badlands are areas of severe erosion, usually found in semiarid climates, and characterized by numerous gullies, steep ridges, and sparse vegetation. The primary waterways in the San Juan Basin have created deep, steep-walled canyons within the plateau. Between the canyons and the upland portions, sand dunes are numerous and well established. Drainages in this portion of the San Juan Basin, like the Chaco River, and respective tributaries, are typically flat, wide, sandy bottom washes (Bierei 1977). The central part of the San Juan Basin is similar to the southwestern region of the San Juan Basin, as it too is characterized by a dissected plateau that gently slopes to the west (Fassett 2000).

With regard to the subject transmission lines, the ROWs cover a diverse range of landforms. The Moenkopi line sits mostly within the Colorado Plateau, while approximately the last 40 miles of the line crosses the Moenkopi Plateau. Both the Moenkopi and Cholla lines cross the Chuska Mountains. The Cholla line diverges south from the Moenkopi line to cross Defiance Plateau in Arizona. The West Mesa line sits predominantly in the eastern portion of the Colorado Plateau. The San Juan Generating Station has a short transmission line (approximately 10 miles long) directly north of the power plant that connects the FCPP to the Generating Station. This transmission line sits within the same physiographic region as the Navajo Mine and FCPP; therefore, the geologic features are the same as those described for the Navajo Mine and FCPP.

Topography

Topography in the Navajo Mine Lease Area and the FCPP is characterized by rolling terrain with areas of steep escarpments, badlands, sand dunes, and an incised landscape of drainages and arroyos. The general elevation of the Pinabete Permit Area ranges from 5,300 to 5,600 feet. The western border of the permit area is characterized by escarpments that are part of ancient channel walls of the Chaco River. Two major arroyos, Pinabete Arroyo and Cottonwood Arroyo, lie within and adjacent to the permit area.

Cottonwood Arroyo defines the northern portion of Area IV North. The western portion of Area IV North follows a bluff that sits 90 to 120 feet above the surrounding area and drains to the Chaco River, while the southern portion drains to Pinabete Arroyo.

The southern portion of Area IV South is bounded by No Name Arroyo. The western edge of Area IV South is defined by two bluffs west of the permit boundary, approximately 80 feet above the surrounding terrain. Pinabete Arroyo bisects Area IV South, creating eastern and western portions of Area IV South. The majority of the terrain within Area IV South drains to Pinabete Arroyo, while some of the terrain along the eastern edge drains in an eastern direction into a tributary of Cottonwood Arroyo (BNCC 2012c).

The FCPP is generally bounded on the west by the Chaco River and the Hogback sandstone ridge. Terrain near the FCPP is relatively level on the Upper Chaco River terrace in the northern and western portion and includes badlands in the south-central and eastern portions (Figure 4-3.1). Elevation ranges at FCPP from 5,060 to 5,364 feet msl (Ecosphere 2012a).

With regard to the subject transmission lines, the Moenkopi and Cholla transmission lines span from northwestern New Mexico to northeastern Arizona. The transmission lines sit within the Colorado Plateau in northwestern Arizona. Hills, mesas, buttes, cliff, and canyons characterize the topography in this area. The West Mesa line extends in a southeastern direction and sits within the Colorado Plateau, and does not traverse any major mountain ranges. The transmission line from the FCPP to the San Juan Generating Station sits within the same physiographic region as the FCPP and does not traverse any major topographic features.

4.3.2.2 Minerals

The San Juan Basin is highly recognized for its economic energy resources. The most prominent economic resources within the San Juan Basin include coalbed methane, coal, and conventional oil and gas (S.S. Papadopoulos 2006). The San Juan Basin is one of the most productive coalbed methane basins in North America. Production of coalbed methane from the lower part of the Fruitland Formation has been on-going since the 1950s (Huffman 1987). All coal to be mined at the Navajo Mine exists within the Fruitland Formation. The extent of the Fruitland Formation coal seams differs across the permit area depending on geologic formations in the area. The permit area to be mined has eight primary coal seams and eight corresponding overburden or interburden horizons (BNCC 2012c).

The occurrence, thickness, and geometry of Fruitland coal deposits is strongly influenced by the depositional environment in which they were created. Individual coalbeds range from 6 to 100 feet. In the northwest-trend, individual coalbeds average more than 9 feet in thickness. Average thickness of

coalbeds in the northeast-trend are approximately 6 feet. The greatest net coal thickness, up to 100 feet, is in a northwest-trending belt in the northern part of the San Juan Basin where thick coal deposits occur in both northwest- and northeast-trending deposits. Fruitland coalbeds are buried under the surface at 4,200-foot depths in the northeastern part of the San Juan Basin (Huffman 1987).

The geological model defined seven minable primary coal seams and seven corresponding overburden/interburden horizons within the Pinabete Permit Area (BNCC 2012c). A minable coal seam is defined as a seam, with a 2-foot minimum thickness, a minimum heating value of 6,000 British thermal units per pound and an aerial extent and stratigraphic position that makes the seam economically viable to mine (BNCC 2009). Coal produced by the Navajo Mine is characterized as subbituminous, which has higher moisture and volatile matter content and lower sulfur content than bituminous coals (EPA 1995). Average total sulfur values of coal in the Pinabete Permit Area range from 0.53 to 1.27 percent. Weighted average total sulfur, as a function of average seam thickness, for all seams is 0.76 percent. Average pyritic sulfur values range from 0.10 to 0.71 percent. Weighted average pyritic sulfur, as a function of average seam thickness, for all seams is 0.28 percent. Pyritic sulfur is the main contributor to acid-forming materials and makes up a small percentage of both the coal seams and the overburden/interburden materials (BNCC 2012c).

Historically, the San Juan Basin has produced most of its natural gas from fractured sandstone reservoirs in the Dakota Sandstone, Mesaverde Group, and the Pictured Cliffs Sandstone in the central San Juan Basin area. Starting in the late 1970s, an increasing amount of gas production has come from Fruitland Formation coalbeds, and annual Fruitland coal-gas production now exceeds gas production from sandstone reservoirs; however, no natural gas reserves are present within the Project Area (Fassett 2000).

Oil and gas deposits are present throughout the San Juan Basin. Almost all of the oil and gas within the San Juan Basin occurs in the Upper Cretaceous sandstone of the central portion of the San Juan Basin, most of which has been produced from stratigraphic traps. Some oil and gas occurs in the Cretaceous units around the flanks of the San Juan Basin as well (Huffman 1987).

The Grants Mineral Belt in New Mexico extends along the southern portion of the San Juan Basin. This belt is home to numerous minerals, most of which are not economically feasible to mine. They include metallic and nonmetallic minerals, and uranium. A large reserve of uranium exists within the Grants Mineral Belt. New Mexico ranks second in uranium reserves in the United States. A belt of sandstone-type uranium deposits stretching 135 kilometers (85 miles) exists along the southern boundary of the San Juan Basin. However, uranium is no longer extracted in New Mexico because it has been deemed uneconomical (New Mexico Bureau of Geology and Mineral Resource 2007). No uranium or other mineral deposits are present within the Project Area (BNCC 2011a).

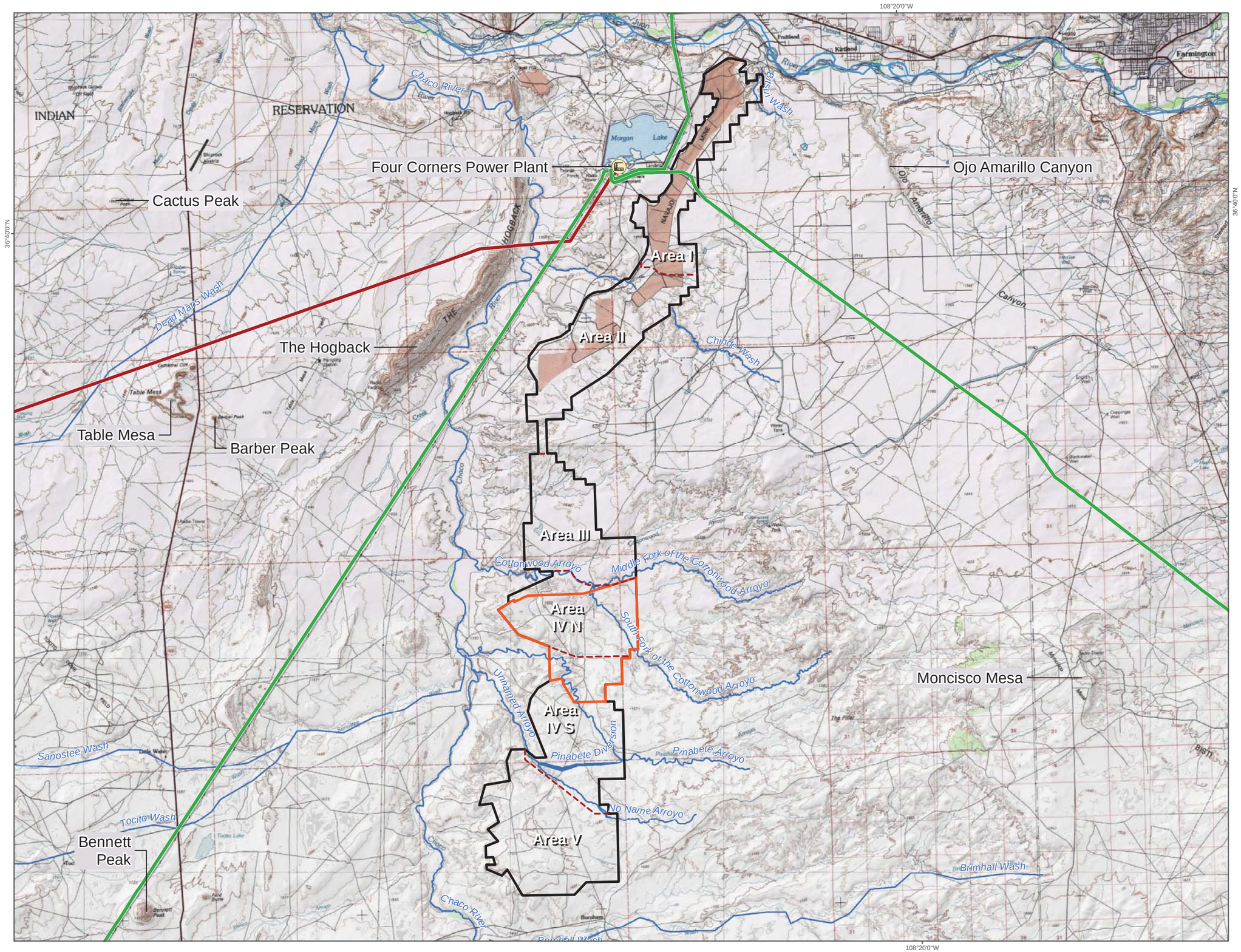

Figure 4.3-1

Landforms and Topography in the Project Area

PROJECT FACILITIES

Four Corners Power Plant

PROJECT BOUNDARIES

Navajo Mine Lease Area

Navajo Mine Resource Areas

Proposed Pinabete Permit Boundary

TRANSMISSION LINES

345kV

500kV

N

0 2.5 5

Scale in Miles

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4.3.2.3 Soils

The Colorado Plateau is characterized by a wide range of topography, geologic materials, soils, and vegetation. As such, most of the soils within this plateau are extremely complex and variable. The soils on the plateaus, mesas, and badlands in the Navajo Mine have been formed by alluvium and eolian sediments derived from shale and sandstone parent material from the Fruitland Formation (Buchanan Consultants 2011). These soils are deep and well-drained. Typically, the surface layer is brown sandy loam (USDA 1977). Soil surveys of the San Juan Basin have shown the geomorphic surfaces were influenced by constructional and erosional processes, which has led to a high occurrence of buried and truncated soils with lithologic discontinuity. Many portions of the Colorado Plateau are subject to high wind and water erosion due to sparse vegetation cover and soil type.

Three major soil-mapping units occur within and adjacent to the FCPP, a Huerfano-Muff-Uffens Complex, Badland-Monierco-Rock Outcrop Complex, and Badland. The Huerfano-Muff-Uffens soils are found on mesas and valleys on slopes from 0 to 8 percent. The Huerfano soil is shallow and well drained with low water-holding capacity and slow permeability. Muffs soils are moderately deep and well drained with low water capacity and slow permeability. Uffens soils are deep and well drained with slow permeability and low available water capacity. This complex has slight to severe water erosion potential and severe wind erosion potential. Huerfano soils form in alluvium derived from weathered shale and sandstone. The Badland-Monierco-Rock Outcrop Complex soils sit atop hills, ridges, and mesas with slopes between 0 and 30 percent. Permeability of the Monierco soil is moderately slow and the potential for water erosion is moderate, while wind erosion potential is severe. The Badland soil type is non-stony barren shale uplands, located on slopes ranging from 5 to 80 percent. Rock crops in the area consist of barren sandstone on ridges, benches, and escarpments. The potential for wind and water erosion is severe (Ecosphere 2012a).

Site-specific soil surveys were performed in the Pinabete permit area in 1987, 1998, and 2008. A total of 28 different soil mapping units were used to define the Pinabete Permit Area (Figure 4-3.2). Of the 28 soil mapping units, 24 are consociation (a unit composed of one kind of component soil), 2 are complexes (a mapping unit made up of two or more taxonomic units), and 2 are undifferentiated units (unit made up of 2 or more taxonomic components, not always associated geographically) (BNCC 2012c).

All of the soils classified in the survey area have been forming since late-Pleistocene and Holocene eras. Predominate types of soil in the survey area are Aridisols and Entisols; both develop in an aridic moisture regime (dry soil moisture due to climate and typically where annual precipitation is less than potential evapotranspiration) and mesic temperature regime (average annual soil temperature is 8 degrees Celsius [ºC] to 15ºC). The prevailing soil types in the Navajo Mine Lease Area and the FCPP consist of sandy loam, loamy sand, and sandy clay loam (Buchanan Consultants 2011).

Aridisols are characterized by dry, desert like soils that have low organic content with little vegetation at the surface. Entisols are soils defined by the absence or near absence of soil horizons that illustrate soil-forming processes. Entisols are found in geographic settings of active erosion or deposition. In the case of the Pinabete permit area, Entisols exist due to erosional processes (Natural Resources Conservation Service 2012). Nearly all of the soils in the Navajo Mine Lease Area were developed under the influence of erosion as indicated by the frequency of moderate and severely eroded surfaces (Buchanan Consultants 2011). Soils in the Pinabete permit area have a high erodibility factor and proper soil management must be implemented to ensure minimum loss of soil occurs during mining operations.

One of the mapping units in the Pinabete permit area is considered a Natric soil type. Some of the Natric soils in the permit area are defined as sodium-affected soils and would not provide suitable topsoil or topdressing because of electrical conductivity levels, and/or sodium absorption ration that exceeds topsoil suitability criteria, as would badland soils (Buchanan Consultants 2011).

On reclaimed surface mines, topsoil is essential for reestablishing native vegetation and local forage. The removal and replacement of native topsoil is required by SMCRA, unless soil has been characterized as unsuitable. Topsoil is removed as a separate layer before mining and is either spread on regraded areas or stockpiled for later use. SMCRA defines topsoil as the A and E soil horizon layers of the four master soil horizons (30 CFR 701.5). The specific parameters for determining topsoil suitability include pH, electrical conductivity, sodium absorption ratio, texture, saturation, hardness as calcium carbonate, fragment size, erosion factor, acid-base potential, and selenium and boron concentrations in soil. Laboratory data from soil surveys were used to classify soils to help determine topsoil suitability in the permit area (Buchanan Consultants 2011). Topdressing volume was calculated from soil surveys (using a conservative 10 percent soil handling loss) to address the amount available in-situ to reestablish native vegetation and local forage.

The baseline soil units within the permit area are composed of Aridisols and Entisols; both soil types contain limited resources that meet the SMCRA topsoil definition. Therefore, NTEC relies on topsoil substitute material (topdressing) for reclamation. NTEC defines topdressing as, “all unconsolidated material capable of supporting plant growth in the upper 60 inches of the native in-situ soil profile.” NTEC includes all topsoil material (A and E soil horizons) and suitable topsoil substitute material (B and C soil horizons) to ensure compliance with SMCRA regulations.

Overburden and interburden material is defined as the consolidated geologic strata from the geologic formations that lie above and between minable coal seams (OSMRE 2012a). The general nature of the overburden is a geologic formation composed of sandstone, siltstone, claystone, mudstone, and shale. A comprehensive sampling of overburden material within the adjacent Navajo Mine and proposed mining areas was completed in 1987, 1998, and 2007 to characterize the material for suitability for reclamation and to identify any potentially acid- or toxic-forming materials throughout the Navajo Mine. The findings for overburden sampling activities indicate that the overburden material is generally acceptable as reclamation root-zone material. Two naturally occurring trace elements of concern—boron and selenium—have been detected in core samples of overburden material. However, elevated levels of the soluble forms are uncommon when averaged throughout the overburden, and therefore, are not considered a limiting factor for reclamation.

Data collected to characterize the overburden suggest that a widespread occurrence of potentially acid- and toxic- forming materials does not occur within the Pinabete Permit Area. An acid-base potential characterization suggests a net alkaline environment for the majority of the interburden layers across the Pinabete Permit Area. Characterization of the in-situ interburden layers above certain coal seams indicate the saturation percent, sodium adsorption ratio, and pH values are outside the criteria limits established by OSMRE and the Navajo Mine for root-zone suitability. However, there is ample overburden material that would meet OSMRE and Navajo Mine root-zone suitability and material characterized as outside the criteria limits would not be used.

4.3.2.4 Paleontological Resources

A variety of paleontological resources are found in the geological formations of the San Juan Basin, including fossilized animal bones, fossil leaves, microscopic fossils, petrified wood, and trace fossils. The fossils are found within Triassic, Jurassic, Cretaceous, and Tertiary age rock formations of the area (BLM 2003). Four paleontologically significant areas have been identified on the adjacent public lands managed by BLMs Farmington Office, including one area to the west of Farmington (Pinon Mesa). This area includes the type sections in the Pictured Cliffs Sandstone, Fruitland Formation, and Kirtland Shale (BLM 2003). A type section is the originally described stratigraphic sequence for a given locality or area.

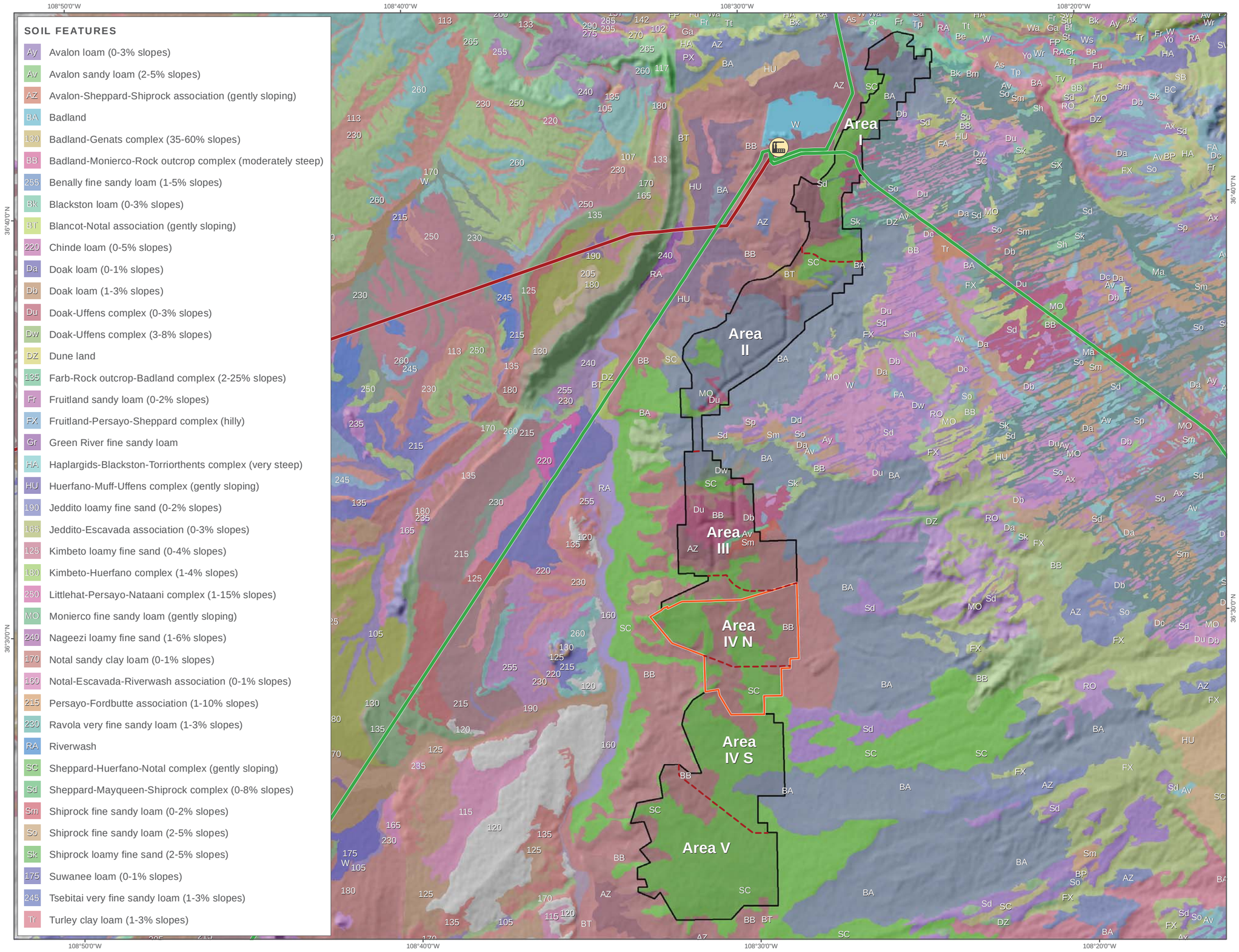

Figure 4.3-2

Soils in the Project Area

PROJECT FACILITIES

Four Corners Power Plant

PROJECT BOUNDARIES

Navajo Mine Lease Area

Navajo Mine Resource Areas

Proposed Pinabete Mine Permit Boundary

TRANSMISSION LINES

345kV

500kV

Soil Data Source: Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database, 2013.

N

0 1.25 2.5 5

Scale in Miles

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The Navajo Mine Lease Area is located on the western flank of the San Juan Basin. The basin contains sedimentary rocks that range in age from Cambrian to Holocene (560 million years ago to less than 10,000 years ago). Fossil-bearing geologic units in the Project Area are Late Cretaceous age (100 to 65 million years old) sedimentary rocks and Holocene age (less than 10,000 years old) alluvial deposits. Late Cretaceous age rock units crop out across most of the Navajo Mine Lease Area. Recent (Holocene) alluvial deposits are found within the river channels, washes, and arroyos DOI and BIA 2007).

During the Cretaceous period, the northwestern portion of the state of New Mexico was on the western margin of a large interior seaway that split the North American continent into two land masses. In a series of sea-level change cycles during this period, the shoreline of the seaway was moved from central Arizona to northwestern New Mexico. The depositional context of the sediments during this period consisted of shoreline and nearshore environments of the interior seaway (DOI and BIA 2007). Most Cretaceous age vertebrate fossils are found associated with the sedimentary rocks that reflect non-marine and shallow marine depositional sequences (sandstone, siltstone, shale, and coal). Vertebrate fauna associated with these sequences include fish, crocodiles, turtles, and dinosaurs (DOI and BIA 2007).

The fossils that may be found in the ROI are based on the rock types present and the documented paleontological resources associated with them. Marine and non-marine sedimentary rocks of Late Cretaceous, Tertiary, and Holocene age are exposed in the Project Area. Inter-tonguing and interbedded sandstones, mudstones, shale, and coal have the potential to yield scientifically significant fossils. The erosion of nearby Tertiary age rocks may also contribute fossils to the alluvial deposits that are present in the Project Area (DOI and BIA 2007).

The San Juan Basin is known to contain a rich and diverse paleontological record. As of 2007, the New Mexico Museum of Natural History and Science database indicated that more than 10,000 fossil specimens had been collected from San Juan County. However, only a small number are from the Navajo Nation lands and they are not well documented (DOI and BIA 2007). Cretaceous age formations that crop out in the area include the Mancos Shale, Point Lookout Sandstone, Menefee Formation, Lewis Shale, Pictured Cliffs Sandstone, Fruitland Formation, and Kirtland Formation (DOI and BIA 2007). The Fruitland Formation and the Kirkland Formation have provided the largest and most diverse Cretaceous age paleontological discoveries in the area (BIA 2007). Tertiary-aged, fossil-bearing formations that overlie the Late Cretaceous formations are located nearby. They include Ojo Alamo Sandstone and Nacimiento Formation. Fossils eroded from these units are found in the unconsolidated Pleistocene-Holocene aged alluvial and colluvial deposits (silts, sands, and gravels) in the washes and arroyos (DOI and BIA 2007).

New Mexico Museum of History and Science records from 2006 indicated a variety of fossils have been recorded in San Juan County from several of the Cretaceous age formations that crop out (DOI and BIA 2007). The Menefee Formation has yielded a variety of fossils including turtles, bivalves, crocodiles, Hadrosaur, and Tyrannosaur. The Lewis Shale was locally rich in fossil ammonites, inoceramid bivalves and gastropods, chonodrichthyes, sharks (selachians), Mosasaurs, and Plesiosaurs. The Pictured Cliffs Sandstone has yielded fossils from a diverse fauna of sharks and isolated bones and teeth of turtles, Plesiosaurs, crocodiles, dinosaurs, and mammals. Fossil discoveries were not from San Juan County, but from the San Juan Basin. The Fruitland and Kirtland formations have yielded numerous fossils in areas of Cottonwood Arroyo, Ojo Amarillo Creek, Pinabete Wash, and Brimhall Wash, all of which are tributaries of the Chaco River, which is located just west of the Navajo Mine Lease Area. Cottonwood Arroyo and Pinabete Wash are within the Navajo Mine Lease Area. Fossils from the Fruitland Formation include diverse fauna of sharks, boney fish (*osteichthyans*), frogs, turtles, lizards, snakes crocodiles, a broad variety of dinosaurs (*Plesiosaur*, *Mosasaur*, *Albertosaur*, *Tyrannosaur*, *Hadrosaur*, *Tricerotops*, and *Pentaceratops*), and mammals. The overlying Kirtland Formation has yielded nearly identical fossils. Fossilized tree stumps and isolated logs have been noted in the Fruitland/Kirkland formation (DOI and BIA 2007). These formations crop out in Areas I, II, III, IV North, IV South, and V on the Navajo Mine Lease Area (DOI and BIA 2007).

The Tertiary age Ojo Alamo Sandstone has yielded fragments of fossils that were eroded from the underlying Cretaceous age formations. However, the overlying Nacimiento Formation has yielded some of the most diverse fauna from the early Paleocene epoch and has been the object of research by several major institutions since the historic Wheeler Survey of 1874. The primary fossil yields from this formation include some of the earliest mammal and plant fossils found. These Tertiary formations do not occur within the Navajo Mine Lease Area, but outcrops do occur on the surrounding mesas (DOI and BIA 2007).

Surveys of the lease area were conducted as early as 1916 and 1924 (Marshall and Breed 1974). In 1972, a survey by paleontologists from the University of California, Berkeley yielded 38 fossil localities within and immediately adjacent to the lease area (Marshall and Breed 1974). An Office of Contract Archaeology at the University of New Mexico small-scale archaeological survey in 1973 and 1974 found some additional fossil localities (Marshall and Breed 1974).

The Museum of Northern Arizona (MNA) University undertook a larger-scale paleontological survey and collection project in 1974 prior to the excavation of coal mining pits in Areas III, IV and V of the Navajo Mine Lease Area, and the construction of the FCPP facilities (Table 4.3-1). This survey examined outcrops for four Late Cretaceous (65 to 75 million years) age formations within the lease area (Lewis Shale, Pictured Cliff Sandstone, Fruitland Formation, and the Kirtland Formation). No significant fossil localities were found in the Lewis Shale formation or the Pictured Cliff formation. Ninety localities within the Fruitland/Kirtland formation containing plants, invertebrates, and vertebrates were found within the lease area, and an additional 30 were found immediately adjacent (Marshall and Breed 1974).

Table 4.3-1 Significant Fossil Localities from Museum of Northern Arizona Survey (1974)

Fossil Type	Significant Locality #s	Significant Localities within Project Boundaries	Collections at Significant Localities within Project Boundaries
Plants	65, 70, 95	65, 70	70
Invertebrates	10, 30, 33, 34, 35, 67, 71, 116, 117, 118	30, 33, 34, 35, 67, 71, 117, 118	30, 33, 34, 35, 67, 71, 117, 118
Microvertebrates	16, 88, 93	16, 88, 93	16, 88, 93
Macrovertebrates	26, 55-67, 70, 80-82, 94-97, 100-102	26, 55-67, 70, 80-82, 94,96,97	26, 55, 59-64, 66, 67, 70, 81, 94,96

Source: Marshall and Breed 1974

A total of 37 significant fossil localities were identified by MNA. Three fossil plant localities identified during the survey were considered to be of major significance. The localities contained a rare and highly significant impression of a large palm tree (collected for further analysis) from one site, and small to medium-sized leaf impressions were collected from the other two (Marshall and Breed 1974). Seventeen invertebrate localities were identified, ten of which were considered to be of major significance. Additional fossil collection was recommended to obtain samples of the full range of invertebrates present (Marshall and Breed 1974). Twelve microvertebrate fossil (fossil of teeth and small bones) localities were also identified within the lease area. Three of them were considered significant and recommended for additional collection activity (Marshall and Breed 1974). Seventy-nine macrovertebrate localities containing the remains of dinosaurs, crocodiles, alligators, and turtles were also identified. Twenty-five of these localities were considered significant and additional survey and collection was recommended; however, no additional collection has been conducted to date with the exception of the excavation and collection of a well preserved and nearly complete hadrosaurian dinosaur that was likely from Locality 82 (Marshall and Breed 1974). Four of the identified significant localities (localities 65, 67, 70, and 95) contained more than one significant fossil type. Of the 37 significant localities identified, 31 are located within the project boundaries (Table 4.3-1).

Collections were made at 24 localities (Table 4.3.1). No collections were made from six localities within the current project boundaries (localities 56, 57, 58, 65, 80, 82).

The New Mexico Bureau of Mines undertook salvage excavations at two vertebrate fossil localities in 1985 under a permit issued by the Navajo Nation and the BIA (Wolberg 1997). J.H. Hartman of the University of Minnesota found three fossil localities on Navajo Mine property, and collections included a significant fossilized clam shell locality along Cottonwood Wash (Wolberg 1997). Navajo Mine employee O.J. Estrada had made a number of significant fossil discoveries in the Yazzie area of the mine over several years. Discoveries have included the fossilized remains of turtle, crocodile, gar, snail, dinosaurs, and logs (Wolberg 1997). In 1997, the MNA's localities were reassessed, and 28 of the localities within the project boundaries were determined to be significant (localities 70, 87, 88, 93 and 118 contain multiple significant fossil types); additional study and fossil collections were recommended (Wolberg 1997) (Table 4.3-2). A majority of the significant fossil localities contain macrovertebrate fossils. In the summer of 2000, a dinosaur (Hadrosaur) skeleton was recovered from the Hosteen-Yazzie area of the Navajo Mine (BHP Minerals 2000). The locality from which this specimen came from is unknown, but may have been from MNA Locality 82.

Table 4.3-2 Significant Fossil Localities in Pinabete Permit Area

Fossil Type	Significant Localities within Project Boundaries (Wolberg 1997)	Significant Localities within Project Boundaries (Clifford 2005)
Plants	70, 118	1, 3-12, 14
Invertebrates	67, 71, 118	2
Microvertebrates	16, 33, 87, 88, 93	
Macrovertebrates	26, 42, 49, 54, 57, 58, 61-64, 66, 68, 70, 80-82, 87, 88, 90, 93,,95, 96, 118	13

Sources: Wolberg 1997; Clifford 2005

To date, few areas of the Navajo Nation lands have been surveyed for paleontological resources. In 2005, a survey was conducted of Area IV North and another was conducted of Area V (Clifford 2005). No vertebrate fossils were found during field survey of Area V, but it was noted that the potential for both vertebrate and invertebrate fossils existed in the area (DOI and BIA 2007). Clifford (2005) identified 14 fossil localities within the project boundaries (Table 4.3-1 and Figure 4.3-3). Fossil Site 1 yielded the largest array of fossils including crocodile teeth and fragmented scute plates; abundant turtle shell fragments; fish gar scale; fish teeth; brackish water ray stingers and teeth; plant fragments; dinosaur bones fragments (Plesiosaur, Hadrosaur, Tyrannosaur) and eggshell fragments. Fossil Site 2 yielded unionid bivalves and freshwater gastropods (Clifford 2005). Fossil Site 13 contained possible dinosaur bone fragments (Clifford 2005). The other fossil sites all contained petrified logs and stumps.

4.3.3 Changes to Earth Resources Affected Environment Post-2014

Two completed federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions; and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared in the following Section. Neither of these completed federal actions would change the affected environment for earth resources.

4.3.4 Environmental Consequences

Potential impacts to geology include the removal of coal, rock layers, and potential changes to surface drainage patterns and topography. Potential impacts to soil include removal, erosion, changes in productivity, and contamination (OSMRE 2012a). The ROI for geology and soils is restricted to only those areas that would be disturbed by the Proposed Action or alternatives – the Navajo Mine and Pinabete permit areas and associated roadways, and the DFADAs proposed at the FCPP. Erosion from maintenance activities within the subject transmission line ROWs are also considered. Paleontological impacts include the removal of fossils or other historical resources from geologic strata during mining operations.

Impacts to earth resources are considered adverse if the Proposed Action or alternatives would result in:

- Major changes to topographic features that could result in elimination of key features of the landscape or significantly change surface relief;
- Construction or clearing on slopes that are prone to mass movement or have very high susceptibility to erosion, such that accelerated erosion, sedimentation, or disruption of unstable slopes would occur;
- Loss of soil or adverse effects to soil productivity, such that revegetation would be ineffective;
- Destruction of unique geologic features or resources, including mineral resources;
- Loss of coal resources due to mining operations and handling;
- Destruction of significant paleontological resources.

The primary potential adverse impact to paleontological resources is physical damage or destruction of significant individual specimens or stratigraphic units within the geological formations that contain a wide array of life forms in great abundance. The greatest potential for adverse impacts to paleontological resources would occur during ground-disturbing activities. At the Navajo Mine, these activities include the excavation of the open pits and the construction of ancillary facilities and infrastructure (roads and power lines). At the FCPP, these activities would include the excavation of soils for the construction of berms around the DFADAs. Adverse indirect impacts would occur if significant paleontological resources (as identified in surveys conducted at the project sites) were removed from their context due to increased access to sensitive areas.

4.3.4.1 Alternative A – Proposed Action

Navajo Mine

Landforms and Topography

Under the Proposed Action, impacts to landforms and topography as a result of mining operations within the Navajo Mine Permit Area would be extensive and would continue for the proposed life of the mine (25 years) or until reclamation was completed. The coal removal process would alter topographic features such as slope gradients and surface drainage patterns, and would also cause topographic alteration to accommodate ditches and coal storage and handling areas. Under the Proposed Action, surface mining of overburden and subsurface coal resources would disturb 4,103 acres of rock and soil and modify topographic and landform features, such as hills, slopes, and surface drainage patterns, while forming high walls in the mining pits and temporary spoil stockpiles of overburden (BNCC 2012c). Proposed mining operations, including topsoil and suitable subsoil salvage, would increase the potential for wind and water erosion and off-site sedimentation.

Figure 4.3-3 Paleontological Resources at the Navajo Mine CONFIDENTIAL

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Per the SMCRA permit, NTEC would be required to remediate and restore all areas disturbed by mining. As described in Chapter 3, restoration to the approximate original contour (AOC) is required for reclamation and includes backfilling pits and grading highwalls and spoils to closely mimic the original shape, topographic relief, and major drainage patterns of the pre-mining permit area. Reclamation plans for the permit area are based specifically on meeting the AOC's drainage requirements. The actual reclaimed surface would closely approximate the approved AOC, and NTEC would ensure current AOC drainage designs are maintained, meet the established SMCRA and OSMRE requirements, and meet the material balance (BNCC 2012c). In doing so, restoration to the AOC would minimize the long-term impact on topography and landforms within and adjacent to the permit area after mining ceased. Naturally occurring slopes and topographic gradients vary substantially in the Navajo Mine Permit Area. The AOC surfaces for Areas IV North and South have been designed using a combination of fluvial geomorphic and traditional reclamation approaches (based on "hard-engineered" structures). Areas designed with the traditional reclamation approach would have interior slopes equal to or less than 6.5h:1v and outslopes less than or equal to 4h:1v. The slopes for post-reclamation slope stability have been designed to minimize land slide potential (BNCC 2012c). The reclaimed permit area would likely have gently rolling hills with smoother contours and less topographic relief than the original topography. The flatter topography would make the reclaimed area suitable for various land uses (e.g., grazing, residential uses). Slight permanent changes would occur to the topographic contouring as the AOC would be slightly altered within the permit area after reclamation. Therefore, the Proposed Action would result in minor impacts to landforms and topography.

Realignment of Burnham Road and construction of other ancillary roads within the permit area could slightly alter surface topography; however, these impacts are considered minor because road construction and removal would only marginally change the approximate contours of topography. At the end of the permit period, NTEC would remove the ancillary roads, and the affected areas would be regraded to the AOCs, top dressed, and revegetated. Proper construction would include embankments with slopes of 2h:1v in unconsolidated material and not steeper than 1h:1v in consolidated material (BNCC 2012c). These features would be designed to withstand landslides and slumping. Approved construction design and methods would be utilized to maintain slope stability.

NTEC does not plan to retain any of the mine roads constructed for the Proposed Action unless the Navajo Nation requires their preservation after the permit expires. Following reclamation, impacts to landform and topography would be considered minor.

Soils

Surface mining activities from the Proposed Action would considerably disturb the soil resources in the Navajo Mine Permit Area; however, all soil handling activities would be in compliance with SMCRA regulations, which are designed to minimize impacts associated with this disturbance. Over the next 25 years, NTEC estimates a total soil disturbance of 4,100 acres. Within the new permit area, NTEC would be required to conduct surface mining reclamation and soil restoration operations on the disturbed soil areas as part of the mine closure. BNCC has prepared a Topdressing Management Plan that NTEC would implement that details the requirements for topsoil replacement over the regraded spoil surface. OSMRE guidelines for reclamation projects identify soil conditions that must be considered during reclamation, including soil pH and acid-forming spoils, sodic zones, and toxic substance occurrence in soil. OSMRE has reviewed the Topdressing Management Plan and confirmed that it meets OSMRE guidelines. As described in Section 4.3.3.3, overburden analysis in the permit area concluded that the soils in Area IV North and Area IV South are alkaline, and potentially acid- or toxic- forming materials are not widespread within the permit area (BNCC 2012c). The analysis also concluded the soil material met SMCRA root-zone soil suitability criteria for selenium, boron, and pH.

The total estimated volume of in-situ topdressing within the permit area is 8,042,225 cubic yards. Approximately 42 percent of the permit area would provide all of the suitable in-situ topdressing, and the

remaining 58 percent of the permit area has no suitable topdressing. Based on the analysis provided by BNCC, OSMRE has determined that sufficient quantities of suitable topdressing are available from the permit area to support successful reclamation.

NTEC would utilize numerous stockpiles within the permit area for storing topdressing (and potentially regolith material, if needed). To minimize loss from wind and water erosion, stockpile surfaces (top and sides) would be mulched and seeded. Topdressing stockpiles that are left undisturbed for greater than 6 months would also be mulched, and those undisturbed for 1 year or greater would be seeded and mulched during the appropriate seeding period. These practices would effectively reduce erosion potential and soil loss. In addition, backfilling and grading spoil material to AOC topography would be conducted using fluvial geomorphic principles. These specific methods would decrease and minimize erosion in the permit area and efficiently stabilize graded spoil material and reclaimed surfaces. Therefore, impacts with regard to erosion would be minor.

Post-reclamation activities would have permanent beneficial impacts on the majority of soils in the permit area. Revegetation of the soil would result in a higher percentage of vegetative cover, improving soil stability, decreasing soil erodibility and increasing overall productivity of the reclaimed soils compared to pre-mining conditions. Beneficial impacts would be most significant on the 58% of the permit area with no suitable topdressing.

Soil excavation, stockpiling and salvaging during mining operations would have short-term effects on soil productivity in the 42% of the permit area that had suitable topdressing. Stockpiling soil can disturb natural processes that occur in the soil and mix established soil horizons. In general, stockpiled soil that is used for reclamation can be deficient in organic matter, nutrients and beneficial soil biota compared to native undisturbed soil. However, because the native undisturbed soil within the Navajo Permit Area is already low in organic matter, nutrients and beneficial soil biota, a decrease in these factors would cause negligible impacts to the establishment of vegetation. The reclaimed (post-mining) soil would not be restored to its original pre-mining soil productivity immediately, but soil productivity would be maximized by reclamation, which would create a suitable root zone over the entire reclaimed area and establish a productive, diverse, and permanent vegetation cover.

Following mining operations, the potential for erosion of redistributed soil would be minimized by constructing gradient terraces. Gradient terraces are earthen embankments or ridges that reduce erosion by slowing, collecting and redistributing surface runoff. Gradient terraces would be built in the permit area to reduce sheet and rill erosion, prevent gullies, and provide water harvesting mechanism for the semi-arid region (BNCC 2012c). Two types of gradient terraces would be implemented if necessary, flat bottom terraces and v-ditch terraces. All design components would be in compliance with SMCRA regulations. Soil productivity and soil suitability are expected to increase over conditions prior to mining activity following completion of mine closure activities.

Direct impacts to soil would be caused by construction of the proposed access roads, maintenance activities, and site preparation. Minor displacement of earth material would be expected during construction of roads. Small quantities of earth material would be irretrievably lost due to these activities. However, this resource is not considered unique or irreplaceable in the Pinabete Permit Area and abundant quantities of like material exists in the vicinity. Approximately 5.2 miles of primary and 15.6 ancillary roads would be constructed under the Proposed Action. Topdressing would be salvaged along roadways and stockpiled or hauled to regraded areas. Fugitive dust emissions would be controlled by application of water and chemical road stabilizers. To minimize additional surface disturbance, road maintenance would consist of light blading. With the implementation of these measures, impacts to soils (e.g., erosion, productivity and soil loss) during realignment of Burnham Road and maintenance of other ancillary roads would be minimized.

NTEC does not plan to retain any of the mine roads constructed for the Proposed Action, unless the Navajo Nation requires otherwise after the permit expires. Following removal, the affected areas would be

regraded, topdressed, and revegetated. Impacts to soils from primary and ancillary road construction, maintenance, and deconstruction would be considered minor due to slight soil loss by wind and water erosion and a decrease of soil productivity due to compaction.

Geology

The minable coal sits within the Fruitland Formation. As such, the overlaying geologic strata, the Kirtland Shale, and the Fruitland Formation, would be removed to access minable coal seams. Geologic hazards within the mining area are limited to those created during the mining process, mostly from exposed high walls and spoil piles. Hazards encountered during mining activities would be managed in accordance with Mine Safety and Health Administration regulations.

The level of impacts to geologic features from primary and ancillary roads is considered negligible because no existing or proposed unique geologic features in or around the permit area would be disturbed by the construction, maintenance, or removal of roads.

Mineral Resources

Since no unique geologic features are within the permit area, no impacts to unique geologic features would occur. Removal and permanent alteration of the coal resources within the permit area would be conducted according to all permit conditions and would maximize the economic recovery of the resources; therefore, no major impacts would occur. Mining of coal would not adversely impact any other mineral resources in the area. Uranium exists within the Grant Mineral Belt in New Mexico along the southern portion of the San Juan Basin, outside the permit area. The proposed mining would not have a major impact on this resource. Oil and gas resources would not be affected by the proposed coal mining operations under the Proposed Action.

Coal is the dominant mineral resource in the permit area, and the only resource to be extracted during mining operations. Coal extraction from the permit area would be conducted in the Fruitland Formation. Coal mining must be conducted in a way to maximize resource recovery while protecting remaining coal deposits after mining. BNCC estimated that a total of 134,439 million tons of coal would be extracted over the 25-year permit period (BNCC 2012c). A small percentage (8 to 10 percent) of coal resources would be lost as wedges and ribs, and at the top and bottom of coals seams. Numerous operational and safety-related conditions would ensure limited coal loss during normal mining activities. The permanent loss of coal resources in the permit area is considered normal given current mining technology and the nature of the coal extraction in the Fruitland Formation.

Paleontological Resources

Under the Proposed Action, 30 known significant paleontological resources would be physically affected by excavation of the pits in Area IV North and construction of the haul roads (Figure 4.3-4). Development of lease areas within Area IV North would affect 14 significant localities from the 1974 survey (Localities 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 80, 81, and 82),six significant localities from the 1997 reassessment (Localities 49, 54, 68, 70, 87, and 90), and 10 significant localities from the 2005 survey (Localities 2, 3, 4, 5, 8, 10, 11, 12, 13, and 14). The destruction of, or damage to, this number of significant localities within the Navajo Mine Lease Area would be considered a major adverse impact to paleontological resources. Furthermore, the potential exists for previously unknown paleontological resources to occur within the permit area. These resources would also be adversely impacted as a result of implementation of the proposed action. Mitigation of these potentially major impacts is addressed in Section 4.3.5.

Four Corners Power Plant

Landforms and Topography

As part of the Proposed Action, five new DFADAs would be created to accommodate future disposal of all fly ash through the end of the lease term. The soil needed to create the impoundment and berms would be borrowed from areas inside the existing FCPP Lease Area. Impacts to landform and topography would occur due to the construction and closure of the five new Ash Disposal Areas. These features would permanently alter topography through both the creation of borrow pits on flat areas of the lease and construction of impoundments as high as 80 feet. These alterations would permanently change the surface relief of the fly ash disposal area; although due to the limited areal extent of the DFADA, impacts are considered minor.

Soils

Impacts to soils at the DFADA could occur due to runoff of CCR if berms and embankments were to fail; however, as discussed in Section 4.5, Water Resources/Hydrology, the berms would be constructed around the areas to restrict any runoff. Equipment and vehicles operating around the DFADA would also have the potential to increase soil erosion; however, design features of the roadways in the DFADAs and BMPs (dust suppression) have been established to minimize any soil erosion. With regard to productivity, placement of CCR would reduce soil productivity and prevent vegetation growth over the long-term on this portion of the lease area. Potential impacts to soil as a result of erosion and productivity would be considered minor due to erosion control features and the limited areal extent of the DFADA. At such time that the FCPP is decommissioned, reclamation should be conducted to increase soil productivity in the DFADAs.

Geology

Although the surface relief of the land would change as a result of emplacement of the new DFADA, no unique geologic features exist in or around the proposed DFADAs; therefore, impacts to geology are expected to be negligible.

Mineral Resources

Although the surface of the land would change as a result of emplacement of the new DFADA, no known mineral resources are present in the proposed DFADA; therefore, impacts to mineral resources are expected to be negligible.

Paleontological Resources

The construction of the five additional DFADAs between the base of the escarpment and the Chaco River near the base of the Hogback geologic feature could affect paleontological resources. The geological context suggests some potential for paleontological resources. However, given the eroded nature of the deposits in the area of the proposed DFADA, the potential for intact paleontological resources is considered low. The Proposed Action within the FCPP Lease Area is unlikely to impact any significant paleontological resources. A plan would be put in place to manage any inadvertent discoveries during development of the new DFADAs.

Figure 4.3-4 Alternative A Paleontological Resources Impacts CONFIDENTIAL

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Transmission Lines

Landforms and Topography

No construction activities or soil disturbing activities are proposed during operation of the subject transmission lines; therefore, no impacts to geology and soils would occur. Similarly, no impacts to mineral resources would occur. All vehicle access to the transmission lines is via paved roadways; therefore, maintenance activities would not result in any erosion or soil disturbance.

Paleontological Resources

Operations and maintenance would continue as they do currently. No new towers or access roads would be constructed and no changes in the ROW would occur as a result of the Proposed Action. The renewal of the ROWs for the four transmission lines would have no impact to paleontological resources.

4.3.4.2 Alternative B – Navajo Mine Extension Project

Navajo Mine

Topography, Soils, Geology, and Mineral Resources

Under Alternative B, surface mining of overburden and subsurface coal resources would disturb 4,998 acres of rock and soil and modify topographic and landform features, such as hills and slopes, while forming highwalls in the mining pits and temporary spoil stockpiles of overburden during the life of the permit. Alternative B would disturb an additional 894.5 acres compared to the Proposed Action.

The impacts to topography, soil, geology, and mineral resources would be similar to those described under the Proposed Action. Alternative B would include all SMCRA-required reclamation activities described under the Proposed Action. Therefore, impacts to topography, soils, geology, and mineral resources would be comparable to impacts described under the Proposed Action.

Under Alternative B, approximately 12.6 miles of primary roads and 14.1 miles of ancillary roads would be constructed (BNCC 2013). An additional 7.4-mile primary road would be constructed, compared to the Proposed Action. Impacts to topography and soils would be similar to those described for the Proposed Action. As such, impacts to topography and soil resources from construction, maintenance, facilities removal, and reclamation are considered minor because road construction and removal would only marginally change the approximate contours of the landscape in certain locations.

Impacts to geologic and mineral resources from construction, maintenance, and removal of primary and ancillary roads would be comparable to the Proposed Action. As such, impacts are considered minor.

Paleontological Resources

Under Alternative B, two known significant paleontological resource would potentially be affected. Localities 117 and 118 found during the 1974 survey are located at the southern end of Area IV South. These localities contain a significant concentration of vertebrate, invertebrate, and plant fossils. More than 60 specimens were previously collected from these localities, but they have the potential to yield additional important specimens and paleoenvironmental information. The destruction of, or damage to, these significant localities would be considered a major adverse impact to paleontological resources. Mitigations as developed under the Proposed Action should be implemented under Alternative B also (see Section 4.3.5).

Four Corners Power Plant

Under Alternative B, impacts to topography, soils, geology, minerals, and paleontological resources would be the same as described for the Proposed Action.

Transmission Lines

Under Alternative B, the transmission line ROWs would be approved, and the lines would continue to be operated and maintained as described under the Proposed Action. No changes from the Proposed Action are proposed under this alternative; therefore, no impacts to topography, soil, geology, minerals, or paleontological resources would occur under Alternative B.

4.3.4.3 Alternative C – Alternative Pinabete Mine Permit

Navajo Mine

Topography, Soils, Geology, and Mineral Resources

Under Alternative C, proposed mining would disturb 6,492 acres. Mining would take place in Areas IV North and South as described in the Proposed Action. Operations, maintenance, and reclamation would be conducted as described under the Proposed Action. Therefore, impacts to topography, soil, geology, and mineral resources would be comparable to impacts discussed under the Proposed Action; however, under Alternative C an additional 2,388.7 acres would be disturbed.

Under Alternative C, approximately 15.1 miles of primary roads would be constructed, along with 14.8 miles of ancillary roads. Primary and ancillary roads would be constructed, maintained, and decommissioned as described in the Proposed Action. Therefore, impacts to topography, soil, geology, and mineral resources would be comparable to the Proposed Action; however, under Alternative C an additional 9.9 miles of primary roads would be constructed compared to the Proposed Action.

Paleontological Resources

Under Alternative C, 37 known significant paleontological resources would be physically affected by excavation of the pits in Area IV North and construction of the haul roads (Figure 4.3-5). Development of lease areas within Area IV North would affect 19 significant localities from the 1974 survey (Localities 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 80, 81, 82, 87, 88, 90, 96, 97, 117, and 118), five significant localities from the 1997 reassessment (Localities 49, 54, 68, 87, and 90), and 13 localities from the 2005 survey (Localities 2 to 14). The destruction of, or damage to, this number of significant localities within the Navajo Mine Lease Area is considered a major adverse impact to paleontological resources (Table 4.3-1). Mitigations as developed under the Proposed Action should be implemented under Alternative C also (see Section 4.3.5).

Four Corners Power Plant

Topography, Soils, Geology, and Mineral Resources

Under Alternative C, impacts to topography, soils, geology, minerals, and paleontological resources would be the same as described for the Proposed Action.

Transmission Lines

Under Alternative C, the transmission line ROWs would be approved, and the lines would continue to be operated and maintained as described under the Proposed Action. No changes from the Proposed Action are proposed under this alternative; therefore, no impacts to topography, soil, geology, minerals, or paleontological resources would occur under Alternative C.

Figure 4.3-5 Alternative C Paleontological Resources Impacts CONFIDENTIAL

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4.3.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action. Therefore, no impacts to topography, soil, geology, minerals, or paleontological resources would occur under Alternative D.

Four Corners Power Plant

Under this alternative, the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The 10% reduction in surface area of the DFADAs could result in a reduction in the potential for unanticipated discoveries of paleontological resources than the Proposed Action. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts to topography, soil, geology, and minerals would the same as described for the Proposed Action.

Transmission Lines

Under this alternative, the transmission line ROWs would be approved and they would continue to be operated and maintained as described for the Proposed Action. No changes from the Proposed Action are proposed under this alternative; therefore, no impacts to topography, soil, geology, minerals, or paleontological resources would occur under Alternative D.

4.3.4.5 Alternative E – No Action Alternative

Navajo Mine

Topography, Soils Geology, and Mineral Resources

Under the No Action Alternative, the Navajo Mine would close, and Areas IV North and IV South would not be mined. Reclamation mandated under the existing SMCRA permit would occur and the mine and all its associated facilities would be closed. As such, no impacts to topography, soils, geology, or mineral resources would occur within Areas IV North and South from mining operations or road construction. All areas within the existing Navajo Mine permit area would be reclaimed in accordance with SMCRA regulations; however, a slight permanent alteration in topographic relief would occur compared to pre-mining conditions. These impacts are considered minor.

Paleontological Resources

Under the No Action Alternative, the Navajo Mine would close. The Pinabete permit area (Areas IV North and South) would not be mined. Burnham Road would not be realigned. Mining in the Navajo Mine Permit Area (Areas III and IV North) would continue until the ROD is issued in 2015. Areas I and II, which are also part of the Navajo Mine permit area, have already been reclaimed and no new mining would occur in these areas. Upon permit expiration, NTEC would begin reclamation activities in Areas III and IV North. Reclamation activities would continue until OSMRE provides approval that all requirements have been met. It is expected that all reclamation would be completed by June 2021. All ancillary buildings and facilities (e.g., communication lines, railroad) would be removed and the land would be reclaimed.

Under the No Action Alternative, two known significant paleontological resources would be impacted within the pre-2016 striplines of Area III. Localities 30 and 42 found during the 1974 survey of the Navajo Mine Lease Area are located in two portions of Area III that would be mined under the current SMCRA permit that expires in 2016. Locality 30 contains a bed of freshwater shells with turtle bone fragments and dinosaur bone fragments above and below it. Locality 42 contains an abundance of fossil wood and reptile bone fragments including dinosaur bones and turtle shell. The destruction of, or damage to, these

significant localities would be considered a major impact to paleontological resources. To mitigate adverse effects, an inadvertent discovery plan should be prepared, as described in Section 4.3.5.

Four Corners Power Plant

Topography, Soils Geology, and Mineral Resources

Under the No Action Alternative, Units 4 and 5 of the FCPP would shut down in 2016 and soon after be decommissioned. The DFADA would not be constructed under the No Action Alternative. As such, no impacts to topography, soils, geology, or mineral resources are anticipated within the area of the FCPP.

Paleontological Resources

Under the No Action Alternative, Units 4 and 5 would be shut down when the lease expires in 2016. The plant facilities would be decommissioned and dismantled if the current lease were allowed to expire and the units were shut down. The three switchyards would also be decommissioned and dismantled.

Under the No Action Alternative, no known significant paleontological resource within the current FCPP Lease Area would be affected (Table 4.3-1).

Transmission Lines

Topography, Soils Geology, and Mineral Resources

Under the No Action Alternative, the ROW would not be approved and the transmission lines would be decommissioned, dismantled, or left in place. If the transmission lines were dismantled, erosion could occur during construction activity. However, decommissioning would be addressed under its own set of permits and approvals and BMPs and mitigation measures would be put in place to minimize erosion to the extent feasible. As such no impacts to topography, soils, geology, or mineral resources are anticipated under Alternative E.

Paleontological Resources

Under the No Action Alternative, no known significant paleontological resource within the current ROWs of the four transmission lines would be affected (Table 4.3-1) because no previously undisturbed areas would be affected.

4.3.5 Earth Resources Mitigation Measures

Impacts to geology, soils, and minerals as a result of the Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects. The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific practices or standard operating procedures that reduce or avoid environmental impacts, and best management practices for specific activities. These are described in Section 3.2.6.3. These measures are part of their application materials and are enforceable through permit or lease conditions. In addition, the Project Applicants must comply with additional protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework (Section 4.3.1). If the environmental analysis in this EIS recommends additional protective measures, over and above the applicant proposed measures and regulatory compliance, they would be listed below as specific mitigation measures. Since no major adverse effects to geology, soils, and minerals have been identified, no additional mitigation measures are recommended. However, impacts to paleontological resources is considered to be major and would require mitigation measures be established to minimize these potential effects.

The destruction of, or damage to, a number of significant paleontological localities within the Navajo Mine Lease Area would be considered a major adverse impact to paleontological resources. Furthermore, the

potential exists for previously unknown paleontological resources to occur within the Pinabete permit area. These resources would also be adversely impacted as a result of implementation of the proposed action.

Mitigation measures are recommended to ensure that any existing or new paleontological discoveries encountered during mining of the Pinabete permit area or road construction associated with the proposed Project would be appropriately evaluated, mitigated, and curated. To mitigate the adverse effects to paleontological resources, an inadvertent discovery plan should be developed that would establish the procedures to be followed in the event that fossilized remains are encountered during surface mining operations in the vicinity of the identified significant localities. The plan should include a discussion of the procedures for monitoring mining activity, procedures for halting operations around any discovery and securing it from further damage, and the procedures and methodologies for evaluating the significance of the discovery. It should also present the procedures and methodologies to be followed if the discovery is determined to be significant. These procedures should include the field and laboratory methods, reporting guidelines, and curation procedures to be followed, such as:

- Conduct an on-the-ground survey prior to mining and road construction, or have a paleontologist available as a monitor during activities.
- Implement an inadvertent discovery plan to ensure that any unknown paleontological resources are properly treated upon discovery.
- Train construction personnel for the transmission line and well field in recognizing possible resources and how to contact a paleontologist if a possible paleontological resource is discovered.

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4.4 Cultural Resources

Cultural resources include the locations of human activity, occupation, or usage that contain materials, structures, or landscapes that were used, built, or modified by people. They also include the institutions that form and maintain communities and link them to their surroundings. Cultural resources consist of prehistoric and historic archaeological resources (e.g., sites and isolated finds), historic resources (e.g., buildings, structures, objects, and districts), and properties of religious and cultural significance, including Traditional Cultural Properties (TCPs). Historic properties, as defined by 36 CFR 800, the implementing regulations of the National Historic Preservation Act of 1966 (NHPA), are a subset of cultural resources that consists of a district, site, building, structure, artifact, ruin, object, work of art, or natural feature important in human history that meets defined eligibility criteria for the National Register of Historic Places (NRHP).

For the purposes of analyzing cultural resources, the Project Area for the Proposed Action is defined by the Area of Potential Effects (APE), which includes areas containing the Navajo Mine, the FCPP, and the four associated transmission lines, along with defined buffer extensions around these project components (see Section 4.4.2).

4.4.1 Regulatory Compliance Framework

The proposed Project is subject to the requirements of Federal, state, and tribal regulations established to guide management of cultural resources.

4.4.1.1 Federal Regulations

Federal regulations include NHPA Section 106 and its implementing regulations (36 CFR Part 800), NEPA, the Archaeological Resources Protection Act of 1979 (ARPA), and the Native American Graves Protection and Repatriation Act (NAGPRA).

NHPA Section 106 and NEPA

The proposed Project is considered an “undertaking” under NHPA (16 USC 470 et seq.) Section 106, as amended, which requires that any Federal or Federally assisted project or any project requiring Federal licensing or permitting take into account the effect of the undertaking on historic properties listed in or eligible for the NRHP (described in further detail below). The regulations that govern NHPA implementation allow for a parallel NEPA and Section 106 process in an effort to streamline the environmental compliance process. OSMRE is the Lead Federal Agency for the Section 106 process for the proposed Project.

Section 106’s intent is for Federal agencies to take into account the effects of a proposed undertaking on any historic properties situated within a proposed APE and to consult with the Advisory Council on Historic Preservation (ACHP), State Historic Preservation Officers (SHPOs), Federally recognized Indian tribes, other Federal agencies with concurrent undertakings as a result of the project, applicants for Federal assistance, local governments, and any other interested parties regarding the proposed undertaking and its potential effects on historic properties.

This regulation established a process of identifying historic properties that may be affected by the proposed undertaking; assessing the undertaking’s effects on those resources; and engaging in consultation that seeks ways to avoid, reduce, or mitigate any effects on NRHP-listed or eligible properties. Effects include, but are not limited to, destruction or alteration of all or part of a property; isolation from or alteration of its surrounding environment; introduction of visual, audible, or atmospheric elements that are out of character with the property or that alter its setting; transfer or sale of a Federally owned property without adequate conditions or restrictions regarding preservation, maintenance, or use; and neglect of a property resulting in its deterioration or destruction.

The NHPA specifies that several state, tribal, and Federal agencies must be consulted in compliance with Section 106, including each SHPO whose state would physically include any portion of the APE. The SHPO is appointed by each state to protect the interests of its citizens with respect to issues of cultural heritage. NHPA Section 101(b)(3) provides each SHPO a prominent role in advising the responsible Federal agencies and ACHP. In addition to the SHPO, the Lead Federal Agency has an obligation to work with state and local governments, private organizations, and individuals during the initial planning and development of the Section 106 process.

On nontribal lands, the Lead Federal Agency (OSMRE for this Project), in consultation with the SHPOs, Tribal Historic Preservation Officers (THPOs), and other consulting parties, assesses the need for historic and archaeological resource investigations in the proposed Project APE, generates and approves methodologies for undertaking such investigations within the state, and evaluates the preliminary NRHP status of any historical or archaeological resources located within the APE. The SHPO also assists the Lead Federal Agency in assessing any potential effects on historic properties. On tribal lands, the SHPO's Section 106 responsibilities can also be assumed by a THPO, per NHPA Section 101(d)(2).

Section 106 regulations state that each SHPO (or THPO, if they have assumed the SHPO's role) is required to respond within 30 days of receiving a request to review a proposed action, or a request to review a Federal agency's finding or determination regarding historic properties located within the proposed Project APE. In the event that the SHPO/THPO does not respond within this timeframe, 36 CFR 800.3(c)(4) states that the Lead Agency can decide to (1) proceed to the next step in the application process based on any earlier findings or determinations that have been made up to that point or (2) consult directly with the ACHP in lieu of the SHPO/THPO. If, after this step is followed, the SHPO or THPO decides to reenter the Section 106 process, 36 CFR 800.3(c)(4) further states that the Lead Agency official may continue the consultation proceeding without being required to reconsider previous findings or determinations.

The National Register of Historic Places

The NRHP, created under the NHPA, is the Federal list of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering, and culture. NRHP properties have significance to the history of their community, state, or the Nation and have been deemed worthy of preservation based on value, integrity, and relevance. The National Park Service (NPS) maintains and expands the NRHP on behalf of the Secretary of the Interior.

To guide the determination of eligibility of archaeological resources, historic resources, or sites of religious and traditional significance as historic properties for inclusion in the NRHP, the NPS has developed the following NRHP Criteria for Evaluation (36 CFR 60.4). The criteria are standards by which every property is evaluated for listing in the NRHP. The criteria (36 CFR 60.4 [a–d]) used to evaluate the significance of a resource are as follows:

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

Additional "Criteria Considerations" A through G are defined to guide application of the Criteria for Evaluation A through D, listed above. Properties also need to exhibit integrity of location, materials, setting, design, association, workmanship, and feeling and must also be at least 50 years old. Buildings less than 50 years old do not meet the NRHP criteria unless they are of exceptional importance under

Criterion Consideration G, as described in NPS Bulletin No. 22, "How to Evaluate and Nominate Potential National Register Properties That Have Achieved Significance Within the Last 50 Years."

Properties of Religious and Cultural Significance

Historic properties include sites of religious or cultural significance (including TCPs) that meet the NRHP criteria of eligibility but that do not necessarily have physical evidence of human activity. National Register Bulletin 38 defines TCPs as locations that embody the "beliefs, customs, and practices of a living community of people that have been passed down through the generations, usually orally or through practice. The traditional cultural significance of a historic property is derived from the role the property plays in a community's historically rooted beliefs, customs, and practices that are essential for continuing the cultural identity of the community. In some tribal cultures, culture and religion are intertwined; therefore, a historic property may have both cultural and religious significance. As noted in Bulletin 38, a property's religious significance does not preclude its eligibility for the NRHP. OSMRE has consulted and will continue to consult with Indian tribes to assist in determining the best ways to identify, evaluate, and mitigate potential effects on TCPs. A summary of tribal consultation undertaken for the proposed Project is presented in Chapter 5, Consultation and Coordination.

Section 106 recognizes the importance of consulting with Indian tribes when Federal undertakings occur. Specifically, 36 CFR 800.2(c)(2)(ii) notes: "Section 101(d)(6)(B) of the NHPA requires the agency official to consult with any Indian tribe or Native Hawaiian organization that attaches religious and cultural importance to historic properties that may be affected by an undertaking. This requirement applies regardless of the location of the historic property." In addition, 36 CFR 800.2(c)(2)(ii)(B) says the "Federal Government has a unique legal relationship with Indian tribes set forth in the Constitution of the United States, treaties, statutes, and court decisions. Consultation with Indian tribes should be conducted in a sensitive manner respectful of tribal sovereignty. Nothing in this part alters, amends, repeals, interprets or modifies tribal sovereignty, any treaty rights, or other rights of an Indian tribe, or preempts, modifies or limits the exercise of any such rights."

Archaeological Resources Protection Act of 1979

ARPA (16 USC 470; 43 CFR Part 7) was created to protect archaeological resources and sites on public and Native American lands in addition to encouraging cooperation and exchange of information among governmental authorities, professionals, and private individuals. ARPA requires Federal landowning agencies to issue ARPA permits to qualified individuals, institutions, or firms that conduct archaeological surveys within Federal and tribal lands. ARPA established civil and criminal penalties for destruction and alteration of cultural resources.

American Indian Religious Freedom Act

The American Indian Religious Freedom Act addresses the protection and preservation for American Indians, Eskimo, Aleut, and native Hawaiians, their inherent rights of freedom to believe, express, and exercise traditional religions, including access to sites, use and possession of sacred objects, and freedom to worship through ceremony and traditional rites (42 USC 1996).

Native American Graves Protection and Repatriation Act

NAGPRA applies to all Federal and tribal lands. NAGPRA effectively protects tribal burial sites and rights to items of cultural significance, including human remains, funerary objects, sacred objects, and objects of cultural patrimony (25 USC 3001[3]; 43 CFR Part 10). NAGPRA requires that Indian tribes be consulted whenever archaeological investigations encounter, or are expected to encounter, Native American cultural items or when such items are unexpectedly discovered on Federal or tribal lands (NPS 2007). On Federal lands, intentional excavation and removal of Native American human remains and objects from Federal or tribal lands for discovery, study, or removal is permissible only if an ARPA permit is issued by a Federal land-holding agency. Consultation with Native Americans must occur prior to the issuance of an

ARPA permit and removal of human remains and objects requires the consent of the applicable Native American tribe. Each state has statutes that govern the inadvertent discovery and/or excavation of human remains as well as artifacts on private lands.

4.4.1.2 State Regulations

New Mexico

In addition to the Federal laws described above, New Mexico statutes provide additional protections for cultural resources. The Cultural Properties Act (Sections 18-6 through 18-6-23, New Mexico Statutes Annotated 1978) was originally enacted in 1969 and has been amended several times. It established the central principles of preservation in New Mexico: "that the historical and cultural heritage of the state is one of the state's most valued and important assets [and] that the public has an interest in the preservation of all antiquities, historic and prehistoric ruins, sites, structures [and] objects of historical significance."

The Cultural Properties Act established the Historic Preservation Division and the Cultural Properties Review Committee. This act authorizes the committee to issue permits for archaeological survey and excavation and excavation of unmarked human burials to qualified institutions with the concurrence of the state archaeologist and SHPO. It also established civil and criminal penalties for looting of archaeological sites and disturbance of unmarked burials. This act requires that state agencies provide the SHPO with an opportunity to participate in planning for activities that will affect properties that are on the State Register of Cultural Properties or the NRHP. The State Register of Cultural Properties is the official list of historic properties worthy of designation in New Mexico and is administered by the Historic Preservation Department. Historic properties can be listed on both the NRHP and the State Register depending on their significance.

The Prehistoric and Historic Sites Preservation Act of 1989 (Sections 18-8-1 through 18-8-8, New Mexico Statutes Annotated 1978) prohibits the use of state funds for projects or programs that would adversely affect sites on the State Register or NRHP unless the state agency or local government demonstrates that no feasible and prudent alternative exists and that all possible planning has been done to minimize the harm to the register site.

Arizona

The Arizona State Historic Preservation Act of 1982 includes Arizona Revised Statutes 41-862 through 41-864, which provide additional protections for cultural resources within the state of Arizona such as archaeological and vertebrate paleontological discoveries, permitting, prohibition of unnecessary defacing of sites or objects, duty to report discoveries, disposition of discoveries, definitions, and laws regarding disturbing human remains or funerary objects. The Arizona Antiquities Act of 1960, which includes Arizona Revised Statutes 41-841 through 41-845, contains regulations designed to protect archaeological and paleontological resources on property owned or controlled by the state (Arizona State Museum 2010, 2013).

4.4.1.3 Tribal Regulations

The Section 106 process is conducted in parallel with a number of tribal laws and policies including the Navajo Nation Cultural Resources Protection Act, the Navajo Nation Policy for the Disposition of Cultural Resource Collections, and the Navajo Nation Policy for the Protection of Jishchaa'.

The Navajo Nation Cultural Resources Protection Act provides a structure that directs the administration of cultural resources in a spirit of stewardship and for the inspiration of present and future generations, in cooperation with states, Federal Government, other Indian tribes, and private organizations and individuals (Navajo Nation n.d.a).

The Policy for the Disposition of Cultural Resource Collections emphasizes the protection of all cultural resources owned by or found under the Navajo Nation's jurisdiction and avoidance of unnecessary excavation, disturbance, or removal of any cultural resources unless a compelling need exists, and it

outlines the protocol to follow if such disturbance occurs either accidentally or out of necessity (Navajo Nation 2008).

The Navajo Nation Policy for the Protection of Jishchaa' addresses the protection of gravesites, human remains, and funerary items under their jurisdiction based on Navajo cultural beliefs (Navajo Nation n.d.b).

4.4.2 Affected Environment Pre-2014

A project APE is defined as the "geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist" (36 CFR 800.16(d)). For the purposes of the proposed Project and NHPA Section 106, the APE includes areas containing the Navajo Mine, the FCPP, and the four associated transmission lines. The Project APE for the Proposed Action consists of the following:

- The APE boundary for the Navajo Mine Permit Renewal, the proposed Pinabete Permit and the lease renewal of the Navajo Mine Area III access road includes (1) certain portions of Areas III and IV North that are approved in the current Navajo Mine SMCRA permit, where future mining-related disturbance is anticipated; (2) the proposed Pinabete Permit Area, which includes portions of Areas IV North and IV South; (3) for consideration of potential effects on TCPs, a buffer of 1 mile in all directions from the future mining-related disturbances and the western lease boundary of Area III including the existing Area III-Lowe coal stockpile and railcar-loading facility, which would be used during operation of the proposed Pinabete Permit Area; and (4) a short segment of the Area III access road extending from the southeastern corner of Area II to the southeast. The portion of the APE that includes the mine has a 1-mile buffer zone for TCPs, as shown on Figure 4.4-1.
- The APE boundary for the FCPP includes all areas within the lease boundaries, as shown on Figure 4.4-2. The APE includes proposed new DFADAs, as well as Morgan Lake and the existing lease areas or corridors for a water pipeline from the power plant area to the San Juan River, a water pipeline access road from the pumping plant to Morgan Lake, a pumping plant on the southern side of the San Juan River, a 69-kV transmission line from the power plant to the pumping plant, County Road 6675 from the FCPP to the San Juan River, and a power plant access road from the power plant area northeastward to San Juan River.
- The APE boundary for four subject transmission lines is the ROW corridors, the Moenkopi switchyard and other ancillary facilities (see Figure 4.4-3).

4.4.2.1 Cultural History

The cultural history of the Four Corners region provides context for evaluating the archaeological and historical resources, as well as TCPs within the proposed APE. Portions of the APE are located within the Navajo Nation, which is bounded by four sacred mountains surrounding the Four Corners area of the Colorado Plateau (see Project Description), the Hopi Reservation, as well as Federal, state, and private lands. The summary below is based on archaeological and historical research, which differs from the traditional Navajo creation accounts and histories.

The proposed Project is situated within the prehistoric culture area of the Four Corners region and, specifically, the San Juan Basin of the Colorado Plateau. This region is characterized by a series of traditions, periods, and phases extending back as far as 10000 years before Christ (BC). The cultural periods represented in the San Juan Basin include the Paleoindian (ca. 10000–5500 BC), the Archaic (ca. 5500 BC–Anno Domini [AD] 400), the Anasazi (ca. AD 1–1300), and the Navajo (ca. AD 1450–present) (see Table 4.4-1).

Table 4.4-1 Cultural History Timeline for the Project Area

Cultural Period	Dates
Paleoindian	10000–5500 BC
Archaic	5500 BC–AD 400
Anasazi	AD 1–1300
Navajo	AD 1450–Present

The Paleoindian period (ca. 10000–5500 BC) is characterized by highly mobile populations focused on hunting large game animals and now-extinct mega-fauna. Paleoindian period sites tend to be characterized as “kill localities” associated with the exploitation of these large game animals and, frequently, include projectile points and butchering tools. Four complexes have been defined for this period based on distinctive projectile point technology: Clovis (10000-9000 BC), Folsom (9000-8000 BC), Plano (8000-7000 BC), and Cody (7000-6000 BC). Changes between the complexes occur in adaptive strategies and tool kits, where mega-fauna were hunted during the Clovis complex and modern bison were hunted during the Cody complex (Reed et al. 2009).

During the Archaic period (ca. 5500 BC–AD 400), an increased focus on gathering plant resources and hunting smaller game developed, which reflects shifting adaptive strategies in response to changing environmental and habitat conditions. Broad spectrum diversification began early in the Jay and Bajada phases of the Archaic period (between 5500 and 3200 BC). Canyon heads were primarily occupied during this time by small, mobile groups of people (Reed et al. 2009). Chipped stone artifacts are commonly found but ground stone artifacts are rare. The mid-Archaic period lasted until about 800 BC and represents a time of significant changes related to the cooking and roasting of foodstuffs and processing plant materials, which occurred in the San Jose and Armijo phases. Numerous large hearths and underground ovens appeared, as well as large chopper tools, shallow basin metates, and one-hand manos. Maize was introduced after approximately 1800 BC, which resulted in substantial population growth, large habitation sites, seasonal aggregation, an increase in ground stone implements, and an appearance of ceremonial items (Reed et al. 2009). The late Archaic period lasted until approximately 100 BC during the En Medio phase, and transitioned into the Basketmaker II phase of the Anasazi period (Reed et al. 2009). During the late Archaic period, agriculture and seasonal cycles became increasingly important, and populations continued to grow.

The Anasazi (Ancestral Puebloan) period (ca. AD 1–1300) is differentiated from the earlier Archaic period by another shift in subsistence strategies. During the Basketmaker II phase (AD 1–500), sedentism increased as agriculture became more important. Ceramics and small pit house structures with extramural cists were introduced during this phase (Meininger and Baker 2006). Settlements were generally located on terraces above major drainages (Meininger and Baker 2006). The Basketmaker III phase (AD 500–700) saw an intensification of agriculture with maize, the increased importance of domesticates such as beans and squash, the introduction of the bow and arrow, and an increase in shell and lithics trade. People also began living in great pit structures during this time (Meininger and Baker 2006). The Pueblo I phase (AD 700–900) included the addition of large built structures such as kivas, aboveground masonry and/or jacal structures, and pueblos, as well as the continuance of pit houses for habitation (Reed et al. 2009). Pueblos increased in size and frequency during the Pueblo II phase (AD 900–1100), along with more sophisticated irrigation and farming techniques. The Chaco Canyon great house was developed during the Pueblo II phase. The agricultural way of life continued into the Pueblo III phase (AD 1100–1300) but began to decline due to resource depletion, population pressure, and climatic change.

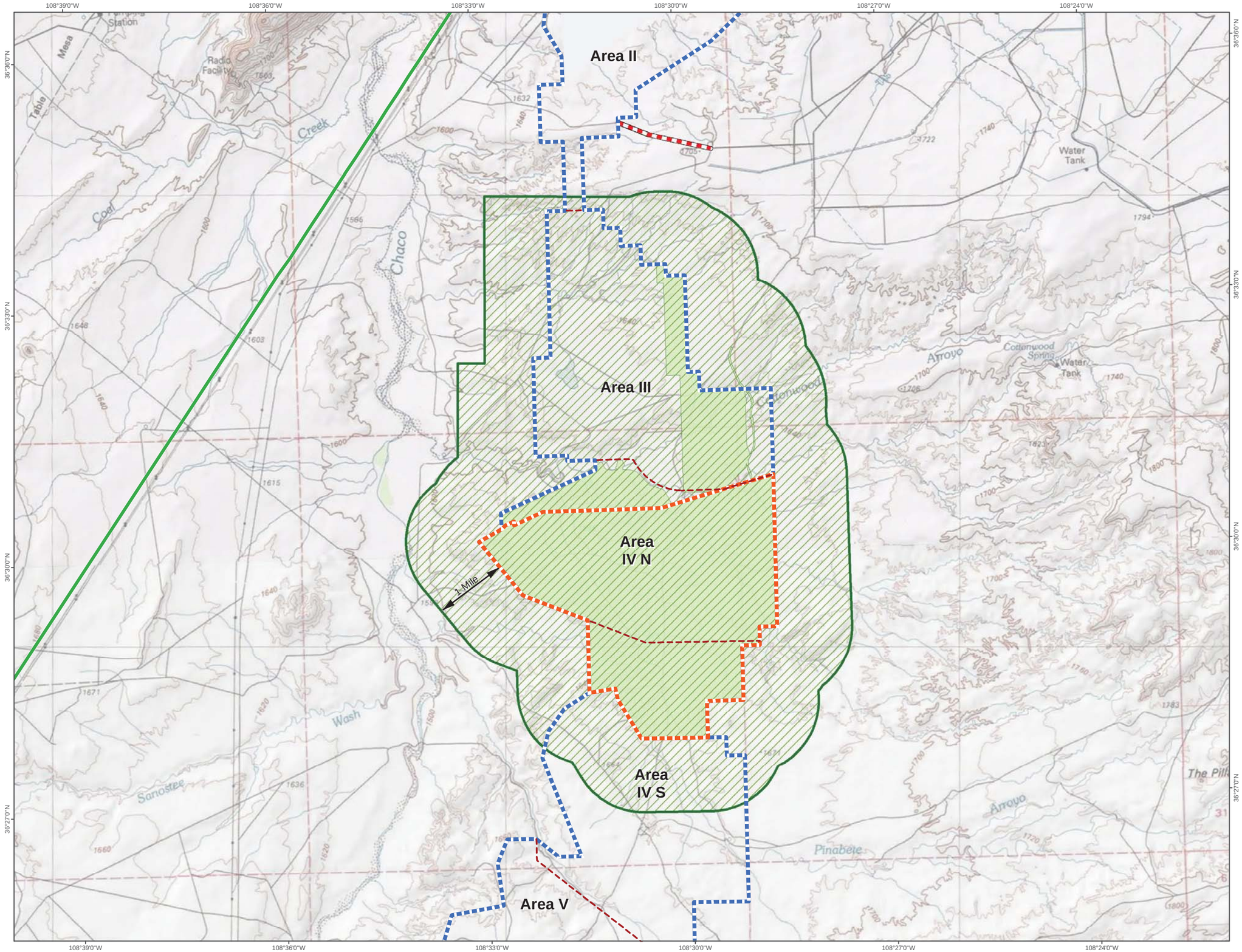

Figure 4.4-1

Area of Potential Effect
Navajo Mine

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Navajo Mine Resource Areas
- Proposed Pinabete Mine Permit Boundary

TRANSMISSION LINES

- 345kV

AREA OF POTENTIAL EFFECT

- Traditional Cultural Properties APE
- Mining Related Disturbance Area
- Area III Road

N

0 0.75 1.5 3
Scale in Miles

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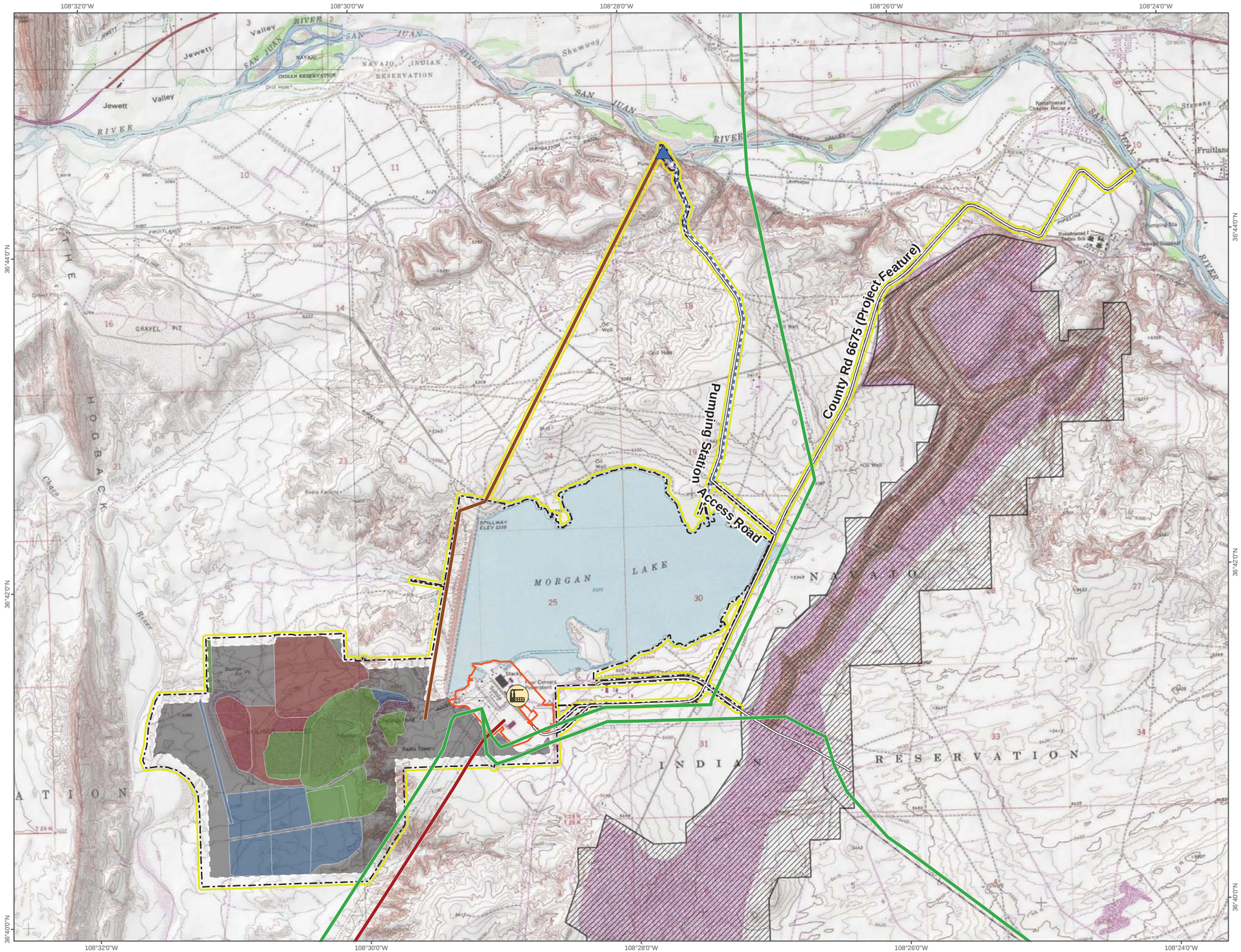

Figure 4.4-2

Area of Potential Effect
Four Corners Power Plant

PROJECT FACILITIES

- Four Corners Power Plant
- Pumping Station
- Pumping Station Pipeline

PROJECT BOUNDARIES

- Four Corners Lease Boundary
- Navajo Mine Lease Area
- Power Plant Fence Line

TRANSMISSION LINES

- 345kV
- 500kV
- 69kV - Pumping Station to Power Plant

AREAS OF POTENTIAL EFFECT

- Area of Potential Effect

ASH FACILITIES

- Existing Active Facility
- Existing Inactive Facility
- Future Facility
- Future Ash Disturbance Area

N

0 0.25 0.5 1
Scale in Miles

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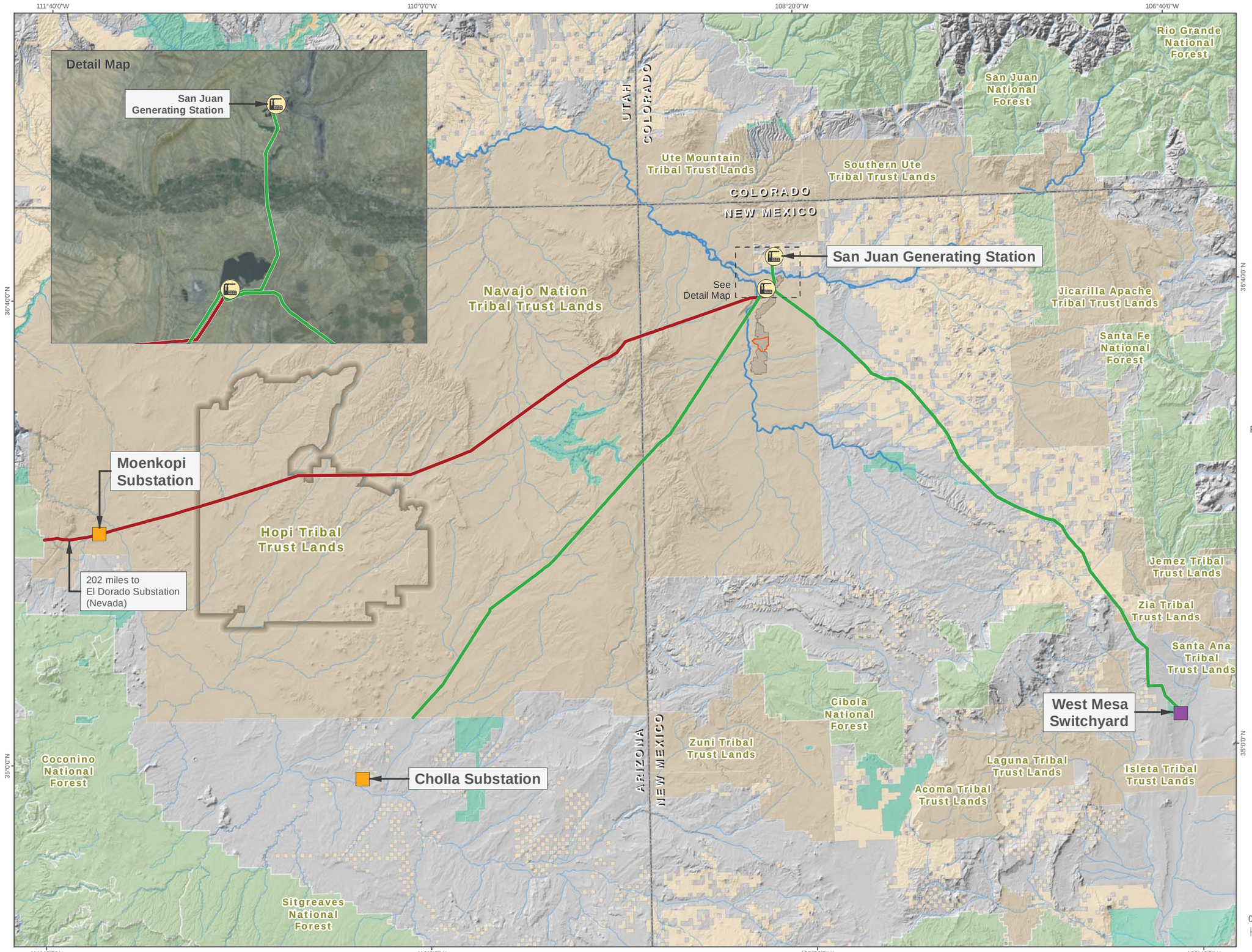

Figure 4.4-3

Area of Potential Effect
Transmission Lines

PROJECT FACILITIES

- Four Corners Power Plant
- Substation
- Switchyard

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Proposed Pinabete Mine Permit Boundary

TRANSMISSION LINES

- 345kV
- 500kV

FEDERAL MANAGING GROUP

- Forest Service
- Bureau of Land Management
- Fish and Wildlife Service
- National Park Service
- Bureau of Indian Affairs
- Bureau of Reclamation

N

0 12.5 25 50
Scale in Miles

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By the end of the Pueblo III phase, the Anasazi abandoned the San Juan Basin (Meininger and Baker 2006), leaving the area sparsely inhabited until Athabascan groups entered the region around AD 1500. However, Navajo traditions recognize their continuous occupation of the San Juan Basin through a cultural affiliation with the Anasazi.

The Navajo are descendants of the Athabascan populations, who initially practiced hunting, gathering, trading and some agriculture in the San Juan Basin during the Dinétah phase (AD 1450–1630). The Navajo continued to practice a mixed economy in the Gobernador phase (AD 1630–1775), utilizing European trade items and adopting some European lifeways, such as animal husbandry (Meininger and Baker 2006). The Navajo also constructed masonry pueblitos during the Dinétah phase. During the Cabezon phase (AD 1775–1863), the Navajo territory expanded, and the practice of sheepherding increased, which resulted in an increase in raiding. The end of the Cabezon phase coincided with the advent of the Carson campaign against the Navajo Nation, which was in response to raids in northern New Mexico (Meininger and Baker 2006). In 1864, the US Army defeated the Navajo and, subsequently, relocated the majority to Bosque Redondo near Fort Sumner; however, some Navajo in southern Utah and in areas near the Grand Canyon and Tuba City, Arizona, managed to avoid the relocation efforts. The eventual signing of the Treaty of 1868 allowed the Navajo at Bosque Redondo to return to their territory in the newly established Navajo Reservation.

The Treaty of 1868 also set forth requirements for the schooling of Navajo children and the establishment of a livestock economy through stock supplied by the Federal Government. This treaty formed the foundation for subsistence herding (primarily sheep) on the reservation, with grasslands to the east of reservation boundaries in the San Juan Basin serving as popular grazing locations. The boundaries of the Navajo Reservation were extended 15 times and, by 1934, it was the largest reservation in the US.

Beginning in 1876, Euro-American settlers arrived in the San Juan River area. Settlement increased with the arrival of the railroad in Gallup in 1880. By 1905, additional railroad connections were created between Durango and Farmington. Trading posts were established that encouraged interaction between Euro-Americans and the Navajo (Baker 2013). Trading posts in Shiprock, Waterflow, and Fruitland became centers for the exchange of mass-produced food and other European goods with wool, weaving, and livestock from the reservation (Unruh and Vierra 2012). The establishment of trading posts and the new transportation infrastructure contributed to a transition from the subsistence-based herding economy to a commercial-herding economy. Increases in the price of wool further encouraged this shift to commercial-based herding and the use of seasonal laborers. Farming also became more prevalent in this period (Baker 2013).

Changes to the Navajo community occurred as a result of the Taylor Grazing Act of 1934. This act mandated a livestock reduction program intended to decrease overgrazing, erosion, and arroyo downcutting. Permitting and fencing reduced the availability of nearby public lands. Livestock herds on the reservation were reduced by 50 percent. With the loss of commercial herding, the community became increasingly dependent on wage labor and cash income (Baker 2013).

Additional change of the traditional patterns of life resulted from modifications in the use of the San Juan River in the 20th century. Between 1933 and 1948, the Federal Government created the Fruitland Irrigation Project on the San Juan River, leading to increased agricultural use of the area. This increase continued in the 1970s and 1980s when the Federal Government constructed the Navajo Irrigation Project. The change in access to water led to the establishment of an industrial farm and the Navajo Agricultural Products Industries (Unruh and Vierra 2012).

Also speeding the process of change was the increasing extraction of the mineral wealth of the region. Initial explorations in oil and gas occurred in the late 1920s around Farmington, but production was low until the 1950s when use of oil and gas expanded throughout the US. In 1960, the FCPP's establishment and the use of coal from the Navajo Mine made the area a center for electric power generation for the entire region (Unruh and Vierra 2012).

4.4.2.2 Archaeological Resources

Cultural resources studies have been completed for archaeological resources within the APE, including the Pinabete Permit Area of the Navajo Mine, the FCPP, and the transmission lines. The studies conducted and resources identified within each area are discussed below. There are additional archaeological resources that have been identified outside of the APE listed in Appendix B. These resources were identified as part of a screening level analysis of alternatives and are not included in the discussion below.

Navajo Mine

Cultural resources surveys and inventories conducted for the mine portion of the APE within the last ten years include a Class I (literature search) cultural resources review (Meininger and Baker 2006), one Class II (pedestrian relocation survey) inventory (Meininger and Wharton 2004), one Class III (100% pedestrian survey) inventory (Burleson 2006), and one Class II and III inventory (Meininger and Wharton 2009). The majority of the APE for the mine area has been surveyed, including those portions of Navajo Mine Areas III and IV North where future mining-related disturbance is anticipated, the Pinabete Permit Area (portions of Mine Areas IV North and IV South), and the Burnham Road realignment. To date, 106 archaeological sites have been identified during cultural resources inventories for the Navajo Mine. Additionally, 54 isolated artifact occurrences were identified during the inventories.

The Class II inventory conducted in Area IV North identified 73 archaeological sites, 57 of which were previously recorded (Meininger and Wharton 2004). Burleson et al. (2006) developed a treatment plan for 47 sites in Area IV North. OSMRE in conjunction with the Navajo Nation THPO have determined 52 of the sites to be eligible for listing in the NRHP.

The Class II and III inventories conducted in both Area IV South and Area V identified 33 archaeological sites in Area IV South, 25 of which were previously recorded (Meininger and Wharton 2009). OSMRE and Navajo Nation THPO have determined 29 sites eligible for listing in the NRHP. In addition, 54 isolated occurrences were identified in the total survey area (Areas IV South and V), which are not eligible for the NRHP.

The Class III inventory for the Burnham Road realignment identified four archaeological sites, three of which were previously recorded (Burleson 2006). OSMRE and Navajo Nation THPO have determined all four sites eligible for listing in the NRHP. Additionally, 13 isolated occurrences were identified, none of which are eligible for the NRHP.

In addition to these recent surveys, an archaeological salvage project was conducted at the Navajo Mine (Sciscenti and Greminger 1962). The salvage project was sponsored by Utah Construction & Mining Company and identified 20 archaeological sites.

The results of the recent surveys performed, recommendations of eligibility by the Applicant, determinations of eligibility by OSMRE, and concurrence by the Navajo Nation THPO are presented in Appendix B.

Four Corners Power Plant

Two cultural resources inventories have been conducted for the FCPP portion of the APE within the last ten years (Jolly et al. 2005; Unruh and Vierra 2012). A Class III survey of 769.7 acres was performed for the proposed construction of a new ash disposal pond (Jolly et al. 2005). A second Class III survey was conducted for planned facilities, including ash disposal ponds, which overlapped portions of the previous survey area (Unruh and Vierra 2012). Additional surveys of the FCPP property and ancillary facilities (Morgan Lake, pumping plant area, 69-kV transmission line from FCPP to the pumping plant, the water pipeline from FCPP to San Juan River, the road adjacent to the pipeline, and the FCPP access road from the plant to the San Juan River) were conducted by APS in late 2013. Results of such surveys will be incorporated herein upon completion. In addition to these recent surveys, an archaeological salvage

project was conducted at the FCPP in 1961 (Sciscenti and Greminger 1962). The salvage project was sponsored by APS and identified 49 archaeological sites.

A total of 20 archaeological resources and 22 isolated occurrences have been identified in the APE. A total of 14 archaeological sites were identified during the Class III survey for the new DFADAs, 13 of which were previously recorded (Jolly et al. 2005, 2006). In consultation with the Navajo Nation Historic Preservation Department (NNHPD), Jolly and colleagues recommended data testing (Phase I data recovery) at one site within the APE (Jolly et al. 2006). This site was tested in 2007 and was recommended cleared for the ash disposal area (Tactikos 2007; Tactikos et al. 2008).

The second inventory for the planned facilities and DFADAs identified 14 sites, 13 of which were previously recorded (Unruh and Vierra 2012). Additionally, 22 isolated occurrences were identified (Unruh and Vierra 2012). OSMRE determinations of eligibility and Project effects are pending for the archaeological sites. The isolated occurrences are not eligible for listing in the NRHP.

The results of the recent surveys performed, recommendations of eligibility by the Applicant, determinations of eligibility by OSMRE, and concurrence by the Navajo Nation THPO will be provided in Appendix B upon completion.

Transmission Lines

Eight cultural resources inventories have been conducted within the APE for the transmission lines within the last ten years. To date, 309 archaeological resources have been identified during the cultural resources inventories for the transmission lines. A total of 793 isolated occurrences were also identified during transmission line surveys; of these, 11 were determined to be isolated features.

A total of 122 archaeological resources were identified in the survey for the APS 500-kV transmission line to the Moenkopi Substation, 7 of which were previously recorded (Laurila, Bild, and Davis. 2011). Additionally, 235 isolated occurrences were identified. The survey conducted for the transmission line on Hopi Tribal Lands identified 29 archaeological sites, of which one was previously recorded (Laurila, Bild, and Davis 2011). An additional 11 isolated features and 76 isolated occurrences were recorded on Hopi Tribal Lands. OSMRE determinations of eligibility and Project effects are pending for the archaeological sites. The isolated occurrences are not eligible for listing in the NRHP. Eight of the isolated features are not eligible for the NRHP; however, three may be eligible pending OSMRE review.

A total of 79 sites were recorded during the survey for the APS 345-kV transmission line to the Cholla Substation, of which 15 sites were previously recorded (North et al. 2011). In addition, 260 isolated occurrences were identified. OSMRE determinations of eligibility and Project effects are pending for the archaeological sites. The isolated occurrences are not eligible for listing in the NRHP.

Two archaeological sites were identified during the survey for the PNM Four Corners to San Juan transmission line on Navajo lands (Walley, Kerr, and Hroncich-Conner 2012). OSMRE determinations of eligibility and Project effects are pending for the archaeological sites. Two previously recorded archaeological sites were identified during the survey for the PNM Four Corners to San Juan transmission line on BLM, state, and private lands (Walley and Hroncich-Conner 2012). OSMRE determinations of eligibility and Project effects are pending for the archaeological sites. Two isolated occurrences were also identified but are not eligible for listing in the NHRP.

A total of 28 archaeological sites were identified during the survey for the PNM Four Corners to West Mesa transmission line on Navajo lands (Walley et al. 2012). OSMRE determinations of eligibility and Project effects are pending for the archaeological sites. Additionally, 89 isolated occurrences were identified, none of which are eligible for listing in the NRHP. Twenty-one archaeological sites were identified during the survey for the PNM Four Corners to West Mesa transmission line on BLM, state, Zia Pueblo, and private lands (Walley, Hroncich-Conner, and Kerr 2012). Five of these sites were previously recorded. Additionally, 90 isolated occurrences were identified. OSMRE determinations of eligibility and

Project effects are pending for the archaeological sites. The isolated occurrences are not eligible for listing in the NRHP.

A total of 26 archaeological sites were identified during the survey for the PNM 345-kV transmission line between the Rio Puerco and West Mesa switchyards (Goar and Kerr 2013). Twenty of these sites were previously recorded. Additionally, 41 isolated occurrences were identified. OSMRE determinations of eligibility and Project effects are pending for the archaeological sites. The isolated occurrences are not eligible for listing in the NRHP.

In addition to these recent surveys, an archaeological salvage project was conducted for the APS 345-kV power line in the 1960s (Olson 1971). The salvage project identified 29 archaeological sites.

The results of the recent surveys performed, recommendations of eligibility by the Applicant, determinations of eligibility by OSMRE, and concurrence by the Navajo Nation THPO, Hopi Cultural Preservation Office (CPO), and applicable SHPOs are presented in Appendix B.

4.4.2.3 Historic Resources

This section identifies historic structures within the Project APE, including in-use areas (IUAs). IUAs are cultural resources that are currently in use, such as habitations, and do not receive site numbers per the NNHPD; however, determination of their eligibility for inclusion in the NRHP is required. Investigations for historic structures including the FCPP, transmission lines, and switch stations are ongoing.

Navajo Mine

Five IUAs were recorded in Areas IV North and IV South during cultural resources inventories (Meininger and Wharton 2004, 2009). Two of the IUAs are located in Area IV North and are both recommended as eligible for the NRHP under Criterion D. Three IUAs are located in Area IV South. All three IUAs were recommended as eligible for the NRHP under Criterion D. OSMRE determinations of eligibility are pending for the IUAs.

Four Corners Power Plant

APS completed research and documentation of the historic impact of the entire FCPP in 2013, through a systematic pedestrian survey of the buildings, structures, and landscape features associated with Units 1-3 of the FCPP. The surveys were conducted to gather information to be used in determining eligibility for listing in the NRHP. The FCPP contains multiple structures which are older than 50 years that are slated to be removed from service. Morgan Lake Dam and the River Pump Station and associated facilities were included in the survey, even though they will not be removed from service in the near future.

Transmission Lines

Two IUAs were recorded during cultural resources inventories for the 345-KV transmission line (Walley, Kerr, and Hroncich-Conner 2012). Both of the IUAs are water conveyance features. OSMRE determinations of eligibility are pending for the IUAs.

4.4.2.4 Properties of Religious and Cultural Significance (including TCPs)

This section identifies known and potential properties of religious and cultural significance that are in and adjacent to the APE, including burials. TCP studies have been completed for archaeological resources within the APE, including the Pinabete Permit Area, the FCPP, and the transmission lines. The studies conducted and resources identified within each area are discussed below.

TCPs are listed by area in Appendix B. As the results of the studies are considered confidential, the specific locations of the TCPs are not included. Details of the TCP locations are described in confidential reports. OSMRE is conducting ongoing consultation with the Navajo Nation and Hopi Tribe regarding the location, NRHP eligibility, and Project effects on properties of religious and cultural significance (including TCPs).

The Hopi have identified a number of areas related to plant resources, animal resources, stone and mineral resources, view sheds, water resources, shrines, ancestral sites, and named places within the APE. These areas have not been specifically defined. There are additional studies that are being completed for the 500-kV line within the Hopi reservation, the results of which will be incorporated within the FEIS.

Navajo Mine

Studies identified a total of 15 TCPs in the Project APE, including 1 TCP in Area III, 8 TCPs in and around Area IV North, 4 TCPs in Area IV South, 1 TCP in Burnham Road, and 1 TCP in an unspecified location.

In 2006, the Navajo National Archaeological Department conducted studies to identify culturally sensitive areas, TCPs, and burials through ethnographic research in Areas IV and V. This study identified seven TCPs in the boundary or in the buffer of Area IV North and South. Another study identified an additional two TCPs in Area IV North (Kelley et al. 2007). As part of the 2006 cultural resources Class III survey, one TCP was identified in the APE for the Burnham Access Road (Burleson 2006). This TCP was not evaluated for NRHP eligibility (Burleson 2006).

Four Corners Power Plant

In 2012, a cultural resource investigation was performed within and around the FCPP. This study identified six TCPs in the Project Area and one outside of the APE (Kelley and Francis 2012).

APS prepared a summary of previous studies at the FCPP for cultural resources, including TCPs. This study notes that the Jolly et al. (Jolly et al. 2005, 2006) survey identified 2 potential TCPs and 3 areas of concern in the proposed DFADAs.

Transmission Lines

According to the 2012 report, the NNHPD TCP Office in Window Rock, Arizona, identified one TCP within the transmission line ROW for — the FCPP to Cholla transmission line. The report indicates that the TCP was not evaluated for NRHP eligibility (AECOM 2012a). According to this report and the Laurila et al. (2011) report, the NNHPD TCP Office identified six TCPs within the transmission line corridor for the FCPP to Moenkopi project corridor. However, the report states that it was not possible to conclude if these six TCPS are within the APE (AECOM 2012a). Currently additional survey work has been conducted within the APE for the expansion of the ROW within the Hopi Reservation.

4.4.3 Changes to Cultural Resources Affected Environment Post-2014

Two completed federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions; and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared in the following Section. Neither of these completed federal actions would change the affected environment for Cultural Resources.

4.4.4 Environmental Consequences

The impact analysis examined likely effects of the proposed Project on historic properties under NHPA. As noted previously in Section 4.4.1, if a project affects a “historic property” within the APE, to comply with NHPA Section 106, the Lead Federal Agency must assess whether the effect is adverse. This assessment is accomplished in consultation with the SHPO by applying the Criteria of Adverse Effect as stated in 36 CFR 800.5(a)(1). The Criteria of Adverse Effect are applied when a project has the potential to:

> *“… [A]lter directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association.”*

Examples of adverse effects include physical destruction of a resource; alterations to a property that are not consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties; removal from its original location; change in the character of the property's use or setting; introduction of visual, atmospheric, or audible elements that diminish historic integrity; neglect; and the transfer, lease, or sale of property out of Federal ownership (36 CFR 800.5(a)2). Adverse effects can also include reasonably foreseeable effects that may occur later in time, at greater distances, or that may be cumulative.

The criteria listed below were considered when evaluating the types of short-term and long-term effects the Project alternatives could have on the historic properties within the APE.

- *Demolition or Alteration of a Property:* Demolition or extensive alteration of all or part of the resource.
- *Isolation/Alteration of Surrounding Environment:* Temporary or permanent restrictions of access to a historic resource or a change in the property's setting.
- *Traffic Congestion/Parking/Access:* Congestion arising from changes in traffic patterns, parking, and access to historic resources.
- *Visual:* Removal of historical resources adjacent to a historic property or the introduction of modern construction that is out of character with or alters the resource's historical setting.
- *Introduction of New Construction:* Addition of new construction that is not compatible with the existing architecture of historic resources.
- *Structural Instability:* Introduction of vibration during construction or operation that would cause damage to historic resources.
- *Noise:* Introduction of audible elements that are out of character with the historic resource and its established use such that its use may be altered or abandoned.
- *Change of Use:* The change in use of a historic resource brought about by construction- or operation-related activities that make it no longer physically or financially feasible or desirable to maintain the current use.
- *Vibration:* Construction or operation techniques that would create vibrations such that a resource may experience damages such as the loosening of paint or mortar, cracking of mortar or plaster, weakening of structural elements, or crumbling masonry.
- *Temporary Dirt/Unintended Damage:* Introduction of atmospheric elements that may alter or damage a historic resource.
- *Neglect:* Neglect of a resource resulting in its deterioration or demolition.

If a project's effects do not diminish the integrity of a historic property, then a "no adverse effect" finding is appropriate (36 CFR Part 800.5(b)). If an adverse effect is expected to occur as a result of a proposed project, the Lead Agency should consult further to resolve the adverse effect, pursuant to 36 CFR Part 800.5(2) and develop and evaluate alternatives or modifications to the undertaking that could avoid, minimize, or mitigate adverse effects on historic properties (36 CFR Part 800.6). In accordance with Section 106 of the NHPRA, and as outlined in 36 CFR Part 800.4(b)(2), OSMRE has elected to develop two Programmatic Agreements (PAs) for the proposed Project. One PA addresses effects on the historic properties within the Navajo Mine Lease Area, and the other PA covers historic properties within the APE for the transmission lines and FCPP. The PAs provide a process for compliance with NHPA pursuant to 36 CFR Part 800.14(b) in parallel with NEPA. Specifically, 36 CFP Part 800.4(b)(2), states that an agency may defer final identification and evaluation of historic properties if it is specifically provided for in a PA or documents used by an agency to comply with NEPA. Accordingly, the identification and evaluation of historic properties within the APE will be completed as specific aspects are refined pursuant to 36 CFR

Part 800.4(b)(1) and 36 CFR Part 800.4(c). The PAs provide procedures and responsibilities for the ongoing identification, evaluation, and mitigation of historic properties and procedures to minimize damage to historic properties. The PAs also include additional information including standards, guidelines, and unanticipated discovery protocols.

The following section provides an analysis of Project effects by Alternative (Table 4.4-2 – Table 4.4-4). Potential impacts were analyzed in three groups: archaeological resources, historic resources, and properties of religious and cultural significance (including TCPs).

Table 4.4-2 Summary of Potentially Affected Historic Properties by Alternative for the Navajo Mine

	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Archaeological Resources	84	86[1]	130[2]	84	0
Historic Resources	0	0	0	0	0
Traditional Cultural Properties	6	3	6	6	0

Includes NRHP eligible, listed, and/or NRHP unevaluated resources. Those historic properties located within Area III have been previously mitigated and therefore are not included.

[1] This number includes 53 archaeological resources identified outside of the APE within the disturbance area of Alternative B.

[2] This number includes 46 archaeological resources identified outside of the APE within the disturbance area of Alternative C.

Table 4.4-3 Summary of Potentially Affected Historic Properties by Alternative for the Four Corners Power Plant

	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Archaeological Resources	20	20	20	20	20
Historic Resources	Evaluation Ongoing	Evaluation Ongoing	Evaluation Ongoing	Evaluation Ongoing	Evaluation Ongoing
Traditional Cultural Properties	7	7	7	7	7

Includes NRHP eligible, listed, and/or NRHP unevaluated resources. Evaluations determining whether components of the FCPP qualify as Historic Resources is ongoing as part of the Section 106 process.

Table 4.4-4 Summary of Potentially Affected Historic Properties by Alternative for the Transmission Lines

	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Archaeological Resources[1]	2	2	2	2	2[4]
Historic Resources[2]	3	3	3	3	3[4]
Traditional Cultural Properties[3]	7	7	7	7	7[4]

Includes NRHP eligible, listed, and/or NRHP unevaluated resources.

[1] To date, there are 2 known archaeological resources that qualify as historic properties within the APE for the transmission lines. Additional studies are ongoing as part of the Section 106 process. If historic properties are determined to exist within the APE, the PA provides measures for mitigation of potential impacts.

[2] To date, there are 3 known historic resources that qualify as historic properties within the APE for the transmission lines. Additional studies are ongoing as part of the Section 106 process. If historic properties are determined to exist within the APE, the PA provides measures for mitigation of potential impacts.

[3] To date, there are 7 known TCPs that qualify as historic properties within the APE for the transmission lines. Additional studies are ongoing as part of the Section 106 process. If historic properties are determined to exist within the APE, the PA provides measures for mitigation of potential impacts.

[4] Under Alternative E, there could be project effects to historic properties due to the decommissioning and dismantling of the transmission lines. If transmission lines are left in place, there would be no effects to historic properties.

4.4.4.1 Alternative A – Proposed Action

Alternative A has the potential to affect 426 archaeological resources, historic resources, and TCPs that are eligible, listed, and/or unevaluated to the NRHP.

Archaeological Resources

Table 4.4-5 lists the archaeological historic properties present within the APE under Alternative A. This table will be updated once Project effects are finalized for the Project. Those historic properties located within Navajo Mine Area III have been previously mitigated and therefore are not included in Table 4.4-5.

Surveys will be completed during the permitting process that may identify additional historic properties. Determinations of Project effects on archaeological resources under Alternative A are still being completed through Section 106 consultation with tribes and agencies. There are seven currently unevaluated archaeological resources within the Navajo Mine, 20 within the FCPP, and 297 within the transmission lines that may be impacted under Alternative A (Appendix B). The PAs for the Project will provide procedures to minimize damage to historic properties and mitigation for historic properties that are evaluated.

Table 4.4-5 Archaeological Historic Properties Located within APE under Alternative A

Area	Site #	Description	Affiliation	Action Recommended
IV North	NM-H-28-2	Previously recorded artifact scatter	Anasazi	Avoidance; data recovery
IV North	NM-H-28-4	Previously recorded habitation/ field house	Anasazi	Avoidance; data recovery
IV North	NM-H-28-174	Previously recorded habitation and feature	Anasazi/ Navajo	Tested 2007; Data recovery conducted 2008; Avoidance
IV North	NM-H-29-102	Previously recorded temporary camp	Navajo	Tested 2007; Avoidance
IV North	NM-H-29-103	Previously recorded temporary camp	Navajo	Tested 2007; Avoidance
IV North	NM-H-29-105	Previously recorded habitation	Navajo	Tested 2007; Avoidance
IV North	NM-H-29-107	Previously recorded single residence habitation	Navajo	Tested 2007; Avoidance
IV North	NM-H-29-110	Previously recorded habitation	Anasazi	Avoidance; limited testing; site may be outside APE
IV North	NM-H-29-34	Previously recorded artifact scatter and multiresidence habitation complex	Anasazi/ Navajo	Tested 2007; Data recovery conducted 2007; Avoidance
IV North	NM-H-29-35	Previously recorded habitation	Navajo	Avoidance; data recovery
IV North	NM-H-29-80	Habitation	Anasazi	Tested 2007; Data recovery conducted 2007; Avoidance
IV North	NM-H-29-87	Sheepherders camp	Navajo	Tested 2007; Avoidance
IV North	NM-H-29-88	Habitation	Anasazi	Data recovery conducted 2008; Avoidance
IV North	NM-H-29-89	Mining test pits	Recent Anglo-Euro/ American Mining	Avoidance
IV North	NM-H-29-91	Previously recorded Wagon road and masonry wall support	Navajo	Avoidance
IV North	NM-H-29-92	Previously recorded features	Navajo	Avoidance
IV North	NM-H-29-93	Previously recorded coal mine shaft/ test pit	Unspecified historic	Avoidance
IV North	NM-H-29-96	Previously recorded habitation	Navajo	Tested 2007; Avoidance
IV North	NM-H-29-97	Previously recorded multiresidence habitation complex	Navajo	Avoidance; data recovery
IV North	NM-H-29-98	Previously recorded habitation	Navajo	Tested 2007; Avoidance

Area	Site #	Description	Affiliation	Action Recommended
IV North	NM-H-29-99	Previously recorded ceramic scatter and pastoral residence	Anasazi/ Navajo	Avoidance; data recovery
IV North	NM-H-36-23	Previously recorded temporary camp and burial	Unknown	Tested 2007; Avoidance
IV North	NM-H-36-24	Previously recorded artifact scatter with features	Archaic/ Anasazi	Data recovery conducted 2008; Avoidance
IV North	NM-H-36-25	Previously recorded lithic scatter	Archaic	Avoidance; data recovery
IV North	NM-H-36-26	Previously recorded artifact scatter and sheep herders camp	Anasazi/ Navajo	Data recovery conducted 2007; Avoidance
IV North	NM-H-36-28	Previously recorded fieldhouse and pastoral habitation	Anasazi/ Navajo	Data recovery conducted 2007; Avoidance
IV North	NM-H-36-29	Previously recorded buried pueblo	Anasazi	Tested 2007; Avoidance
IV North	NM-H-36-30	Previously recorded feature	Unknown	Tested 2007; Avoidance
IV North	NM-H-36-31	Previously recorded activity area and habitation	Anasazi/ Navajo	Data recovery conducted 2007; Avoidance
IV North	NM-H-36-35	Previously recorded activity area	Anasazi	Avoidance; testing/ additional ethnographic investigation; site may be outside APE
IV North	NM-H-36-76	Lithic scatter	Unknown	Tested 2007; Avoidance
IV North	NM-H-36-77	Temporary camp	Navajo	Tested 2007; Avoidance
IV North	NM-H-36-79	Petroglyph panel	Navajo	Avoidance
IV North	NM-H-36-80	Lithic scatter and cairn markers	Unknown/ Navajo	Tested 2007; Avoidance
IV North	NM-H-36-81	Previously recorded lithic scatter and sheepherders camp	Unknown/ Navajo	Tested 2007; Avoidance
IV North	NM-H-36-82	Previously recorded activity areas	Archaic	Avoidance; data recovery
IV North	NM-H-36-84	Previously recorded temporary camp	Navajo	Avoidance
IV North	NM-H-36-85	Previously recorded water control dams	Unknown recent	Avoidance
IV North	NM-H-36-86	Previously recorded lithic scatter and temporary camp	Unknown/ Navajo	Avoidance
IV North	NM-H-36-87	Previously recorded sheepherders camp	Navajo	Avoidance
IV North	NM-H-37-48	Previously recorded ceramic and lithic scatter	Anasazi	Tested 2007; Avoidance
IV North	NM-H-37-49	Previously recorded sheepherders camp	Navajo	Tested 2007; Avoidance

Area	Site #	Description	Affiliation	Action Recommended
IV North	NM-H-37-50	Previously recorded lithic scatter and habitation	Unknown/ Navajo	Tested 2007; Avoidance
IV North	NM-H-37-52	Previously recorded lithic scatter	Unknown	Tested 2007; Avoidance
Burnham Road	NM-H-28-175	Previously recorded artifact scatter with feature	Unknown	Avoidance
Burnham Road	NM-H-28-176	Previously recorded multiple habitation	Navajo	Tested 2007; Avoidance
Burnham Road	NM-H-28-177	Previously recorded artifact scatter with features	Archaic	Tested 2007; Avoidance
Burnham Road	NM-H-28-178	Artifact scatter with features	Unknown	Tested 2007; Avoidance
IV South	NM-H-36-134	Previously recorded single residence	Navajo	Avoidance
IV South	NM-H-36-135	Previously recorded multiple residences	Navajo	Avoidance
IV South	NM-H-36-136	Previously recorded single residence	Anasazi	Avoidance; testing
IV South	NM-H-36-137	Previously recorded artifact scatter and features	Navajo	Avoidance
IV South	NM-H-36-138	Previously recorded artifact scatter and features/ rock art panel	Unknown/ Navajo	Avoidance; testing
IV South	NM-H-36-139	Previously recorded artifact scatter and features	Archaic	Avoidance; testing
IV South	NM-H-36-140	Previously recorded single residence	Navajo	Avoidance
IV South	NM-H-36-141	Previously recorded artifact scatter	Anasazi	Avoidance; testing
IV South	NM-H-36-144	Previously recorded multiple residence	Navajo	Avoidance
IV South	NM-H-36-145	Previously recorded artifact scatter and features	Navajo	Avoidance
IV South	NM-H-36-146	Previously recorded lithic scatter/ artifact scatter and features	Unknown/ Navajo	Avoidance; testing
IV South	NM-H-36-147	Previously recorded ceremonial feature	Navajo	Avoidance
IV South	NM-H-36-149	Previously recorded artifact scatter and features	Anasazi	Avoidance; testing
IV South	NM-H-36-150	Previously recorded artifact scatter and single residence	Anasazi/ Navajo	Avoidance; testing
IV South	NM-H-36-151	Previously recorded residential complex	Navajo	Avoidance
IV South	NM-H-36-152	Previously recorded features	Navajo	Avoidance
IV South	NM-H-36-237	Artifact scatter	Unknown	Avoidance

Area	Site #	Description	Affiliation	Action Recommended
IV South	NM-H-36-244	Single residence and burials	Navajo	Avoidance
IV South	NM-H-36-247	Single residence/ recent trash dump	Navajo	Avoidance
IV South	NM-H-36-248	Rock art panels	Navajo	Avoidance
IV South	NM-H-36-254	Artifact scatter/ artifact scatter and features	Unknown/ Navajo	Avoidance
IV South	NM-H-36-260	Artifact scatter and features	Anasazi	Avoidance; testing
IV South	NM-H-36-50	Previously recorded multiple residence/ rock art panels	Anasazi/ Navajo	Avoidance; testing
IV South	NM-H-37-91	Previously recorded artifact scatter and rock artifact/ artifact scatter with features and rock art	Unknown/ Navajo	Avoidance
IV South	NM-H-37-92	Previously recorded artifact scatter and features	Archaic	Avoidance; testing
IV South	NM-H-37-93	Previously recorded artifact scatter and features	Navajo	Avoidance
IV South	NM-H-37-94	Previously recorded artifact scatter	Archaic	Avoidance; testing
IV South	NM-H-37-95	Previously recorded artifact scatter and features	Archaic	Avoidance; testing
IV South	NM-H-37-96	Previously recorded artifact scatter and features	Archaic	Avoidance; testing
PNM FC	LA 68213	Previously recorded Farmer's Mutual Ditch	Anglo	Avoidance; use of existing roads
PNM FC	LA 83965	Previously recorded Jewett Valley Ditch	Anglo/ Euro-American and Navajo	Avoidance; use of existing roads

Navajo Mine

Under Alternative A, a new permit area (Pinabete Permit Area) would be mined and reclaimed, as described in Section 3.2.1.1.

Development of the resource areas and the construction of the new roads and mine-support power lines could impact the 84 archaeological resources in Area IV North, Area IV South, and the Burnham Road realignment (Table 4.4-5). OSMRE is consulting with the Navajo Nation THPO for determinations of Project effects on these historic properties within the APE. Additionally, there are seven archaeological resources within the Navajo Mine for which determinations of eligibility are ongoing through consultation with the Navajo Nation THPO.

Four Corners Power Plant

Under Alternative A, the FCPP would continue to operate under a new lease agreement through 2041, as described in Section 3.2.1.2. The construction of the five additional DFADAs between the base of the escarpment and the Chaco River near the base of the Hogback geologic feature could impact archaeological resources.

OSMRE is consulting with the Navajo Nation THPO on determinations of eligibility for 20 resources and Project effects for historic properties within the APE.

Transmission Lines

The operations and maintenance of the transmission lines could impact 297 archaeological resources that are currently unevaluated for the NRHP and two archaeological resources that are determined eligible for the NRHP (Table 4.4-5).

OSMRE is consulting with the Navajo Nation THPO, Hopi CPO, New Mexico SHPO, Arizona SHPO, or federal land manager, as appropriate, on determinations of Project effects for historic properties within the APE.

Historic Resources

Determinations of Project effects on historic resources under Alternative A are being conducted through Section 106 consultation with tribes and agencies. Identification of historic resources is completed for the Navajo Mine and transmission lines but is ongoing for the FCPP (Appendix B). There are no historic properties in the Navajo Mine and three unevaluated historic resources in the transmission lines that may be impacted under Alternative A (Appendix B).

Navajo Mine

As all historic resources have been determined not eligible for listing in the NRHP, the operation of the mine and construction of new roads and mine-support power lines will have no impacts on this resource type (Appendix B).

Four Corners Power Plant

Under Alternative A, the FCPP would continue to operate under a new lease agreement through 2041, as described in Section 3.2.1.2. No ground-disturbing activities would occur at the FCPP and, therefore, would have no effect on historic resources. The construction of the five additional DFADAs between the base of the escarpment and the Chaco River near the base of the Hogback geologic feature could impact historic resources. As stated above, identification and evaluation of historic resources is ongoing as part of the Section 106 process. When the evaluation process is complete, OSMRE will consult with the Navajo Nation THPO regarding the effects on historic properties.

Transmission Lines

The operation and ongoing maintenance of the transmission lines under Alternative A could impact three historic resources that are currently unevaluated for the NRHP (Appendix B). The exact number of historic resources that could be impacted is currently undergoing evaluation. OSMRE is consulting with the Navajo Nation THPO, or New Mexico SHPO, as appropriate regarding Project effects on historic properties, in accordance with Section 106 of the NHPA.

Properties of Religious and Cultural Significance (including TCPs)

Consultation with the Navajo Nation THPO and Hopi CPO regarding the determinations of Project effects is ongoing for those TCPs located within the APE. Table 4.4-6 lists the TCP that has been determined eligible for the NRHP to date. In addition, there are five currently unevaluated TCPs within the Navajo Mine, seven unevaluated TCPs within the FCPP, and seven unevaluated TCPs within the transmission lines APE that may be impacted under Alternative A (Appendix B).

In addition to direct effects from construction activities and mine operation, indirect impacts to TCPs may occur from noise and visual intrusion that impede use of the historic property in the traditional manner. OSMRE recommends avoiding TCPs through reroutes and design. The avoidance and mitigation of TCPs

will be developed in coordination and consultation with the Navajo Nation THPO and Hopi CPO and included in the PAs.

Table 4.4-6 TCP Historic Properties Located within the APE under Alternative A

Area	TCP #	Description	Affiliation	Action Recommended
IV South	Bii' Diich' ii Dahazkani (Tangy Spring Mesa Breeze Mountain)	Eagle taking area	Navajo	Avoidance, No further work

Navajo Mine

Development of the lease areas and the construction of the new roads and mine-support power lines could impact six TCPs, five of which are unevaluated and one is determined eligible for the NRHP. Consultation with the Navajo Nation THPO is ongoing regarding determinations of eligibility and Project effects on TCPs.

Four Corners Power Plant

Seven TCPs have been identified in the FCPP, none of which have been evaluated for listing in the NRHP. The construction of the new additional DFADAs could adversely impact these TCPs. Consultation with the Navajo Nation THPO is ongoing regarding and the determination of eligibility and Project effects on the historic properties that are TCPs.

Transmission Lines

The operations and maintenance of the transmission lines could impact seven TCPs identified by the Navajo Nation, which are currently unevaluated for the NRHP (Appendix B). OSMRE is consulting with the Navajo Nation THPO on determinations of eligibility and Project effects for these TCPs.

In addition, the Hopi Tribe has identified TCPs within the APE through surveys completed in January 2014. OSMRE is consulting with the Hopi CPO on determinations of eligibility and project effects.

4.4.4.2 Alternative B – Navajo Mine Extension Project

Alternative B has the potential to affect 372 archaeological resources, historic resources, and TCPs that are eligible, listed, and/or unevaluated to the NRHP.

Archaeological Resources

Archaeological historic properties under Alternative B have been evaluated as a literature search. There are a total of 33 archaeological resources that are located within the APE. There are additional archaeological resources that have been identified outside of the APE as part of a screening level analysis of alternatives that are included in the discussion below.

Navajo Mine

Under Alternative B, BNCC would seek approval from OSM for an alternative mine plan for the Navajo Mine which would include a 5,412-acre SMCRA permit area and proposed mining disturbance in approximately 4,998 acres. Development of the lease areas and the construction of the new roads and mine-support power lines could impact 86 archaeological resources within Area IV South (33 resources within the APE and 53 resources outside of the APE).

Four Corners Power Plant

Under Alternative B, the FCPP would continue to operate under a new lease agreement through 2041, as described under Alternative A. The construction of the five additional DFADAs between the base of the

escarpment and the Chaco River near the base of the Hogback geologic feature could impact archaeological historic properties.

OSMRE is consulting with the Navajo Nation THPO on determinations of eligibility for 20 resources and Project effects for archaeological historic properties within the APE. Additional information to assist in the evaluation of Project effects for archaeological resources will be provided upon completion of FCPP surveys.

Transmission Lines

The operations and maintenance of the transmission lines could impact 297 archaeological resources that are unevaluated for the NRHP and two archaeological resources that are determined unevaluated for the NRHP (Table 4.4-5). Impacts would be the same as described for the Proposed Action.

OSMRE is consulting with the Navajo Nation THPO, Hopi CPO, New Mexico SHPO, Arizona SHPO, or federal land manager, as appropriate, on determinations of Project effects for historic properties within the APE.

Historic Resources

Determinations Project effects on historic resources under Alternative B are still being conducted through Section 106 consultation with tribes and agencies. Identification of historic resources is completed for the Navajo Mine and transmission lines but is ongoing for the FCPP (Appendix B). There are no historic resources in the Navajo Mine that are eligible for the NRHP but there are three unevaluated historic resources in the transmission lines that may be impacted under Alternative B (Appendix B).

Navajo Mine

As all historic resources have been determined not eligible for listing in the NRHP, the operation of the mine and construction of new features will have no impacts on this resource type under Alternative B (Appendix B).

Four Corners Power Plant

Under Alternative B, the FCPP would continue to operate under the same lease amendment as in the Proposed Action. No ground-disturbing activities would occur at the FCPP and, therefore, Alternative B would have no effects on historic properties at this location. However, the construction of the five additional DFADAs between the base of the escarpment and the Chaco River near the base of the Hogback geologic feature could impact historic properties. Identification and evaluation of historic properties is ongoing. When the evaluation process is complete, OSMRE will consult with the Navajo Nation THPO regarding the effects on historic properties.

Transmission Lines

The operation and ongoing maintenance of the transmission lines under Alternative B could impact three historic resources that are currently unevaluated for the NRHP (Appendix B). The exact number of historic properties that could be impacted is currently undergoing evaluation. OSMRE is consulting with the appropriate Navajo Nation THPO or New Mexico SHPO, as appropriate, regarding the effects on historic properties. Impacts would be the same as described for the Proposed Action.

Traditional Cultural Properties

Consultation with the Navajo Nation THPO and Hopi CPO regarding the determinations of Project effects is ongoing for those TCPs located within the APE. There are three unevaluated TCPs within the Navajo Mine, seven unevaluated TCPs within the FCPP, and seven unevaluated TCPs within the transmission lines APE that may be impacted under Alternative B (Appendix B).

Impacts are similar to those described under Alternative A. OSMRE recommends avoiding TCPs through reroutes and design. The avoidance and mitigation of TCPs will be developed in coordination and consultation with the Navajo Nation THPO and Hopi CPO and included in the PAs.

Navajo Mine

Under Alternative B, development of the lease area in Area IV South and the construction of the new roads and power lines could impact the three unevaluated TCPs that have been identified in Area IV South. Consultation with the Navajo Nation THPO is ongoing regarding effects on historic properties.

Four Corners Power Plant

Seven TCPs have been identified in the FCPP, none of which have been evaluated for listing in the NRHP. The construction of the new additional DFADAs could adversely impact these TCPs. Consultation with the Navajo Nation THPO is ongoing regarding and the determination of eligibility and Project effects on the historic properties that are TCPs.

Transmission Line

The operations and maintenance of the transmission lines could impact seven unevaluated TCPs. (Appendix B). Impacts would be the same as those described for the Proposed Action. OSMRE is consulting with the Navajo Nation THPO on determinations of eligibility and Project effects for these TCPs.

In addition, the Hopi Tribe has identified TCPs within the APE through surveys completed in January 2014. OSMRE is consulting with the Hopi CPO on determinations of eligibility and project effects.

4.4.4.3 Alternative C – Alternative Pinabete Mine Plan

Alternative C has the potential to affect 426 archaeological resources, historic resources, and TCPs that are eligible, listed, and/or unevaluated to the NRHP.

Archaeological Resources

The Project effects on archaeological historic properties present within the APE under Alternative C are similar to those impacts under Alternative A. In total, there are 84 archaeological resources present in the APE. There are additional archaeological resources that have been identified outside of the APE as part of a screening level analysis of alternatives that are included in the discussion below.

Additional surveys are currently being completed that may identify additional historic properties and further surveys will be completed during the permitting process. Section 106 consultation with tribes and agencies regarding NRHP eligibility and project effects is ongoing.

Navajo Mine

Under Alternative C, the proposed mining activity would be located in both Area IV North and Area IV South, as described in Section 3.2.3.1.

Development of the lease areas under Alternative C and the construction of the new roads and power lines could impact 77 historic properties within the APE in Area IV North, Area IV South, and the Burnham Road realignment (Table 4.4-5). OSMRE is consulting with the Navajo Nation THPO on determinations of Project effects on these historic properties within the APE. Additionally, there are seven archaeological resources within the Navajo Mine for which determinations of eligibility are ongoing through consultation with the Navajo Nation THPO. In addition, mining activity could impacts 46 additional archaeological resources outside of the APE.

Four Corners Power Plant

Under Alternative C, the FCPP would continue to operate under a new lease agreement through 2041, as described under Alternative A. The construction of the five additional DFADAs between the base of the escarpment and the Chaco River near the base of the Hogback geologic feature could impact archaeological historic properties.

OSMRE is consulting with the Navajo Nation THPO on determinations of eligibility for 20 archaeological resources and Project effects for historic properties within the APE. Additional information to assist in the evaluation of Project effects for archaeological resources will be provided upon completion of FCPP surveys.

Transmission Lines

Impacts under Alternative C would be the same as described for the Proposed Action. The operations and maintenance of the transmission lines could impact 297 archaeological resources that are currently unevaluated for the NRHP and two archaeological resources that are determined eligible for the NRHP (Table 4.4-5).

OSMRE is consulting with the Navajo Nation THPO, Hopi CPO, New Mexico SHPO, Arizona SHPO, or federal land manager, as appropriate, on determinations of Project effects for historic properties within the APE.

Historic Resources

Determinations of Project effects on historic resources under Alternative C are still being conducted through Section 106 consultation with tribes and agencies. Identification of historic resources is completed for the Navajo Mine and transmission lines but is ongoing for the FCPP (Appendix B). There are no historic period resources that are eligible for the NRHP in the Navajo Mine but there are three unevaluated historic resources within the area of the transmission lines that could be impacted under Alternative C (Appendix B).

Navajo Mine

As all historic resources have been determined not eligible for listing in the NRHP, the operation of the mine and construction of new roads and mine-support power lines will have no impacts on this resource type under Alternative C (Appendix B).

Four Corners Power Plant

Under Alternative C, the FCPP would continue to operate under the same lease amendment as in the Proposed Action. No ground-disturbing activities would occur at the FCPP and, therefore, would have no effect on historic properties. However, the construction of the five additional DFADAs between the base of the escarpment and the Chaco River near the base of the Hogback geologic feature could impact historic resources. Identification and evaluation of 20 historic resources is ongoing (Appendix B). When the evaluation process is complete, OSMRE will consult with the Navajo Nation THPO regarding the effects on historic properties.

Transmission Lines

The operation and ongoing maintenance of the transmission lines under Alternative C could impact three historic resources that are currently unevaluated for the NRHP (Appendix B).The exact number of historic properties that could be impacted is under evaluation. OSMRE is consulting with the Navajo Nation THPO or New Mexico SHPO, as appropriate, regarding the effects on historic properties. Impacts would be the same as those described for the Proposed Action.

Traditional Cultural Properties

Consultation with the Navajo Nation THPO and Hopi CPO regarding the determinations of Project effects is ongoing for those TCPs located within the APE. There are six currently unevaluated TCPs within the Navajo Mine, seven unevaluated TCPs within the FCPP, and seven unevaluated TCPs within the transmission lines APE that may be impacted under Alternative C (Appendix B).

In addition to direct effects from construction activities and operation of the mine, indirect impacts may occur from noise and visual intrusion that impede use of the historic property in the traditional manner. OSMRE recommends avoiding TCPs through reroutes and design. When it is not possible to avoid the resource, then mitigation will be proposed and included in the PAs.

Navajo Mine

Under Alternative C, the proposed mining activity would be located in both Area IV North and Area IV South similar to Alternative A. Development of the lease areas and the construction of the new roads and power lines under Alternative C could impact six TCPs, five of which are unevaluated and one is determined eligible for the NRHP. Consultation with the Navajo Nation THPO is ongoing regarding Project effects on the TCPs.

Four Corners Power Plant

Seven TCPs have been identified in the FCPP, none of which have been evaluated for listing in the NRHP. The construction of the new additional DFADAs could adversely impact these TCPs. Consultation with the Navajo Nation THPO is ongoing regarding and the determination of eligibility and Project effects on TCPs that qualify as historic properties. Impacts would be the same as those described under the Proposed Action.

Transmission Lines

The operations and maintenance of the transmission lines could impact seven TCPs, which are currently unevaluated for the NRHP (Appendix B). Impacts would be the same as those described for the proposed action. Consultation with the Navajo Nation THPO is ongoing for determinations of eligibility and Project effects for these TCPs.

In addition, the Hopi Tribe has identified TCPs within the APE through surveys completed in January 2014. OSMRE is consulting with the Hopi CPO on determinations of eligibility and project effects.

4.4.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Alternative D has the potential to affect 426 archaeological resources, historic resources, and TCPs that are eligible, listed, and/or unevaluated to the NRHP.

Archaeological Resources

The Project effects on archaeological historic properties present within the APE under Alternative D are similar to those impacts under Alternative A, as listed in Table 4.4-5.

Determinations of Project effects on archaeological resources under Alternative D are still being conducted through Section 106 consultation with tribes and agencies. There are seven currently unevaluated archaeological resources within the Navajo Mine, 20 within the FCPP, and 297 within the transmission lines that may be impacted under Alternative A (Appendix B).

Additional surveys are currently being completed that may identify additional archaeological resources and further surveys will be completed during the permitting process. Section 106 consultation with tribes and agencies regarding NRHP eligibility and project effects is ongoing.

Navajo Mine

Under Alternative D, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under Alternative A. Impacts to archaeological historic properties present within the APE under Alternative D would be the same as those described under the Proposed Action (Table 4.4-5). Development of the lease areas and the construction of the new roads and mine-support power lines could impact the 77 historic properties in Area IV North, Area IV South, and the Burnham Road realignment. Additionally, there are seven archaeological resources within the Navajo Mine for which determinations of eligibility are ongoing through consultation with the Navajo Nation THPO.

OSMRE is consulting with the Navajo Nation THPO for determinations of Project effects on these historic properties within the APE.

Four Corners Power Plant

Under Alternative D, the FCPP would continue to operate under a new lease agreement through 2041, as described for the Proposed Action. However, under this alternative the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The 10% reduction in surface area of the DFADAs would reduce the potential for effects on historical properties within the APE from those described for the Proposed Action.

OSMRE is consulting with the Navajo Nation THPO on determinations of eligibility of 20 unevaluated archaeological resources within the APE. Additional information to assist in the evaluation of Project effects for archaeological resources will be provided upon completion of FCPP surveys. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

The operations and maintenance of the transmission lines could impact 297 archaeological resources that are currently unevaluated for the NRHP and two archaeological resources that are determined eligible for the NRHP (Table 4.4-5). Impacts would be the same as described for the Proposed Action.

OSMRE is consulting with the Navajo Nation THPO, Hopi CPO, New Mexico SHPO, Arizona SHPO, or federal land manager, as appropriate, on determinations of Project effects for historic properties within the APE.

Historic Resources

The Project effects on historic period resources that are eligible for the NRHP present within the APE under Alternative D would be the same as those described under the Proposed Action (Table 4.4-5). Determinations of Project effects on historic resources under Alternative D are still being conducted through Section 106 consultation with tribes and agencies. Identification of historic resources is completed for the Navajo Mine and transmission lines but is ongoing for the FCPP (Appendix B). There are no historic properties in the Navajo Mine but there are three unevaluated historic resources in the transmission lines that may be impacted under Alternative D (Appendix B).

Navajo Mine

As all historic resources have been determined not eligible for listing in the NRHP, the operation of the mine and construction of new roads and mine-support power lines will have no impacts on this resource type Under Alternative D (Appendix B).

Four Corners Power Plant

Under Alternative D, the FCPP would continue to operate under a new lease agreement through 2041, as described in the Proposed Action. The construction of the DFADAs between the base of the escarpment and the Chaco River near the base of the Hogback geologic feature could impact archaeological resources. Under this alternative the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The 10% reduction in surface area of the DFADAs would reduce the potential for effects on historical properties within the APE from those described for the Proposed Action. OSMRE is consulting with the Navajo Nation THPO on determinations of Project effects for 20 historic resources within the APE. Additional information to assist in the evaluation of cultural resources effects for archaeological resources will be provided upon completion of FCPP surveys.

Transmission Lines

The operation and ongoing maintenance of the transmission lines under Alternative D could impact three historic resources that are currently unevaluated for the NRHP (Appendix B). The exact number of historic properties that could be impacted is currently undergoing evaluation. OSMRE will consult with the Navajo Nation THPO or New Mexico SHPO, as appropriate, regarding the determinations of effects on historic properties. Impacts would be the same as those described for the Proposed Action.

Traditional Cultural Properties

Consultation with the Navajo Nation THPO and Hopi Tribe CPO regarding the determinations of Project effects is ongoing for those TCPs located within the APE. Table 4.4-6, under Alternative A, lists the Project effects on TCPs that have been determined eligible for the NRHP to date. In addition, there are five currently unevaluated TCPs within the Navajo Mine, seven unevaluated TCPs within the FCPP, and seven unevaluated TCPs within the transmission lines APE that may be impacted under Alternative D (Appendix B).

In addition to direct effects from construction activities and operation of the mine, indirect impacts may occur from noise and visual intrusion that impede use of the historic property in the traditional manner. OSMRE recommends avoiding TCPs through reroutes and design. When it is not possible to avoid the resource, mitigation will be proposed and included in the PAs.

Navajo Mine

Development of the lease areas and the construction of the new roads and mine-support power lines under Alternative D could impact six TCPs, five of which are unevaluated and one is determined eligible for the NRHP. The exact number of TCPs that could be impacted is currently undergoing evaluation. Impacts would be the same as described for the Proposed Action. Consultation with the Navajo Nation THPO is ongoing regarding Project locations and effects on TCPs.

Four Corners Power Plant

Seven TCPs have been identified in the FCPP, none of which have been evaluated for listing in the NRHP. The construction of the new additional DFADAs could adversely impact these TCPs. Under this alternative the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The 10% reduction in surface area of the DFADAs would reduce the potential for effects on TCPs within the APE than those described for the Proposed Action. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action. Consultation with the Navajo Nation THPO is ongoing regarding and the determination of eligibility and Project effects on the historic properties that are TCPs.

Transmission Lines

The operations and maintenance of the transmission lines could impact seven TCPs, which are currently unevaluated for the NRHP (Appendix B). Impacts would be the same as those described for the Proposed Action. Consultation with the Navajo Nation THPO is ongoing for determinations of eligibility and Project effects for these TCPs.

In addition, the Hopi Tribe has identified TCPs within the APE through surveys completed in January 2014. OSMRE is consulting with the Hopi CPO on determinations of eligibility and Project effects.

4.4.4.5 Alternative E – No Action Alternative

Alternative E has the potential to affect 426 archaeological resources, historic resources, and TCPs that are eligible, listed, and/or unevaluated to the NRHP.

Archaeological Resources

The Project effects on archaeological historic properties present within the APE under Alternative E would be less than those under Alternative A, as listed in Table 4.4-5.

Determinations of Project effects on archaeological resources under Alternative E are still being completed through Section 106 consultation with tribes and agencies. There are seven currently unevaluated archaeological resources within the Navajo Mine, 20 within the FCPP, and 297 within the transmission lines that may be impacted under Alternative A (Appendix B).

Additional surveys are currently being completed and further surveys will be completed during the permitting process that could identify additional historic properties. Section 106 consultation with tribes and agencies regarding NRHP eligibility and project effects is ongoing.

Navajo Mine

The closure of the Navajo Mine would have no effect on historic properties. Lack of mining in Areas IV North and portions of IV South within the APE would have no effect on historic properties.

Four Corners Power Plant

The decommissioning and dismantling of the FCPP could impact historic properties. OSMRE is consulting with the Navajo Nation THPO on determinations of Project effects for 20 unevaluated archaeological resources within the APE.

Additional information assist in the evaluation of Project effects for archaeological resources will be provided upon completion of FCPP surveys.

Transmission Lines

Under the No Action Alternative, the lines would either be decommissioned and dismantled or left in place to transmit power from another power source in the region. If the transmission lines are left in place, there would be no impacts to archaeological resources. If the transmission lines are dismantled, the ground disturbance activities could impact the currently known 297 archaeological resources that are currently unevaluated for the NRHP and two archaeological resources that are determined eligible for the NRHP (Table 4.4.-5). OSMRE is consulting with the Navajo Nation THPO, Hopi CPO, New Mexico SHPO, Arizona SHPO, or federal land manager, as appropriate, on determinations of Project effects for historic properties within the APE.

Historic Resources

The Project effects on historic resources historic properties present within the APE under Alternative E would be similar to those described under Alternative A (see Table 4.4-5). Determinations of Project effects on historic resources under Alternative E are still being conducted through Section 106

consultation with tribes and agencies. Identification of historic resources is completed for the Navajo Mine and transmission lines but is ongoing for the FCPP (Appendix B). There are no historic properties in the Navajo Mine and three unevaluated historic resources in the transmission lines that may be impacted under Alternative D (Appendix B).

Navajo Mine

As all historic resources have been determined not eligible for listing in the NRHP, the closure of the mine and reclamation activities will have no impacts on this resource type under Alternative E (Appendix B).

Four Corners Power Plant

The decommissioning and dismantling of the FCPP could impact historic properties. OSMRE is consulting with the Navajo Nation THPO on determinations of Project effects for 20 historic resources within the APE. Additional information to assist in the evaluation of cultural resources effects for archaeological resources will be provided upon completion of FCPP surveys.

Transmission Lines

Under the No Action Alternative, the lines would either be decommissioned and dismantled or left in place to transmit power from another power source in the region. If the transmission lines are left in place, there would be no impacts to archaeological resources. If the transmission lines are dismantled, the ground disturbance activities could impact three historic resources that are currently unevaluated for the NRHP (Appendix B). OSMRE is consulting with the Navajo Nation THPO or New Mexico SHPO, as appropriate, regarding determinations of eligibility and Project effects for historic properties within the APE.

Traditional Cultural Properties

Consultation with the Navajo Nation THPO and Hopi Tribe CPO regarding the determinations of Project effects is ongoing for those TCPs located within the APE. Table 4.4-6, under Alternative A, lists the Project effects on TCPs that have been determined eligible for the NRHP to date. In addition, there are five currently unevaluated TCPs within the Navajo Mine, seven unevaluated TCPs within the FCPP, and seven unevaluated TCPs within the transmission lines APE that may be impacted under Alternative E (Appendix B).

In addition to direct effects from reclamation activities of the mine, indirect impacts may occur from noise and visual intrusion that impede use of the historic property in the traditional manner. OSMRE recommends avoiding TCPs through reroutes and design. When it is not possible to avoid the resource, then mitigation will be proposed and included in the PAs.

Navajo Mine

The closure of the Navajo Mine would have no effect on historic properties. Lack of mining in Areas IV North and portions of IV South within the APE would have no effect on historic properties. Reclamation activities could impact six TCPs, five of which are unevaluated and one is determined eligible for the NRHP. OSMRE is consulting with the Navajo Nation THPO on determinations of eligibility and Project effects for historic properties within the APE.

Four Corners Power Plant

The decommissioning and dismantling of the FCPP could impact historic properties. OSMRE is consulting with the Navajo Nation THPO on determinations of Project effects for seven TCPs that have been identified in the FCPP, none of which have been evaluated for listing in the NRHP.

Transmission Lines

Under the No Action Alternative, the lines would either be decommissioned and dismantled or left in place to transmit power from another power source in the region. If the transmission lines are left in place, there would be no impacts to archaeological resources. If the transmission lines are dismantled, the ground disturbance activities could impact seven TCPs, which are currently unevaluated for the NRHP. OSMRE is consulting with the Navajo Nation THPO for determinations of eligibility and Project effects for these TCPs.

In addition, the Hopi Tribe has identified TCPs within the APE through surveys completed in January 2014. OSMRE is consulting with the Hopi CPO on determinations of eligibility and project effects.

4.4.5 Historic Properties Mitigation Measures

The Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects to cultural resources. Therefore, no additional mitigation is recommended. The Proposed Action would result in adverse effects to historic properties, as defined under the NHPA.

As part of the proposed Project, two PAs are being developed that define mitigation for adverse effects on historic properties. One PA will address effects on the historic properties within the Navajo Mine Lease Area, and the other PA will cover historic properties within the APE for the transmission lines and FCPP. When it is not possible to avoid the historic properties, then mitigation will be proposed and included in the appropriate PA.

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4.5 Water Resources/Hydrology

This section describes the surface water and groundwater systems in the ROI and impacts of the Proposed Action and alternative actions on those systems.

The ROI for groundwater resources is contained within the San Juan Basin, and is limited to the area within the Basin that could be affected by the actions taken at the Navajo Mine, proposed Pinabete Permit Area, and FCPP. The discussion describes the local groundwater hydrology and water quality of the San Juan Basin, including water balance and a description of the geologic formations and aquifers that comprise the basin. The discussion then provides data related to site-specific hydrology and water quality beneath the Navajo Mine and the FCPP. The subject transmission line ROWs are located over the San Juan Basin; however, since operation and maintenance activities associated with these lines would not involve deep excavation or use of water wells, detailed description of the groundwater hydrology or water quality beneath these lines is not provided.

The ROI for surface water is the entire San Juan Basin and includes all perennial, intermittent, and ephemeral streams and lakes that intersect the Pinabete Permit Area, FCPP Lease Area and associated existing transmission lines. The deposition of metals in emissions from power plants has the potential to adversely affect surface water quality. Since FCPP emissions have the potential to travel and deposit a substantial distance from the power plant site itself, the ROI also includes all surface water features within the defined deposition area for the power plant, which extends approximately 30 miles northwest and southeast and approximately 20 miles to the northeast - based on the prevailing wind direction and as described in Section 4.1, Air Quality. The affected environment includes a description of the surface water features, existing water quality conditions, and current water uses for the FCPP and Navajo Mine.

4.5.1 Regulatory Compliance Framework

4.5.1.1 Federal Regulations

Clean Water Act

Clean Water Act (CWA) Sections 401, 402, and 404 pertain to regulating impacts to waters of the US and are applicable to the Project. The following subsections discuss each of these CWA sections in detail.

Section 401

Section 401 requires that any applicant pursuing a Federal permit to conduct any activity that may result in a discharge of a pollutant must obtain a water quality certification (or waiver). The NNEPA issues water quality certifications for activities that occur within the Navajo Nation. Under the CWA, the NNEPA must issue or waive Section 401 water quality certification for the Project to be permitted under Section 404. The NNEPA also issues water quality certifications for Section 402 NPDES permits within the Navajo Nation. Water quality certification requires the evaluation of water quality considerations associated with dredging or placement of fill materials into waters of the US and imposes project-specific conditions on development. A Section 401 waiver establishes standard conditions that apply to any project that qualifies for a waiver. Prior to implementation of the Project, MMCo would be required to obtain Section 401 water quality certification or waiver from the NNEPA, if the USACE finds that a Section 404 permit is required.

Section 402

Section 402 establishes the NPDES permit program to control discharges of pollutants from point sources. The USEPA administers and enforces the NPDES program for the Navajo Nation. Section 402 addresses both construction and industrial activities, as described below.

Both the Navajo Mine and FCPP are covered under individual Industrial NPDES permits. APS is authorized to discharge effluent from FCPP to Morgan Lake and an unnamed wash tributary to the Chaco

River under NPDES permit NM0000019. NTEC is also authorized to discharge effluent from the coal storage facility to Morgan Lake under NPDES permit NN0028193, held by MMCo (MMCo's permit also authorizes discharges to the San Juan River and Chaco River). The NPDES permit sets limits on discharge from four discharge points at the FCPP: the cooling ponds, condenser cooling water, chemical metal cleaning water, and combined waste treatment pond. A review of monthly discharge reports submitted to EPA for 2012 indicated that no discharge was released from the chemical metal cleaning water or combined waste treatment pond during the year. Discharge from the cooling ponds and condenser cooling water met the permit limits. A review of EPA records also verified that BNCC and APS have no recorded NPDES permit violations (EPA 2013f). Table 4.5-1 provides a summary of the permit limits (EPA 2001; APS 2012b).

Table 4.5-1 FCPP NPDES Discharge Limits into Morgan Lake

	Cooling Ponds	**Condenser Cooling Ponds**	**Chem Metal Cleaning Water**	**Combined Waste Treatment Pond**
Temperature	32.2 moving average/ 36 daily max	N/A	N/A	N/A
pH	Min 6/ max 9	Min 6/ max 9	Min 6/max 9	Min 6/ max 9
Flow	14.7 million gallons daily max	Required monitoring/ no limit	Required monitoring/ no limit	Required monitoring/no limit
TDS	Required monitoring/no limit	N/A	N/A	N/A
TSS	N/A	N/A	N/A	30 mg/L weekly average/ 100 daily max
Chlorine	N/A	954 mg/L daily max		N/A
Oil and grease	N/A	N/A	15 mg/L weekly average/ 20 mg/L daily max	15 mg/L weekly average/ 20 mg/L daily max
Copper	N/A	N/A	1 mg/L weekly average/1 mg/L daily max	N/A
Iron	N/A	N/A	1 mg/L weekly average/1 mg/L daily max	N/A
Static 4 day chronic selenium	N/A	Required monitoring/no limit	N/A	N/A
Static 7 day chronic *Ceriodaphnia dubia*	N/A	Required monitoring/no limit	N/A	N/A
Static 7 day chronic *Pimphales promelas*	N/A	Required monitoring/no limit	N/A	N/A

Construction activities that disturb greater than 1 acre are regulated under the NPDES General Permit for Discharges of Storm Water Runoff Associated with Construction Activity (General Construction Permit), Coverage under the General Construction Permit requires the preparation of a Stormwater Pollution Prevention Plan (SWPPP) and Notice of Intent. The SWPPP includes pollution prevention measures (erosion and sediment control measures and measures to control non-stormwater discharges and hazardous spills), demonstration of compliance with all applicable local and regional erosion and sediment

control standards, identification of responsible parties, a detailed construction timeline, and a Best Management Practice (BMP) monitoring and maintenance schedule. The Notice of Intent includes site-specific information and the certification of compliance with the terms of the General Construction Permit.

Section 404

Section 404 regulates the discharge of dredged and fill materials into "waters of the US," which include oceans, bays, rivers, streams, lakes, ponds, and wetlands. Before any actions that may affect surface waters are implemented, a delineation of jurisdictional waters of the US must be completed, following USACE protocols, to determine whether a project area contains wetlands or other waters of the US that qualify for CWA protection. Such areas include:

- Areas within the ordinary high water mark of a stream, including non-perennial streams with a defined bed and bank and any stream channel that conveys natural runoff, even if it has been realigned; and
- Seasonal and perennial wetlands, including coastal wetlands.

Wetlands are defined for regulatory purposes as areas "inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3; 40 CFR 230.3).

Project proponents must obtain a permit from the USACE for discharges of dredged or fill material into jurisdictional waters of the US before proceeding with a proposed activity. Delineations of potential waters of the US have been conducted for both the Pinabete Permit Area and the proposed DFADA for the FCPP. These studies have been submitted to the USACE, which has determined that a permit is required for the Pinabete Permit Area, but not the FCPP. As per the regulation, the USACE will conduct an alternatives analysis and is required to permit the least environmentally damaging practicable alternative (USACE 2013). This alternatives analysis and permit review process is being conducted concurrent to the OSMRE's review of the Project. USACE's draft decision document is provided in Appendix C.

Other Federal Programs

Prior to MATS and CSAPR, the EPA sought to address interstate deposition-related pollution through CWA programs. Specifically, states typically establish water quality standards based on EPA-recommended criteria for surface waters. If surface water does not meet standards, CWA generally requires the state to set a Total Maximum Daily Load (TMDL) that identifies the maximum amount of pollutant that can enter the water and still meet standards. States are responsible for taking actions to ensure the TMDL is not exceeded. For point sources of pollution, such as an outfall from a sewage treatment plant, CWA permitted discharge limits are to be consistent with the TMDL. However, there is no similar regulatory requirement for nonpoint sources of pollution, such as atmospheric deposition over states or regions. States may take actions, such as providing technical or financial assistance to limit pollution from nonpoint sources, but legal obstacles arise when atmospheric deposition affecting state waters originates in emissions from another state (GAO 2013).

The EPA has issued numerous CAA regulations over the years (e.g., Acid Rain, CSAPR, MATS) that have reduced stationary- and mobile-source emissions of NO_X and SO_2, and more recently, mercury. In addition to reducing airborne contaminants, these rules also serve to limit the amount of pollution in surface waters. However, even with reduced emissions, NO_X, SO_2, and mercury continue to impact the nation's waters. One control strategy proposed by the EPA is to establish new secondary NAAQS (i.e., standards to protect public welfare) that target the effects of acid rain caused by NO_X (as NO_2) and SO_2 on water bodies. However, initial agency efforts were unsuccessful due to uncertainty in atmospheric modeling results and limitations in available data, which prevented determination of secondary NAAQS adequate to protect against the effects of acid rain. No alternative strategies have been identified;

however, the EPA recently announced an integrated nitrogen research effort that includes approaches to reducing atmospheric deposition of nitrogen compounds into waters already impaired by nutrient over-enrichment due to fertilizer runoff (GAO 2013).

4.5.1.2 State Regulations

New Mexico Standards for Interstate and Intrastate Surface Waters

Water quality standards for the San Juan Basin are set forth in the New Mexico Standards for Interstate and Intrastate Surface Waters (New Mexico Administrative Code 20.6.4). The administrative code specifies general standards that apply to all waters in the state at all times, unless otherwise noted. Specific water quality standards for pH and bacteria (fecal coliform), phosphorus and temperature have been set for the La Plata and Animas rivers.

4.5.1.3 Tribal Standards

The Navajo Nation has adopted the Navajo Nation Surface Water Quality Standards (NNEPA 2008), which establish various surface water use quality standards. These standards apply to all waters of the Navajo Nation, which include, but are not limited to, ephemeral, intermittent, and perennial streams, springs, wetlands, and any natural or man-made depressions or basins that impound water within the Navajo Nation's border. However, due to a covenant in the lease between APS and the Navajo Nation (Covenant 17: Operation of Power Plant; 1960 *et. seq*.), NNEPA water quality standards do not apply to the facilities or operations of the FCPP, only Navajo Mine. The standards associate specific uses within specific stream reaches, including Cottonwood Arroyo and Chaco River. Specific uses have not been identified for No Name Arroyo or Pinabete Arroyo. Designated uses for Cottonwood Arroyo and Chaco River include livestock water, aquatic and wildlife habitat, fish consumption, and secondary human contact standards. Applicable standards for the designated uses are provided in Table 4.5-2. The NNEPA has no water quality standard for total dissolved solids (TDS), sulfate, or fluoride. The NNEPA surface water quality standard for suspended sediment applies only to surface water that is at or near baseflow and does not apply to surface water during or soon after a precipitation event and is, therefore, not applicable to ephemeral flows (NNEPA 2008).

Table 4.5-2 Navajo Nation Water Quality Standards for Designated Uses (all in mg/L except pH)

Constituent	Livestock	Aquatic and Wildlife Habitat		Secondary Human Contact	Fish Consumption
		Acute	Chronic		
Aluminum		0.75	0.087		
Arsenic	0.2	0.34	0.15	0.28	0.08
Barium				98	
Boron	5			126	
Cadmium	0.05	0.00217	0.00026	0.47	0.008
Chromium III		0.00035	0.0201	1400	75
Chromium IV		0.016	0.011	2.8	0.15
Copper*	0.5	0.01445	0.00956	9.33	
Fluoride	2				
Lead*	0.1	0.07022	0.00274	0.015	
Mercury		0.0024	0.000001	0.28	0.00015
Nitrate	132			1493.33	

Constituent	Livestock	Aquatic and Wildlife Habitat		Secondary Human Contact	Fish Consumption
		Acute	Chronic		
pH	6.5-9.0	6.5-9.0	6.5-9.0		
Radium 226+228	30				
Selenium	0.05	0.033	0.002	4.67	0.67
Silver*		0.00367		0.00467	8
Sulfate	1,000				
TDS	3,000				
Zinc*	25	0.0214	0.0215	280	5.1

SOURCE: NNEPA 2008

Notes:

*Aquatic and Wildlife Criterion are hardness dependent and calculated for a hardness of 108 mg/L as calcium carbonate ($CaCO_3$), which is the median for Pinabete and Cottonwood arroyos.

mg/L = milligram(s) per liter

The Navajo Nation released Draft 2013 Surface Water Standards for public review in 2013. These standards are not yet adopted by the NNEPA and it is uncertain when they will go into effect. As of February 2014, the standards had been given preliminary approval by EPA and were under review by the Navajo Nation Resources Council. Primary changes in the 2010 standards include a revision of waterbodies addressed to include only those reaches within the jurisdiction of the Navajo Nation. In addition, a hardness-based standard for aluminum for aquatic and wildlife habitat was developed for waters with pH greater than 7. Water quality standards were also set for mercury and methylmercury with regard to chronic impacts to aquatic and wildlife habitat (NNEPA 2013).

4.5.2 Affected Environment Pre-2014

4.5.2.1 Groundwater

Local Groundwater Overview

The ROI is contained within the San Juan Basin (Figure 4.5-1). The specific geologic formation and characterization is described in Section 4.3, Geology. The primary source of groundwater used in the San Juan Basin is from wells constructed in the surficial valley-fill deposits of Quaternary age and sandstones of Tertiary, Cretaceous, Jurassic, and Triassic age (Stone et al. 1983). Groundwater found in sandstone formations is generally under confined conditions resulting in artesian flow. Artesian flows occur when subsurface sources contain groundwater under positive pressure, and if the overlying natural pressure is high enough, the groundwater may reach the ground surface.

Local groundwater resources considered in this EIS include any groundwater source that could be affected directly or indirectly by the proposed Project and alternatives. These resources include the unconsolidated alluvial sediment or alluvium in the valleys of the San Juan River, the Chaco River, and associated tributaries, including Cottonwood and Pinabete arroyos. Cottonwood and Pinabete arroyos originate in agricultural areas 10 to 12 miles east of the ROI and flow westward across the permit area and into the Chaco River. The Fruitland Formation underlies the alluvial sediment and is the formation that contains the coal resources for the mine. Since the coal seams are discontinuous throughout the formation, the Fruitland Formation is generally treated as a single aquifer unit (Billings and Associates, Inc. 1987). The Pictured Cliffs Sandstone lies beneath the Fruitland Formation.

The alluvium, Fruitland Formation, and Pictured Cliffs Sandstone units have been defined and characterized in a number of technical reports (Thorn 1993; Stone et al. 1983; Myers and Villanueva 1986). In addition, a number of groundwater and hydrogeology studies have been conducted at and around the ROI. BNCC, the New Mexico Bureau of Mines, and the United States Geological Survey (USGS) have conducted these studies, which have added to the understanding of the hydrogeologic setting and groundwater flow system of the area.

Almost all of the known wells within the ROI were completed within the alluvium formation, which is characterized by a loose, unconsolidated soils or sediments. No known water supply wells are completed in the Fruitland Formation or the Pictured Cliffs Sandstone within the ROI or adjacent areas. Four wells are believed to be completed in bedrock formations. These wells are not in the Navajo Mine Permit Area and are under no potential threat or impact from the proposed mining activities.

Groundwater use in the ROI is extremely limited, except from withdrawals in the San Juan River alluvium. A regional study identified no water supply wells constructed in the Fruitland Formation or underlying Pictured Cliffs Sandstone within several miles of the Navajo Mine Lease Area. This study also concluded that these geologic units are not important water supplying aquifers within the San Juan Basin because of low yields and high salinity. As such, the only groundwater in the area is derived from a few stock wells constructed in the alluvium formation in portions of the San Juan Basin (see Figure 4.5-1) (Stone et al. 1983). Each of these formations is described in more detail below.

Alluvium

An Alluvial Valley Floor is "the unconsolidated stream laid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities", and does not include upland areas. Under SMCRA, coal-mine related impacts to Alluvial Valley Floors are generally not permitted if the Alluvial Valley Floor is deemed significant to agricultural operations. Baseline characterization was performed for the Chaco River, No Name Wash, and Pinabete and Cottonwood arroyos to determine if the alluvium deposits are considered to be Alluvial Valley Floors, which are defined as unconsolidated stream-laid deposits where water availability is sufficient for flood irrigation. A 1981 study performed by the New Mexico Bureau of Mines and Mineral Resources and additional studies conducted by BNCC were used to form the Alluvial Valley Floors determination, taking into consideration both geomorphic/geologic and water availability criteria. Alluvial well drilling along Pinabete and Cottonwood arroyos revealed the occurrence of unconsolidated stream-laid deposits, meeting the geologic criteria for an Alluvial Valley Floors. However, water is inadequate to support agriculture; the arroyos are ephemeral and only flow in response to precipitation events, making flood irrigation implausible. As such, it was concluded that no Alluvial Valley Floors are within the permit area (BNCC 2012a).

Fruitland Formation

Groundwater availability in the Fruitland Formation is limited by its relatively low hydraulic conductivity (0.002 to 0.00013 feet per day), which means that water cannot move easily through pores or fractures in the formation, as well as low rates of recharge. Based on past mining of the Navajo Mine within the Fruitland Formation, the coals, overburden, and interburden do not yield much water during mining. The existing mine pits have generally remained dry except during precipitation events when surface flows are captured in the pits.

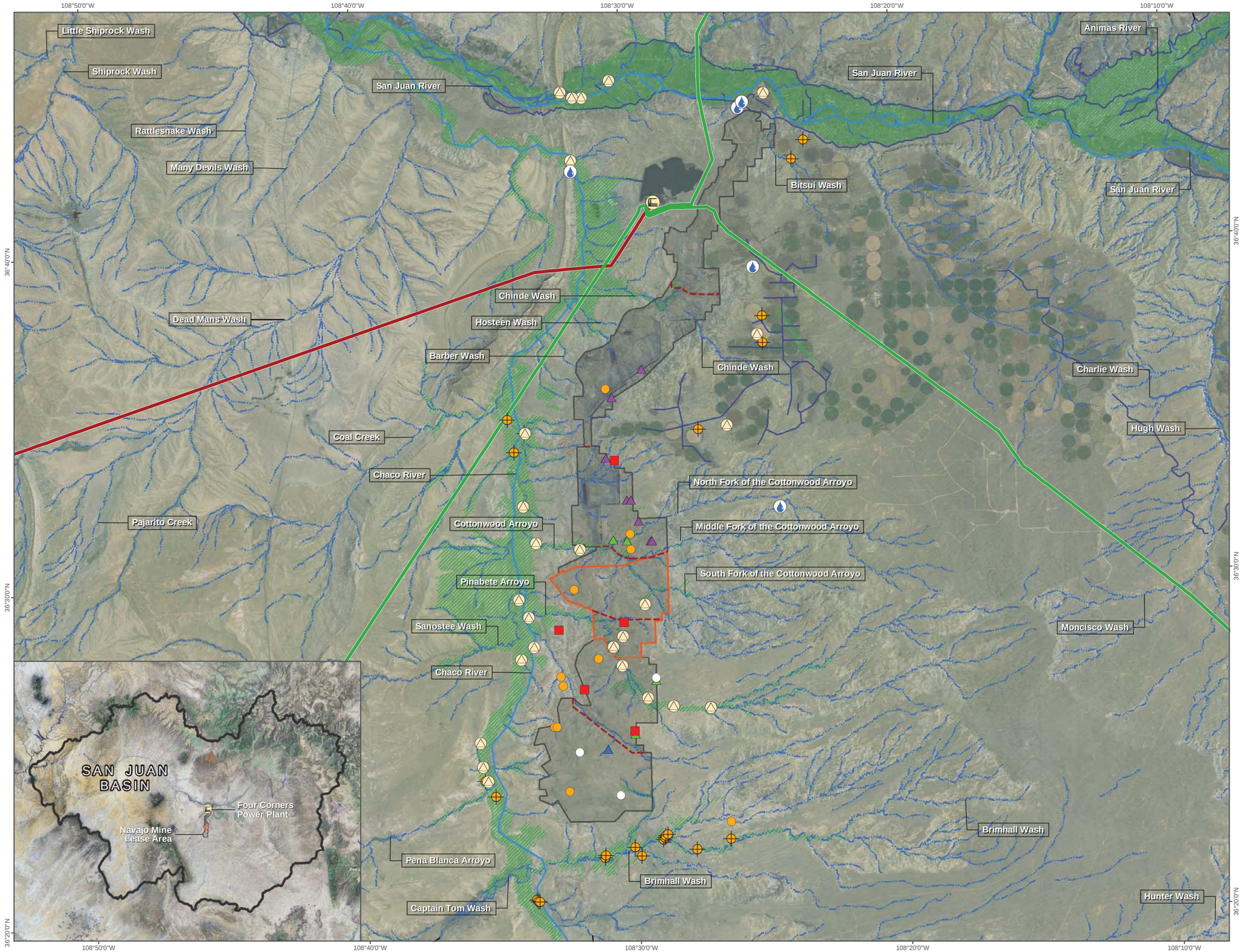

Figure 4.5-1

Water Wells and Springs

PROJECT FACILITIES

Four Corners Power Plant

PROJECT BOUNDARIES

Navajo Mine Lease Area

Navajo Mine Resource Areas

Proposed Pinabete Mine Permit Boundary

TRANSMISSION LINES

345kV

500kV

WATER FEATURES

Springs and Seeps [1]

Perennial Stream [2]

Intermittent Stream [2]

Intermittent Canal [2]

NAVAJO MINE MONITORING WELLS

Active Fruitland Well [3]

Active Pictured Cliffs Sandstone Well [3]

Active Piezometer [3]

Coal Seam Monitoring Well [3]

Abandoned Wells [3]

NAVAJO NATION MONITORING WELLS

Alluvial Wells [1]

Wells [1]

Unpermitted Well [1]

Data Sources:
[1] Navajo Nation Hydrographic Survey (2010)
[2] USGS National Hydrography Data
[3] Navajo Mine (2011)
[4] USGS Geology Maps: MF-1026, MF-1076, MF-1077, MF-1080, MF-1092, MF-1093, and I-1978

N

0 1.75 3.5 7

Scale in Miles

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Pictured Cliffs Sandstones

Although water is found throughout most of the Navajo Mine Lease Area in the Pictured Cliffs Sandstone, no known water supply wells are completed in this formation within or adjacent to the current Navajo Mine Permit Area or FCPP. One water supply well was completed near the Burnham Chapter house but was abandoned due to poor yield and poor water quality (BNCC 2012a). Water yields from monitoring wells in the vicinity are low (most are pumped dry within minutes; the yield of one well that can sustain a constant rate during a pump test was 0.4 gallon per minute). The Pictured Cliffs Sandstone is also a natural gas reservoir in the San Juan Basin. The Pictured Cliffs Sandstone cannot be considered a major aquifer and it is important primarily because it is the water-bearing horizon immediately underlying the coals in the Fruitland Formation (Stone et.al. 1983).

Springs and Seeps

No springs or seeps have been observed during hydrologic investigations conducted within and adjacent to the ROI (BNCC 2012a). However, springs and seeps do occur along upper Chinde Wash, above the Navajo Mine Lease Area boundary. These springs and seeps are due to Navajo Agricultural Products Industry (NAPI) irrigation return flows. Individual springs have not been verified but approximate locations are shown on Figure 4.5-1.

Groundwater Quantity

Extensive exploration drilling and data from the active Navajo Mine areas provides information about the groundwater hydrology for the ROI Monitoring wells and vibrating wire piezometers were installed in the alluvium of the Pinabete and No Name arroyos, in the Fruitland Formation and in the Pictured Cliffs Sandstone to characterize the baseline hydrogeology setting of Area IV South and Area V. Additional monitoring wells and piezometers were installed in various coal seams in Area IV South and Area V of the Navajo Mine Lease Area (Table 4.5-3). Figure 4.5-1 shows the location of all the monitoring wells and piezometers.

Table 4.5-3 Groundwater Monitoring Wells Installed in Area IV South and Area V Coal Seams

Coal Seam	Number of Monitoring Wells	Number of Piezometers
No. 2	0	4
No. 3	3	3
No. 6	0	1
No. 7	0	1
No. 8	1	1

Historical water level data collected during the mid-1970s are also available for six wells that were completed in the Pictured Cliffs Sandstone within or adjacent to the NTEC mining lease. These data, together with data from the Navajo Mine and other local sources, supplement the recent baseline groundwater information obtained for Area IV South and Area V of NTEC's mining lease and are summarized below (BNCC 2012a).

Pressure testing on monitoring wells within the Navajo Mine also provides the range of hydraulic conductivity and transmissivity of each formation. Hydraulic conductivity is the ability of water (or other fluids) to move through the soil or rock. Transmissivity is the rate at which groundwater flows through the formation. Only one well, completed in the No. 3 coal seam within Area IV South, has sufficient yield to allow for a constant rate-pumping test to determine hydraulic characteristics of the coal. The majority of

the wells are quickly pumped or bailed dry during conventional sampling. Table 4.5-4 below summarizes the results of BNCC's tests.

Table 4.5-4 Groundwater Aquifer Properties in the San Juan Basin

Formation		Transmissivity	Hydraulic Conductivity
Pinabete Arroyo alluvium		230.7 square foot per day and 75.6 square foot per day	51.3 feet per day and 11.1 foot/day
No Name alluvium			Insufficient yield to measure
Fruitland Formation	No. 3	0.01 to 0.001 square foot per day	0.002 to 0.00013 foot/day
	No. 2	No measurement provided	0.001 foot/day
	No. 4-6	No measurement provided	0.0014 foot/day
	No. 7	No measurement provided	0.003 foot/day
Pictured Cliffs Sandstone		0.12 to 0.79 square foot per day	0.032 foot/day to 0.0001 foot/day

Source: BNCC 2012a

Alluvium Aquifer

Baseline alluvium monitoring has been conducted within the Navajo Mine Lease Area at four alluvial monitoring wells in Cottonwood Arroyo, two alluvial monitoring wells in the Pinabete Arroyo alluvium, and two alluvial monitoring wells in the No Name Arroyo alluvium, and 44 at the FCPP in the vicinity of the existing ash disposal areas.

At the Navajo Mine, water levels for the Cottonwood and Pinabete alluvial monitoring wells were measured monthly. Water levels in the Pinabete Arroyo alluvium monitoring wells ranged from approximately 8-12 feet between 1998 and 2008, and elevation was approximately 5,340 and 5,420 feet above mean sea level in the two wells. Water levels in the Cottonwood Arroyo alluvium monitoring wells ranged from approximately 8-21 feet between 1974 and 2004, when water was detected. All wells were dry during tests from 2005 to 2008 (the most recent data provided).

A pump test was conducted at two wells to measure hydraulic conductivity in the Pinabete Arroyo alluvium (one well near Pinabete Arroyo in Area IV North and the other in Area IV South). The measured conductivity was 51.3 feet per day and 11.1 feet per day, respectively. These results are within the range expected for sand. Well yields from the alluvium are limited by a low saturated thickness (the vertical thickness in which pores are filled with water) of about five feet or less. Saturated thickness in the No Name alluvial wells was insufficient to permit a pumping test or slug test, which is a test used to determine hydraulic conductivity of a material. The hydraulic conductivity of the No Name alluvium is expected to be considerably lower than the Pinabete Arroyo alluvium due to the high percentage of fine-grained alluvial silts and clays, as evidenced by the well logs.

Beneath the ash disposal ponds at the FCPP, groundwater flows to the west, mainly in the weathered shale and in local alluvial channels that drain towards the Chaco River. APS began groundwater evaluations in 1971 and installed initial monitoring wells in 1974. Figure 4.5-2 shows the location of existing monitoring wells. Wells 1 through 23 were first installed and have the longest period of record. Wells 25 through 44 were installed after 2009. A review of monitoring data over the period of 1987 to 2012 indicates that groundwater levels in the vicinity of the ash disposal ponds has either remained relatively constant or slightly decreased over time in most wells (APS 2013). Tables 4.5-4 and 4.5-6 provides the physical characteristics of the monitoring wells installed at the FCPP.

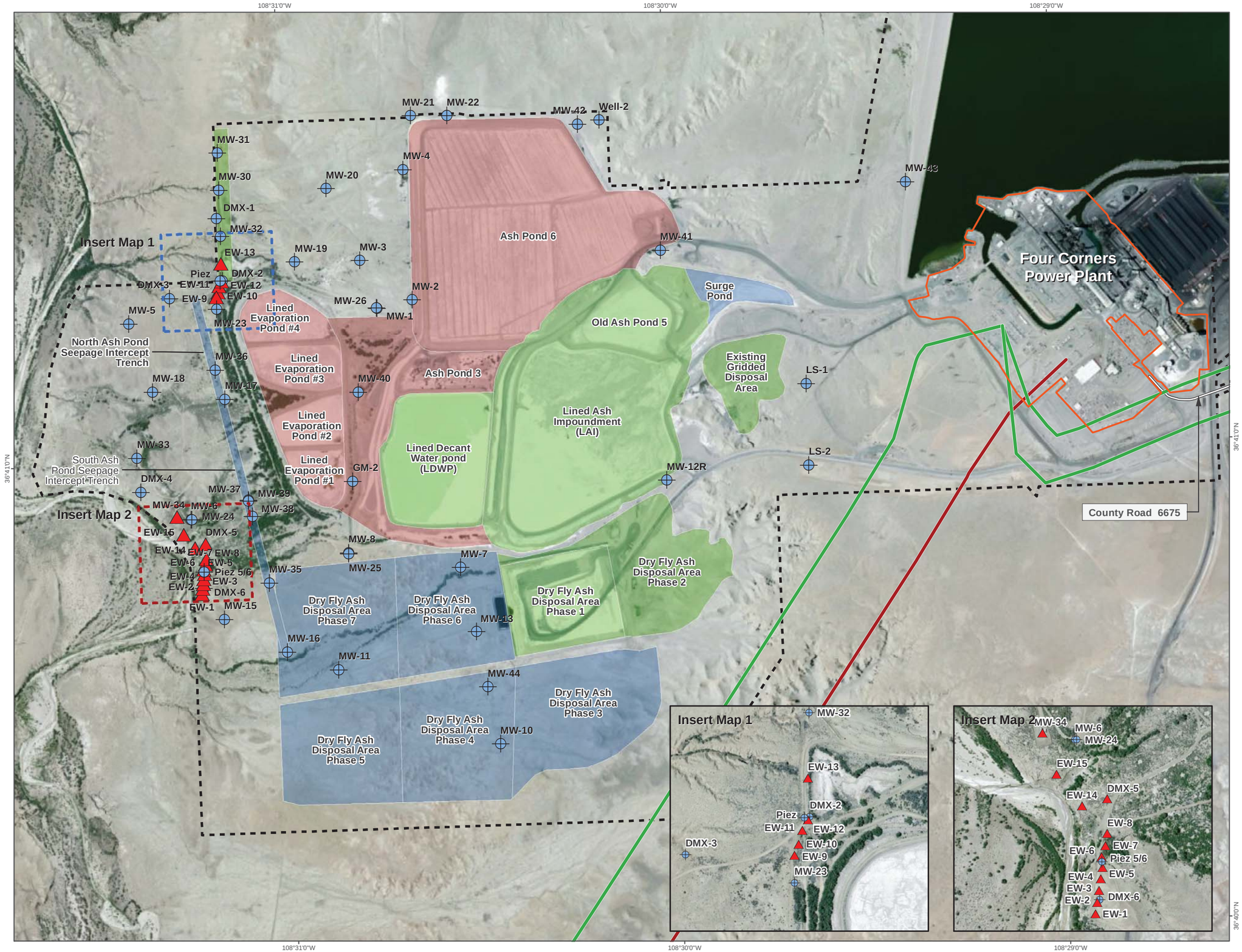

Figure 4.5-2

Monitoring and Extraction Well Locations

PROJECT BOUNDARIES

Power Plant Lease Boundary

Fence Line

TRAMISSION LINES

345kV

500kV

WELL LOCATIONS

Extraction Well

Monitor Well

ASH FACILITIES

Existing Active Facility

Existing Inactive Facility

Future Facility

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Fruitland Formation

Groundwater production within the Fruitland Formation is limited. The majority of exploratory drill holes within the Navajo Mine Lease Area have not produced measurable groundwater during drilling, and measurable water was only encountered at a few locations. Specifically, three boreholes located within the northeastern portion of Area IV South produced water at rates estimated at greater than 10 gallons per minute (gpm). This groundwater is believed to be associated with the No. 6 and the No. 8 coal seams. Measurable groundwater was encountered in the unconsolidated sand and gravel above the No. 8 coal seam at a depth of about 22 feet. The No. 8 coal seam was encountered in the 24 to 38 foot depth interval. Water was produced at a rate of about two to three gpm from the coal and the overlying sand and gravel. The general flow direction of groundwater in the Fruitland Formation is downward through the interbedded shale and coal units to the lower strata of the Fruitland Formation, with marginal upward movement from the Pictured Cliffs Sandstone into the Fruitland Formation.

Pictured Cliffs Sandstone

The Pictured Cliffs Sandstone underlies the Fruitland Formation and follows the structure of the Fruitland coal seams. It is a marginal water resource due to low permeability, poor water quality, gas production, and low yields (Stone et al. 1983). The Pictured Cliffs Sandstone appears to be in the range of 110 to 120 feet thick within the ROI.

Water levels in the Pictured Cliffs Sandstone (sometimes referred to as PCS) were also measured using piezometers installed at five locations. The measurements were used to estimate potentiometric surfaces and gradients. The potentiometric gradients in both the No. 2 and No. 3 coal units indicate groundwater flow components toward the north-northeast in the vicinity of these monitoring wells and piezometers. Flow directions in the upper coal seams are expected to be generally toward the northeast, similar to the gradients observed in the No. 2 and No. 3 coals, although local gradients may be influenced by the lower elevations along Pinabete, No Name, and Cottonwood arroyos. The No. 6, No. 7, and No. 8 coal seams outcrop along the valleys of Pinabete, No Name, and Cottonwood arroyos.

Historical water level data collected during the mid-1970s was reviewed for six wells that were completed in the Pictured Cliffs Sandstone within or adjacent to the Navajo Mine Lease Area (BNCC 2012a). Recent and historical water level data were used to estimate the potentiometric surface and flow gradients. The potentiometric gradients in Pictured Cliffs Sandstone indicate an overall northerly gradient and a slight easterly component in the gradients at the southern end of the site due to a structural high in the formation along the southeast perimeter of Area V. Also, local gradients exist toward the topographic lows along No Name, Pinabete, and Cottonwood arroyos.

Groundwater Quality

The water quality characteristics of Cottonwood, Pinabete, and No Name arroyos, the Fruitland coal seams, and the underlying Pictured Cliffs Sandstone have been determined from the baseline groundwater monitoring. These results show that the groundwater within and adjacent to the permit area is poor and suitable only for marginal livestock use. Table 4.5-4 provides a summary of groundwater quality monitoring results in each formation within the Navajo Mine.

Materials that remain after burning coal (including fly ash, bottom ash, coal slag, and flue gas desulfurization residue) are referred to as coal combustion byproducts (CCB) when placed in the mine (a practice discontinued in 2008) and as CCR when disposed in the FCPP ash disposal area (the current and ongoing practice). CCR from FCPP were placed in mined out pits or ramps at the Navajo Mine during the period from 1971 to 2008. Continued operations of the FCPP do not include placement of CCR materials in the mine backfill for reclamation at the Navajo Mine. Historic CCR placement occurred primarily within Area I with limited placement in Area II. Figure 4.5-3 shows the locations of the CCR placement along with the monitoring wells used to monitor possible contaminants of concern from these areas.

A National Academy of Sciences study (NRC 2006) identified potential impacts to water quality from CCR which was conducted in response to national public concern. The study suggested that, while no cases existed where water quality exceedances were directly attributable to CCR burial, concern about proper management was warranted. The report recommended characterization of a power plant CCR disposal site and the materials placed in it, including recommended characterization methods and leach tests. Reclamation plans need to specify how CCR would be used and what sorts of covers are placed to prevent root invasion and uptake of trace elements. The report also suggested design of monitoring plans to target potential releases from CCR disposal areas, and establishment of performance standards.

The water quality characteristics of Cottonwood, Pinabete, and No Name arroyos, the Fruitland coal seams, and the underlying Pictured Cliffs Sandstone have been determined from the baseline groundwater monitoring. These results show that the groundwater within and adjacent to the permit area is poor and suitable only for marginal livestock use. Table 4.5-4 provides a summary of groundwater quality monitoring results in each formation within the Navajo Mine.

The potential impacts of CCR to groundwater in the Cumulative Hydrological Impact Assessment (CHIA) for Navajo Mine have been previously addressed. It was concluded that “[t]he reclamation of the CCR placement areas at the mine has been sufficient in part because of the natural conditions prevalent in the area and also because precautions were taken when engineering the CCR placement and reclamation. Thus far, negligible impacts have resulted from the CCR placement. It is also unlikely that any significant future effects will ensue from the CCR placement at the Navajo Mine because of the very slow groundwater movement and the likely attenuation of contaminants of concern as they migrate through the subsurface; however, there is no hydrologic connection between Areas III /IV and Area I/II. Therefore, past CCR placement at the Navajo Mine is determined to have no impact in the short- or long-term (OSMRE 2012c). Lack of impact from previous CCR placement within Areas I and II is further substantiated through the following analysis.

Unsaturated conditions currently exist at CCR backfill placement locations except for two locations at the northern end of Area I. CCR materials placed in the Bitsui Pit are saturated as are an isolated location of basal saturation of CCR material around the Watson-4 well. Current groundwater flow directions from the Bitsui Pit are toward the subcrop of the Fruitland Formation along the alluvium of the San Juan River (BNCC 2011a). Any groundwater flow in the future from Area I and portions of Area II is also expected to be to the northeast toward Fruitland Formation subcrop along the alluvium of the San Juan River. Consequently, groundwater from CCR placement locations and associated mine backfill within Areas I and II are not expected to affect the alluvium of the Chaco River.

A supplemental groundwater study program and monitoring well installation was implemented to assess possible impacts to groundwater from historic mine placement of CCR at Navajo Mine (BNCC 2009). BNCC also completed a series of detailed laboratory batch leaching studies of the constituents leached from CCR and mine spoil for the PHC determination (BNCC 2011a). Both of these results—the field monitoring and the laboratory leach studies—show that TDS and sulfate concentrations do not increase in CCR that become saturated with spoil water (water that flows through the backfilled mine spoils after mining). Arsenic, boron, fluoride, and selenium concentrations may increase in CCR leachate. Boron and fluoride in the CCR monitoring wells were above the livestock criteria. Arsenic concentrations in the CCR wells were close to the livestock criteria, while selenium concentrations were below the livestock criteria. Other trace constituents were below detection limits in the majority of the samples from both CCR and spoil wells (BNCC 2011a). The arsenic, boron, and fluoride concentrations in a spoil monitoring well immediately downgradient of a CCR well showed that spoil attenuates or reduces the concentrations of these constituents (BNCC 2011a).

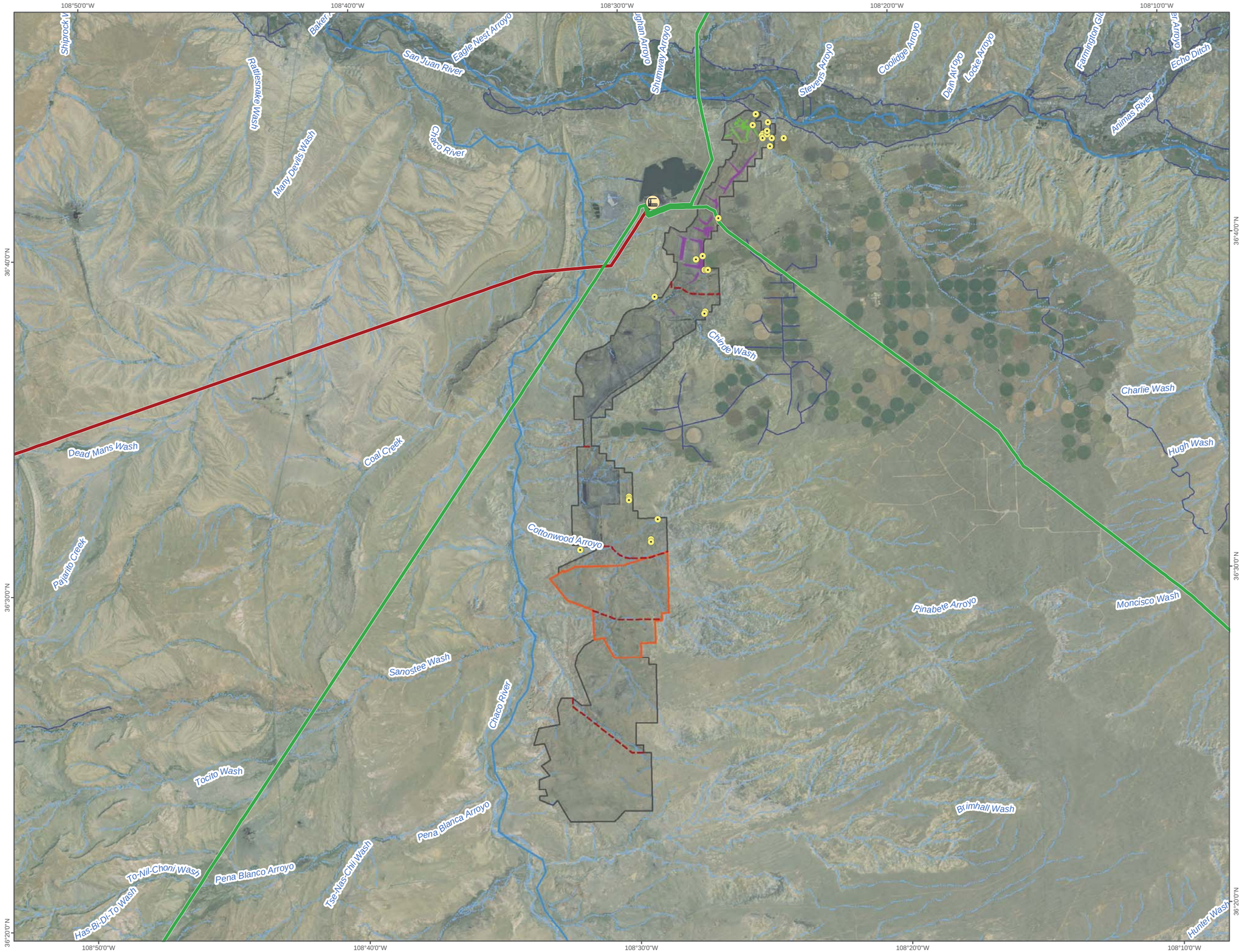

Figure 4.5-3

Monitoring Wells in the Vicinity of Former CCR Placement Areas at the Navajo Mine

PROJECT FACILITIES

- Four Corners Power Plant
- Groundwater Monitoring Wells
- Coal Combustion Residue Placement
- Approximate Coal Combustion Residue Placement

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Navajo Mine Resource Areas
- Proposed Pinabete Mine Permit Boundary

TRANSMISSION LINES

- 345kV
- 500kV

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Scale in Miles

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Transport modeling of spoil water from Area I through the Fruitland Formation to its discharge location at the formation subcrop beneath the alluvium of San Juan River indicates that changes in sulfate concentrations in the San Juan River alluvial groundwater are not expected to occur. Furthermore, groundwater flow in the San Juan River alluvium is estimated to be approximately two orders of magnitude higher than the estimates of groundwater flow discharging to the San Juan River alluvium from the Fruitland Formation (BNCC 2011a). Thus, TDS and trace constituents such as boron that may be above livestock suitability levels in CCR or mine spoil leachate will be reduced by mixing with the groundwater in the San Juan River alluvium even if they are not attenuated during transport to the Fruitland Formation. The existing water quality in the San Juan River alluvial aquifer is quite variable as indicated by the available water quality data from San Juan River alluvial wells provided in the Mine Plan Revision (BNCC 2011a). There are no cumulative adverse impacts to surface water quality from CCR placement at the Navajo Mine. CCR materials have not been placed within mine backfill in Area III and there are no plans for placement of CCR within mine backfill within either Area III or IV. CCR materials were placed within Area I and portions of Area II but there is no cumulative groundwater impact or connection between Areas III and IV and Area I and II.

At the Navajo Mine, groundwater quality samples have been gathered from monitoring wells installed in Pinabete Arroyo, Cottonwood Arroyo, and the No Name alluvium. Analytical results for the water quality samples from these wells are summarized below in Table 4.5-5 (BNCC 2012a).

The baseline results for the Cottonwood alluvial wells show water quality to be a sodium-sulfate type with relatively high but variable TDS concentrations. TDS concentrations ranged from 2,590 to 3,615 mg/L. Median sulfate concentrations exceed recommended livestock use criteria at all the Cottonwood alluvial wells. Median concentrations of TDS and sulfate in the groundwater within the Cottonwood alluvial wells also exceed EPA's Secondary Drinking water use criteria. Fluoride concentrations fluctuate in the alluvial groundwater and are often above relevant criteria for livestock and drinking water use.

The baseline results for the Pinabete alluvial wells show the water quality to be a sodium-sulfate type with TDS concentrations ranging from 1,500 to 4,300 mg/L. Water within the alluvium is unsuitable for drinking water use due to TDS, sulfate, fluoride, iron, and manganese concentrations above secondary drinking water standards. The quality of the alluvial groundwater varies, although the TDS, sulfate, and fluoride concentrations usually exceed relevant criteria for livestock use.

The baseline results for the No Name Arroyo alluvial wells show the water to be a sodium-sulfate type similar to Pinabete Arroyo but with much higher sulfate, sodium, and TDS concentrations. Water quality within the alluvium downstream of the No Name Impoundment is unsuitable for either drinking water or livestock water use.

All of the monitoring wells at the FCPP are in the Alluvial Aquifer. The FCPP ash ponds are built upon the Lewis Shale, a marine shale that contains substantial amounts of evaporite deposits, including gypsum, and tends to cause relatively high levels of total dissolved solids in the water. All monitoring wells at the FCPP, including those that would represent "background", or pre-power plant, levels, exceeded the New Mexico and EPA drinking water standard for boron (0.75 mg/L) at various times during the period of record (1987-2012). Most recently, sampling data for 2011 and 2012 indicate exceedances of boron at every well (APS 2013). Table 4.5-6 provides a summary of groundwater quality monitoring results beneath the ash disposal area at the FCPP.

Alluvium Aquifer

Water derived from alluvial wells in the vicinity of the FCPP and Navajo Mine is predominantly used for livestock watering; therefore, alluvial water quality is compared to the applicable livestock water criteria. The criteria are not enforceable standards with respect to groundwater and are included only as a reference for the suitability of the groundwater quality for livestock use. Generally the alluvial systems are of sodium-sulfate type with variable TDS concentrations.

Pinabete Arroyo alluvium generally shows consistent pH at all monitoring wells, although iron and mercury tends to increase moving downstream while arsenic, boron, cadmium, copper, lead, selenium, zinc, and nitrate tends to decrease, and other constituents did not show any apparent trend. All pH values for samples within the Pinabete Arroyo alluvium were within the ranges for livestock water criteria. Arsenic, selenium, chloride, fluoride, sulfate and TDS exceeded livestock criteria for the Pinabete Arroyo alluvium for 5%, 4%, 4%, 86%, 75% and 46% of all samples respectively. All median values for arsenic, selenium, and chloride were below the criteria indicating that the criteria exceedances are generally more characteristic of the high variability in the data set as compared to the general water quality. The median fluoride, sulfate and TDS values exceed the livestock criteria. Based on these relevant use criteria, the water in the Pinabete Arroyo alluvium system is a poor source of supply for livestock watering use. This is especially apparent when considering fluoride, sulfate and TDS concentrations. These water quality parameters often exceed relevant criteria for livestock use, although the alluvium has been historically and is currently used for this purpose.

Moving downstream along the Cottonwood Arroyo alluvium pH, selenium, and fluoride tended to increase while boron, manganese, mercury, nitrate, sulfate and TDS tended to decrease, and other constituents did not show any apparent trend.

All pH values for all samples within the No Name Wash alluvium were within the appropriate range. Sulfate and TDS exceeded livestock criteria for the No Name Wash alluvium for 100% and 100% of all samples, respectively. The median sulfate and TDS values exceed the livestock criteria. Based on these relevant use criteria, the water in the No Name alluvium system is a poor source of supply for livestock watering use. This is especially apparent when considering sulfate and TDS concentrations. These water quality parameters often exceed relevant criteria for livestock use, although the alluvium has been historically and is currently used for this purpose (OSMRE 2012c).

Fruitland Formation

The pH levels within the No. 3 coal seam range from 7 to 9, which is characteristic of the Fruitland coals within the San Juan Basin. The water quality is unsuitable for drinking water use due to concentrations of TDS, chloride, and boron above the Navajo Nation surface water quality criteria for drinking water (the Navajo Nation does not have groundwater quality standards). The TDS concentrations also exceed the relevant criterion for livestock use. The groundwater in the No. 3 coal seam is a sodium-bicarbonate-chloride type, with TDS of about 3,300 mg/L. The ion composition results are consistent with the baseline coal water quality monitoring data at the Navajo Mine.

Water quality monitoring data from the coal wells located within or adjacent to the Navajo Mine Permit Area show very high TDS concentrations in the coal seam groundwater, with median concentrations at individual wells ranging from 2,770 to 13,400 mg/L. The coal seam water quality results show that TDS concentrations increase with depth and distance from the outcrop. Furthermore, TDS concentrations as high as 50,000 mg/L have been observed in the Fruitland coal units located east and down slope of the Navajo Mine Permit Area.

Water quality analytical results from the baseline sampling of the No. 8 coal seam are unsuitable for drinking water due to concentrations of TDS, chloride, fluoride, and sulfate that are above EPA's secondary drinking water use criteria. The sulfate and TDS concentrations often exceed relevant criteria for livestock use and would not be sufficient to use for livestock water supply.

Based on the trends observed from sampling of coal wells within the permit area, concentrations of TDS, bicarbonate, and chloride appear to increase with depth and distance from the outcrop, but sulfate concentrations appear to decrease. The groundwater chemistry changes as soluble minerals dissolve and cation exchange processes reduce the proportion of calcium and increase the proportion of sodium in solution. Sulfate reduction also occurs when groundwater transitions from oxidizing to reducing conditions, particularly within the coals.

Pictured Cliffs Sandstone

Data from monitoring wells located within and adjacent to the permit area indicate the groundwater in the Pictured Cliffs Sandstone has high TDS concentrations, ranging from 5,000 to over 9,000 mg/L. Sulfate is the dominant anion, although the concentrations of chloride and bicarbonate are also relatively high. Sodium is the dominant cation. Magnesium and calcium concentrations are quite low and are typically less than potassium concentrations, although potassium was not included in the historic samples collected during the 1970s.

The high concentrations of TDS, sulfate, chloride, and boron in the water from the Pictured Cliffs Sandstone within and adjacent to the permit area preclude its use for domestic purposes. The Pictured Cliffs Sandstone is also a poor source for livestock watering due to the very high TDS and sulfate concentrations, as well as low permeability and low yield.

Table 4.5-5 Summary of Groundwater Quality Monitoring at Navajo Mine

Constituents[1]	Average Values for Water Quality in the Fruitland Coals at the BNCC Lease (2007–2008)	Average Values for Water Quality in the Pinabete Arroyo Alluvium (2008)	Average Values for Water Quality in the Picture Cliffs Sandstone (2008)
pH (SU)	8.405	7.47	8.59125
TDS	3310	2895	6061.25
Arsenic	NS	0.001	0.013
Barium	NS	0.017	0.033
Bicarbonate as HCO_3	1409.5	366.55	825
Boron	0.3645	0.45	0.5875
Cadmium	NS	0.00005	0.00005
Calcium	5.05	108.61	18.78
Carbonate as CO_3	150	<10	745
Chloride	631.5	30.63	318.13
Chromium	NS	0.005	0.019
Copper	NS	0.01515	0.127275
Fluoride	2.175	2.6	1.525
Iron, total	0.40	11.21	68.33
Lead	NS	0.0002	0.0002
Magnesium	1.3	17.91	6.98
Manganese, total	0.026	0.93	1.28
Mercury	NS	0.0002	0.0002
Nitrate as N	0.16	0.0675	1.475
Potassium	15.25	2.29	21.76
Selenium	NS	0.008	0.006
Silver	NS	0.00006	0.00005
Sodium	1175	705	1906
Sulfate	429.5	1632	2610
Uranium	NS	0.026	0.006
Zinc	NS	0.015	0.014

Source: BNCC 2012a
[1]All units in mg/l, unless indicated otherwise
NS = Not Sampled

Table 4.5-6 depicts the summary of groundwater quality monitoring results at the FCPP and compares results to the EPA Maximum Contaminant Level and the NNEPA drinking water standards.

Table 4.5-6 Summary of Groundwater Quality Monitoring Results at FCPP

Constituent	Minimum	Maximum	Average	EPA MCL	NNEPA
Primary Drinking Water Standards					
Antimony[1]	0.0001	0.0060	0.0021	0.006	0.0056
Arsenic	<0.001	0.2260	0.0244	0.010	0.010
Barium	0.0036	1.10	0.03	2.0	1.0
Beryllium	<0.0005	0.001	0.001	0.004	0.004
Cadmium	0.00013	0.0160	0.0029	0.005	0.005
Chromium	<0.0001	0.240	0.0136	0.10	0.10
Copper	0.0015	0.551	0.0780	1.3	1.3
Fluoride	0.05	100	1.0	4.0	4.0
Lead	0.0002	0.130	0.0155	0.015	0.015
Mercury	0.0001	>0.001	0.0001	0.002	0.002
Nitrate (N)	0.0100	1,422	134	10	10
Selenium	0.0018	1.710	0.2595	0.05	0.050
Thallium	0.0001	0.2030	0.0239	0.002	0.002
Secondary Drinking Water Standards					
Chloride	200	12,051	1,385	250	NA
Iron	0.0030	12.3	0.941	0.3	NA
Manganese	0.0371	204	3.0	0.05	NA
pH	5.52	8.17	7.18	6.5-8.5	5-9
Silver	0.0001	0.1160	0.0165	0.10	.035
Sulfate	2,039	131,822	23,602	250	NA
TDS	5,230	186,360	38,959	500	NA
Zinc	0.0060	0.2500	0.0391	5.0	2.1
Constituents with No Applicable Drinking Water Standards					
Temperature (C)	8.23	22.5	15.53		
Field Conductance (µmhos)	962	101,800	26,368		
Alkalinity ($CaC0_3$)	140	13,750	713		
Boron	0.20	70.7	8.91		
Calcium	30	7,800	448		
Bicarbonate (HCO_3)	0	16,775	870		
Magnesium	144	17,000	2,656		
Nickel	0.0140	0.750	0.0998		
Silica (Si02)	0.0	96	10		
Sodium	220	56,000	7,092		
Potassium	8	360	80		
Uranium	0.0028	270	3.518		

[1]All results and limits are in mg/L, unless indicated otherwise
[2]NNEPA Domestic Water Supply Standards are part of the surface water quality standards. No specific groundwater quality standards have been adopted by the Navajo Nation

4.5.2.2 Surface Water (including waters of the US)

The Navajo Mine, FCPP, and associated existing transmission lines are located within the San Juan Basin Watershed, which extends across portions of four states, including northwestern New Mexico, southwestern Colorado, southeastern Utah, and northwestern Arizona (Figure 4.5-4). The San Juan Basin Watershed encompasses a 24,908-square-mile drainage within USGS Hydrologic Unit Code (HUC) 1408. The Navajo Mine and FCPP Lease Areas are within Chaco River Watershed HUC 14080106, which drains 4,563 square miles. The transmission lines intersect numerous HUCs within the San Juan Basin Watershed. The following subsections provide an overview of surface water resources and water quality issues within the FCPP's region of influence, based on an air deposition model conducted for the proposed Project (EPRI 2013), as well as a description of the surface water resources present at the Navajo Mine, and FCPP lease. Water quality data and existing water use at the Navajo Mine and FCPP are also described below. As described in Chapter 2, no water is used in the operation or maintenance of the subject transmission lines; therefore, details regarding water quality and water use of the water bodies crossed by the lines are not provided below.

Regional Surface Water Resources

The ROI is located within the main portion of San Juan Basin Watershed, which covers approximately 4,600 square miles and encompasses most of the Four Corners geographic region. An estimated 670,000 acre-feet of water are available from the San Juan Basin for domestic, agricultural, commercial, and industrial use (BNCC 2012a). The most prominent surface water feature in the watershed is the San Juan River, which flows generally east to west, originating along the southern slope of the San Juan Mountains in southwestern Colorado. The San Juan River flows through Farmington and passes about 5 miles north of the ROI before it drains into the Colorado River at Lake Powell in Utah. Other major surface water bodies in the area include the Animas, La Plata, and Chaco rivers. The Animas River flows south from its headwaters in the San Juan Mountains in southwestern Colorado. The La Plata River originates in the La Plata Mountains, also in southwestern Colorado, 35 miles north of the New Mexico Border. Both the Animas and La Plata rivers join the San Juan River just west of Farmington. The Chaco River is an intermittent wash that flows northwest through Chaco Canyon. It joins the San Juan River west of Farmington and the FCPP. Other water features in the watershed include numerous arroyos and washes. Two larger arroyos near the Navajo Mine, Pinabete and Cottonwood, are intermittent waterways with only seasonal water present. Most other washes are ephemeral, receiving and carrying water only during heavy rains that come during the spring rains or the summer monsoons (San Juan Water Commission 2003).

The USGS located three stream gaging stations along the San Juan River in the Project vicinity. Station 09368000 is active and located on the San Juan River approximately 0.9 mile south of Shiprock, New Mexico, and 2 miles west of the Chaco River confluence. Station 09367540 is inactive and located approximately 0.4 mile west of Fruitland, New Mexico, 13.8 miles east of the Chaco River confluence, and 8.3 miles west of the La Plata River confluence. Station 09365000 is active and located approximately 0.9 mile southwest of Farmington, New Mexico, 1.7 miles southeast of the La Plata River confluence, and 0.7 mile northwest of the confluence with the Animas River. Review of data collected at these three stations demonstrates variability of flow along the San Juan, with a general decreasing flow trend for the period of record (1931–2010). Although flows initially increased upstream to downstream along the San Juan, this trend reversed around 1972 such that downstream flows were less than upstream flows (OSMRE 2012c).

The NMED has set a standard for temperature of 32.2 Celsius (°C) or less has been for the main stem of the San Juan River from the Navajo Nation boundary to its confluence with the Animas River. The San Juan River is listed as impaired for sedimentation and turbidity between the Animas River and Canon Largo. The Navajo Reservoir on the Navajo Nation is also listed as impaired for mercury in fish tissue (NMED 2005). Total maximum daily loads (TMDLs) for the San Juan River Watershed were approved in 2005 for sedimentation, bacteria, and selenium (NMED 2005). Additional TMDLs were approved in 2006 for nutrients in the Animas River and dissolved oxygen in the La Plata River (NMED 2006).

The NNEPA maintains a number of water quality monitoring sites along surface waterbodies in the Navajo Nation. In the vicinity of the ROI, monitoring locations are located along the Chaco River, Chinde Wash, Bitsui Wash, and the San Juan River. Monitoring data for all sample locations for all years collected was compared to NNEPA surface water quality standards for designated uses (NNEPA 2008). The Chaco River had the longest dataset of record with sampling from 1998 to 2011. Chinde Wash data covered the period 2009-2011, Bitsui Wash only had data for 2010 and 2011 and data collected in the San Juan River was for the years 2006, 2011, and 2012. Based on the data collected, nearly all sample sites met the standards for the designated beneficial uses. The exceptions are listed below:

- Mercury levels in Chaco River in all samples in which it was detected are above the standards for acute and chronic wildlife habitat and fish consumption. Concentrations detected range from 0.000001 mg/L to 0.002 mg/L.
- Two samples in 2005 and two in 2011 in the Chaco River were above the acute and chronic wildlife habitat standards for cadmium
- A sample collected during one sample event in the Bitsui Wash in 2011 was above the standards for secondary human contact and acute wildlife for lead.
- Samples collected during a sample event in the San Juan River in 2011 were above the standard for acute wildlife for cadmium and lead. One sample collected in 2006 was above the standard for acute wildlife habitat for mercury (NNEPA 2013).

Navajo Mine

The San Juan River is a perennial water body located adjacent to the northern boundary of the Navajo Mine Lease Area and Navajo Mine Permit Area, which lies on the terrace above the floodplain. Surface water in the Pinabete Permit Area, and immediately adjacent areas, is characterized by ephemeral or intermittent streams that convey water only after precipitation events. The climate of the ROI includes summer rains that fall almost entirely during brief, but frequently intense, thunderstorms. As such, stream flows are widely variable, going from no discharge (dry channels) to peak discharge, followed by a gradually diminishing discharge over several subsequent hours. These rapidly varying flows can transport large amounts of sediment and cause extensive changes in the shape of the channels after single events.

Navajo Mine Permit Area

The primary ephemeral or intermittent streams that pass through the Navajo Mine Permit Area and adjacent areas include the Chaco River, Bitsui Wash, Chinde Wash, Hosteen Wash, Barber Wash, Neck Arroyo, Lowe Arroyo, Cottonwood Arroyo, and Pinabete Arroyo, all described in more detail below. All eventually drain into the San Juan River to the north of the permit area.

Cottonwood Arroyo is a major sand bed intermittent drainage that passes through the southern portion of the permit area. Cottonwood Arroyo is one of the largest of the Chaco River tributaries with a drainage area of approximately 80.1 square miles, though only approximately six percent of the drainage area is within the permit area. Approximately half of the watershed is located on badlands, which accounts for the high discharge and sediment load. Cottonwood Arroyo is also seasonally influenced by irrigation activities in the NAPI lands just east of the Navajo Mine Lease Area.

Bitsui Wash is located near the northernmost portion of the permit area. It originates to the east of the permit area at the Navajo Indian Irrigation Project (NIIP), flows into the permit area, and then flows north into the San Juan River. Chinde Wash is located near the southern boundary of Navajo Mine North Area. It flows from east to west across the permit area, originating near the NIIP and flowing into the Chaco River. Under natural conditions, Bitsui and Chinde washes would flow ephemerally after large precipitation events, but both flow intermittently due to irrigation and direct discharges associated with the NIIP. Chinde Wash flows throughout the year with short-term peak flows caused by precipitation or NIIP direct canal discharges.

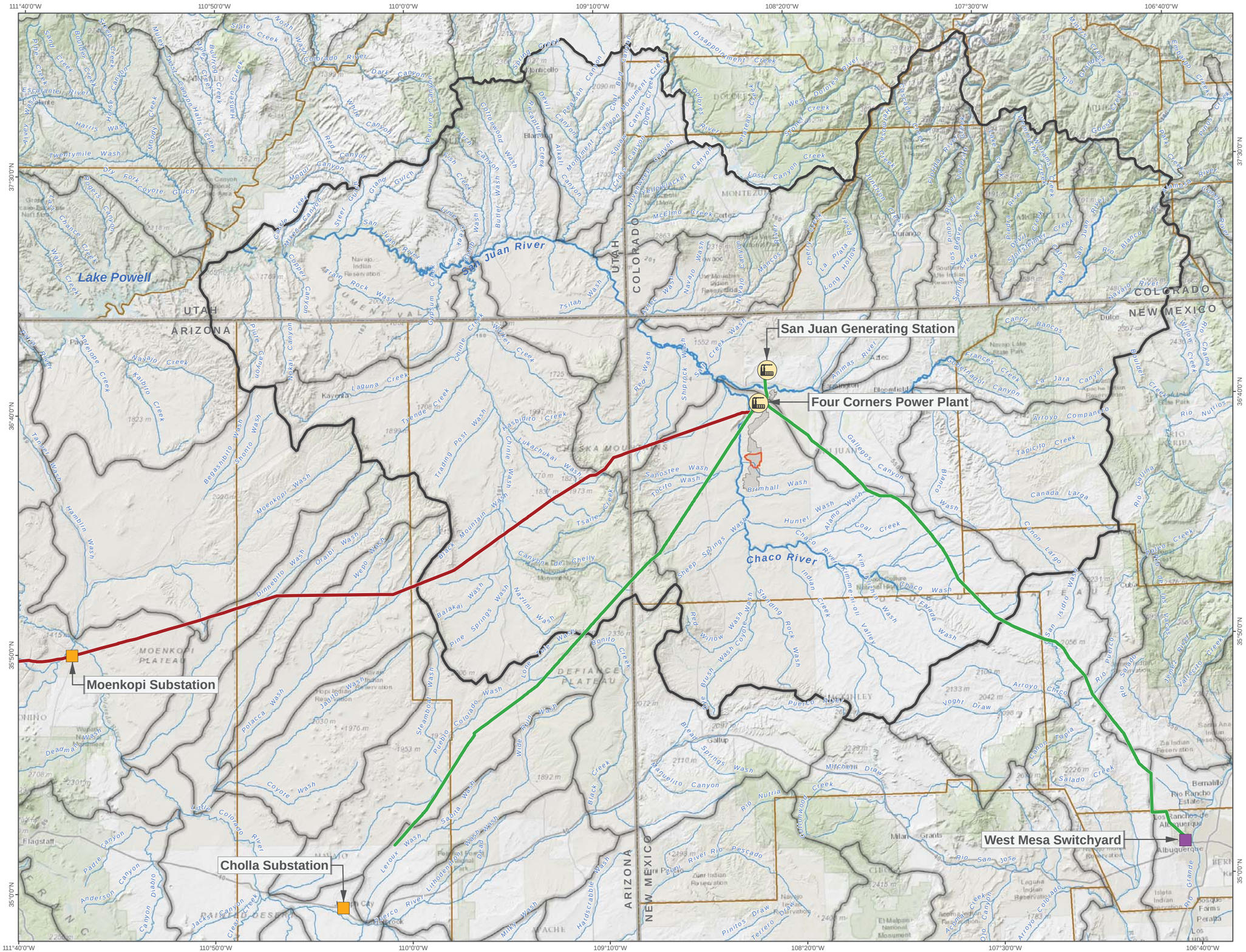

Figure 4.5-4

Regional Surface Water Resources

PROJECT FACILITIES

- Four Corners Power Plant
- Substation
- Switchyard

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Proposed Pinabete Mine Permit Boundary

TRANSMISSION LINES

- 345kV
- 500kV

HYDROLOGY FEATURES

- Rivers | Streams
- Watershed Boundaries
- San Juan Basin Watershed

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Scale in Miles

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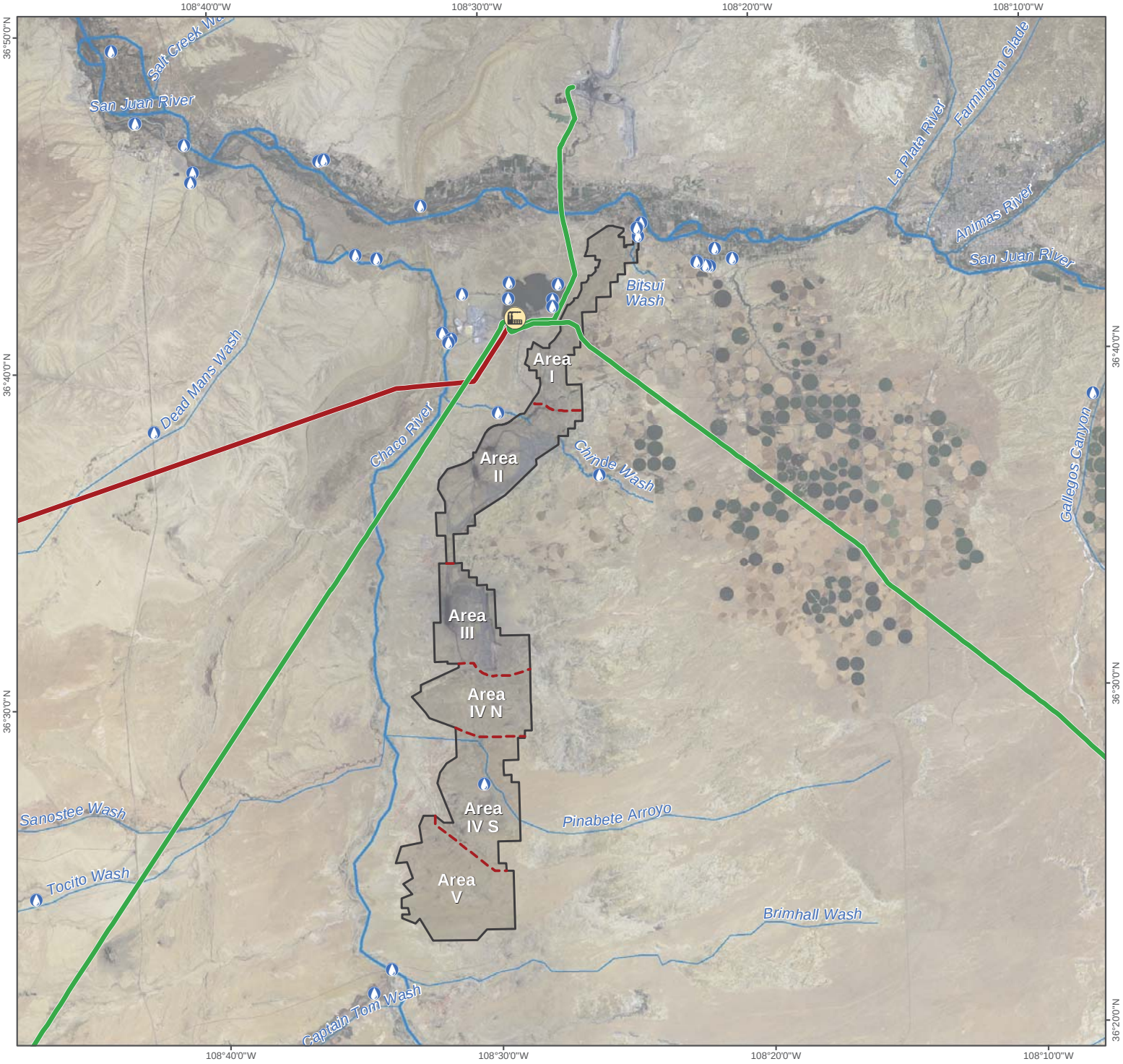

Four Corners Power Plant and Navajo Mine Energy Project

ENVIRONMENTAL SETTING & CONSEQUENCES

Figure 4.5-5

Water Quality Stations

PROJECT FACILITIES

Four Corners Power Plant

NNEPA Water Quality Station

PROJECT BOUNDARIES

Navajo Mine Lease Area

Navajo Mine Resource Areas

TRANSMISSION LINES

345kV

500kV

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Hosteen Wash, Barber Wash, Neck Arroyo, and Lowe Arroyo are all ephemeral streams that flow in response to precipitation events. All flow across the permit area from east to west and into the Chaco River. Hosteen Wash is located in the northern portion of Area II and originates near the NIIP. The Hosteen Wash watershed area is about 9.1 square miles, approximately 3.7 square miles of which is disturbed by mining activity. Barber Wash originates just east the permit boundary; the watershed area is about 5.3 square miles, approximately 1.4 square miles of which is disturbed by mining activities. Neck Arroyo is located south of the Area III shop complex and just north of Lowe Pit in the Area III mining area. The Neck Arroyo watershed area is 1.88 square miles, approximately 14 percent of which is within the permit area. The South Barber Drainage is a tributary to the Neck Arroyo that is 0.82 square mile, approximately 0.03 square mile (17 acres) of which is disturbed by mining activities. Lowe Arroyo flows through the middle of the Navajo Mine Permit Area and has a drainage area of about 11.25 square miles, approximately 41 percent of which lies within the permit area.

Pinabete Permit Area

BNCC conducted a delineation of jurisdictional waters of the US and wetlands within the Pinabete Permit Area in April 2012 (Ecosphere 2012b). The delineation identified three primary surface water features in the Pinabete Permit Area: Pinabete Arroyo, the south forks of Cottonwood and No Name arroyos. The arroyos in the Pinabete Permit Area all eventually drain into the Chaco River to the west, and ultimately to the San Juan River to the north. The mainstem of Cottonwood Arroyo is outside of the Pinabete Permit Area, but the arroyo (described in detail above) passes through Area IV North and borders the permit area to the northwest. Pinabete and No Name arroyos pass through Area IV South and border the permit area to the southwest and south, respectively. Pinabete Arroyo has a drainage area of about 60 square miles; approximately 16 percent is within the Navajo Mine Lease Area. No Name Arroyo has a drainage area of about 11 square miles, of which approximately 16 percent lies within the lease area. The headwaters of No Name Arroyo are within the Navajo Mine Lease Area. Table 4.5-7 provides the dimensions of these drainages within the ROI.

Table 4.5-7 Intermittent and Ephemeral Drainages within the Pinabete Permit Area

Drainage	Length (miles)	Area (acres)
Cottonwood Arroyo	7.6	10.4
Pinabete Arroyo	19.2	34
No Name Arroyo	2.8	1.1
Total	29.8	46.5

Source: Ecosphere 2012b

In addition to the intermittent and ephemeral drainages, three stock ponds in the Pinabete Permit Area were identified as jurisdictional. All three have defined channels upstream and are connected to defined channels downstream either by an active spillway or a diversion channel. These ponds catch surface flows from some tributary drainages and are often dry. Table 4.5-8 summarizes the area of each of these ponds. The USACE has reviewed the delineation report and verified its findings (USACE 2013). Figure 4.5-6 shows the location of the identified jurisdictional features within the Pinabete Permit Area.

Table 4.5-8 Stock Ponds in the Pinabete Permit Area

Drainage	Site	Area (acre)	Classification
Pinabete Arroyo	Pond 1	0.58	Palustrine unconsolidated shore
Pinabete Arroyo	Pond 2	0.34	Palustrine unconsolidated shore
Pinabete Arroyo	Pond 3	1.13	Palustrine unconsolidated shore

Source: Ecosphere 2012b

The USACE used CRAM to evaluate the background condition of the arid ephemeral streams and channels within Area IV North and Area IV South to estimate the effects of post-project direct and indirect impacts. CRAM is a technique that was originally intended to provide a rapid and repeatable assessment method that can be used routinely for wetland monitoring and assessment throughout the State of California; however, the constructs of CRAM can be applied to a wide range of arid, ephemeral streams similar to those found throughout the arid southwestern US. CRAM assesses four overarching attributes of stream condition: 1) buffer and landscape context; 2) hydrology; 3) physical structure; and 4) biotic structure. Within each of these attributes are a number of metrics that assess more specific aspects of stream condition. Metric scores under each attribute are aggregated in CRAM to yield scores at the level of attributes, and attribute scores are aggregated to yield a single overall index score, via simple arithmetic formulas. Attribute and index scores are expressed as percent possible, ranging from 25 (lowest possible to a maximum of 100. Table 4.5-9 shows the overall CRAM index and attribute scores.

Table 4.5-9 Overall CRAM Index and Attribute Scores

CRAM Index and Attribute Scores	Headwater Systems	Cottonwood and Pinabete Arroyos	Overall
Overall Index Score	56	68	59
Buffer and Landscape Context	93	93	93
Hydrology	70	87	73
Physical Structure	32	43	34
Biotic Structure	35	49	38

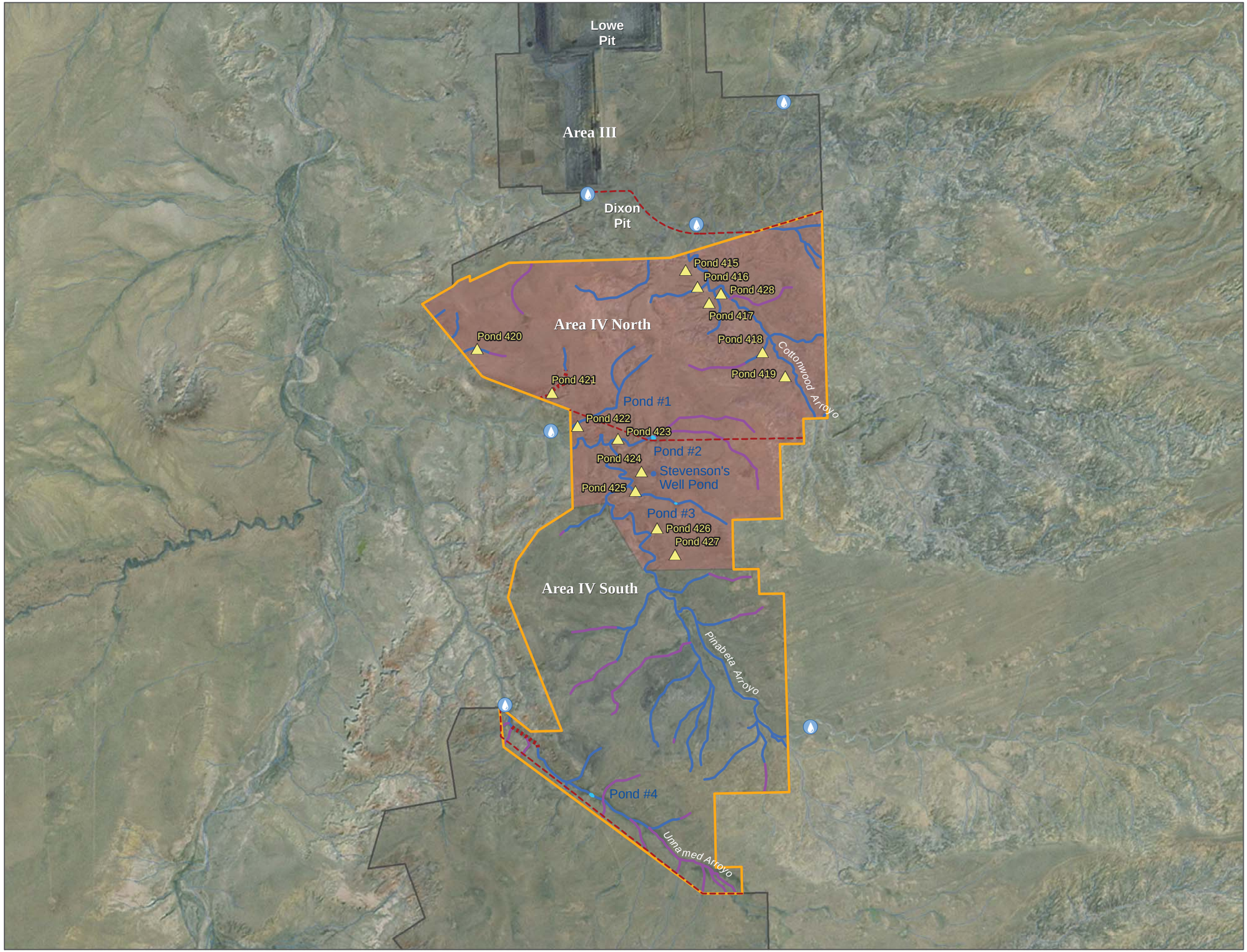
Source: USACE 2013

Water Quality

Historic data was analyzed for over 20 physical and chemical constituents collected by the USGS along the San Juan River at the three gaging stations between 1958 and 2010. The analysis indicated high variability, generally increasing pH, and generally decreasing or relatively unchanged concentrations in constituents over time (OSMRE 2012c). Naturally occurring selenium is one of the water quality issues in both the Animas and San Juan rivers. In 2005, it was determined that the background level of selenium in the Animas River exceeded the prior standard of two parts per billion. Subsequently, the standard was changed from two to five parts per billion by the New Mexico State Water Quality Board. As a result, the natural water in the region now generally complies with the EPA water quality standard for selenium (0.05 mg/L). The natural water is generally of higher quality and more consistent over time and space in the Animas River than in the San Juan River. The Animas River is a newer and steeper river than the San Juan River and as a result has weathered and eroded its watershed less (San Juan County 2007).

Figure 4.5-6

Jursidictional Waters of the U.S.
within the Pinabete Permit Area



PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Navajo Mine Resource Areas
- Proposed Pinabete Mine Permit Boundary
- Preliminary Jurisdictional Determination

JURISDICTIONAL STATUS

- Yes
- Discontinuous
- No
- Stock Pond

HYDROLOGIC FEATURES

- Monitoring Locations
- Sediment Ponds
- Rivers | Streams

N

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Scale in Miles

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Surface water studies associated with permitting of the existing Navajo Mine and the proposed Pinabete Permit Area indicate that under baseline conditions, the drainages that cross the permit area carry a very high concentration of suspended solids and bed loads during storm runoff events, averaging 98,000 mg/L (BNCC 2011b, 2012a). At the active Navajo Mine north of the Pinabete Permit Area, sediment control measures prevent additional contributions of sediment to stream flow or to runoff during operations. The most recent water quality data for Cottonwood Arroyo within the Pinabete Permit Area is from 1997 to 1999. At that time, the general characterization of water quality was alkaline with moderate saline sodium sulfate levels and hardness. The average selenium concentration ranged from 0.003 to 0.006 mg/L, and exceeded the NNEPA standard for aquatic wildlife habitat of 0.002 mg/L. Total sediment and TDS concentrations in Cottonwood Arroyo average 97,989 and 656 mg/L, respectively (BNCC 2012a). Similarly, suspended sediment concentrations in Pinabete Arroyo during storm runoff events are very high with total suspended solids concentrations ranging from 10,200 to 521,000 mg/L as collected in samples between 1998 and 2007 (BNCC 2012a).

The NNEPA (2008) has identified designated uses of Cottonwood Arroyo to include secondary human contact (direct contact to skin associated with recreation or cultural uses), fish consumption, aquatic and wildlife habitat, and livestock watering. Water quality was collected for a brief period between 1990 and 1999 on Cottonwood Arroyo. The moderately saline (median TDS ranged from 610 to 780 mg/L) sodium sulfate waters are alkaline with a moderate hardness (BNCC 2011a). The median total selenium concentration at all sites of 0.0025 mg/L exceeds the chronic wildlife habitat standard of 0.002 mg/L. Levels of selenium were highest at the upstream, North Fork of Cottonwood Arroyo. Suspended sediment concentrations are high, greater than 100,000 mg/L during storm runoff events, and the sandy channel bed and bank materials can be extensively modified by the larger flood events.

A comparison of surface water quality data at USGS gaging stations on the Chaco River upstream and downstream of the Navajo Mine was conducted. The analysis indicates that the downstream gage is also downstream of the FCPP and Morgan Lake discharge; therefore, it is impossible to differentiate the impact of the Navajo Mine from the FCPP. The analysis found that water quality downstream of the two facilities had relatively high variability in comparison to the upstream data, where the median percent relative standard deviation for all constituents was 96 percent compared to 44 percent. The downstream data were also compared to NNEPA criteria. Mercury exceeded the NNEPA fish consumption criteria for 85 percent of all sample data. Cadmium exceeded NNEPA secondary human contact, fish consumption, and livestock criteria for eight percent of all samples. NNEPA acute aquatic and wildlife habitat criteria for cadmium, copper, mercury, selenium, and zinc were exceeded for 100, 25, 100, 85, and eight percent of all samples, respectively. Further, the median cadmium, mercury, and selenium concentrations were 1.2, 300, and 3 times greater than NNEPA chronic aquatic and wildlife habitat standards. All other median values were below all criteria indicating that the criteria exceedances were generally more characteristic of the high variability in the dataset compared to the general water quality (OSMRE 2012c).

A similar analysis was conducted for Chinde Wash. The watersheds include the Morgan Lake-Chaco River, Chinde Wash-Chaco River, Coal Creek-Chaco River, and Cottonwood Arroyo watersheds. The Chinde Wash and Cottonwood Arroyo Watersheds are both representative of the same hydrologic unit, and they were modeled directly in the Probable Hydraulic Consequences (OSMRE 2012c). Four monitoring stations within the Chinde Wash provided data for the analysis, two upstream of the mine and two downstream. However, both upstream stations are located downstream of NAPI activities, and therefore, are subject to direct and indirect NAPI influences. The downstream data were found to have slightly higher variability relative to the baseline data where the median percent relative standard deviation for all constituents was 100 percent compared to 85 percent. The NNEPA fish consumption criterion was not exceeded for any samples, but the acute aquatic and wildlife habitat criteria were exceeded for cadmium, chromium, selenium, silver, and zinc for 4, 100, 1, 2, and 60 percent of all samples, respectively. Lead exceeded the NNEPA secondary human contact standard for 4 percent of all samples. Livestock criteria for boron, chloride, selenium, sulfate, and TDS were exceeded for 0.5, 5, 23,

0.5, and 6 percent of all samples. All other median values were below established criteria, indicating that exceedances were generally more characteristic of high variability in the dataset rather than indicative of the general water quality (OSMRE 2012c).

Water Use

BBNMC holds New Mexico Office of the State Engineer Permit Number 2838 and associated groundwater Permit Number SJ-2917, which provides NTEC a total diversionary right of 51,600 acre-feet annually, with a consumptive right of 39,000 acre-feet annually, for waters drawn from the San Juan River. The diversions under the water rights are the sources of water for Morgan Lake and for the water supplies used by NTEC for mining, coal processing, and reclamation operations, and by APS for FCPP operations. Flow in the Chaco River is ephemeral, except for releases of water from Morgan Lake that provide perennial flow in the Chaco River downstream of the discharge point in the lower, northern reaches of the watershed near its confluence with the San Juan River.

Based on monthly reports submitted to the New Mexico Water Rights Division, BNCC used approximately 301 acre-feet of water per year for dust control purposes and 340 acre-feet of water per year for irrigation of reclaimed areas in 2011 (BNCC 2012d). The previous year, water use was approximately double with 633 acre-feet used for dust control and 1,166 acre-feet for irrigation (BNCC 2011b).

Surface water within the Navajo Mine and Pinabete Permit Areas is not used for drinking water by humans, or for irrigation, but has been used for livestock watering.

Four Corners Power Plant

The site of the primary FCPP facilities (Units 1-5 and associated facilities and parking lots) is a generally paved area, graded locally to surface inlets and catch basins and eventually to the discharge canal. The low-volume wastewater facility collects, treats, and disposes of surface water runoff and wastewater resulting from the operation of Units 4 and 5. Types of wastewater include chemical and oily wastewater, process wastewater, and ash-handling wastewater. More information regarding wastewater handling can be found in the Hazardous and Solid Waste Section (Section 4.15).

Outside of the area described above, the remaining portions of the FCPP lease area are unpaved and consist of Morgan Lake, the ash disposal areas, and other open, undeveloped areas. Morgan Lake, located within the FCPP lease and directly to the west of the FCPP, is a man-made lake built to support the FCPP. Water for Morgan Lake is drawn from the San Juan River, which is approximately 2.5 miles away. The lake encompasses 1,287 surface acres and has a capacity of 39,000 acre-feet of water. Built in 1961, Morgan Lake was constructed to supply water to mining and power generation activities.

A delineation of wetlands and waters of the US was conducted in the existing and proposed DFADAs in April 2012. The purpose of the delineation was to determine the jurisdiction of wetlands and drainages in the ROI under CWA Section 404. Per joint USACE and EPA guidance regarding jurisdictional determinations (dated June 5, 2007), for potentially isolated waters of the US, or non-navigable tributaries, USACE and EPA are required to coordinate on the jurisdictional determination decision. As such, the USACE prepares the initial jurisdictional determination and submits it to the regional EPA office. The agencies will coordinate and attempt to resolve any jurisdictional delineation issues at the local level within 15 calendar days after EPA's receipt of the form. EPA may notify the USACE at any time within the 15-day period that it does not intend to provide comments on a particular draft jurisdictional delineation. Within these 15 calendar days, the EPA regional office may elect to elevate the review to their Regional Administrator. If the review is elevated, the Regional Administrator has 10 days to resolve the issue. The agencies will then prepare a mutual decision document for the jurisdictional determination (USACE and EPA 2007). Accordingly, the USACE, in coordination with the EPA, has reviewed the FCPP delineation report and concurs with its findings (USACE 2013). A brief summary of the delineation findings is provided below.

The Chaco River, which flows south to north just west of the proposed DFADA, is identified as a perennial river by the National Hydrography Dataset; however, the portion of the river in the ROI was field verified as intermittent. Typical flow characteristics of this section of the river vary from low to no discharge (dry channel) to peak discharge after intense rain events, followed by a recession to low discharge over several hours. In contrast, irrigation return flows from NAPI lands and discharge from Morgan Lake consistently lend to perennially wet conditions in the portion of the Chaco River near its confluence with the San Juan River. Approximately 1.7 acres of the Chaco River was delineated within the survey area (APS 2012b).

In addition to the Chaco River, three ephemeral drainages are located near the center of the proposed DFADAs (Drainages 11, 12, and 13 on Figure 4.5-7). No bed, bank, or ordinary high water mark was observed within the segments of these three drainages within the proposed DFADAs; therefore, these segments of the drainages were determined to not be jurisdictional under CWA Section 404 (AECOM 2012b).

Other surface water areas within the FCPP lease area include, the proposed surge pond area, the lined impoundment that would be constructed to capture generated FGD waste and historic ash seepage intercept water that is currently used as a staging area for piping and other equipment. A concrete v-ditch along the perimeter conveys slurry waste to the disposal ponds below. The area of the proposed surge pond is 9.4 acres and has no vegetation cover. The delineation determined that the v-ditch is not a jurisdictional Water of the US (AECOM 2012b).

Three potential wetland areas were surveyed within the ROI. One 0.07-acre wetland was observed along the base of the existing southwestern detention pond along Drainage 10. The wetland drains into a concrete-lined detention pond downstream at the pump house. The wetland is located along a non-jurisdictional ephemeral drainage and is considered isolated due to lack of connectivity with the Chaco River. Therefore, this wetland is considered non-jurisdictional. Two additional wetlands were observed adjacent to the ordinary high water mark of the Chaco River within the ROI. The wetlands are characterized as seeps and are approximately 0.02 and 0.09 acre in size, respectively. Based on their location adjacent to the Chaco River, both wetlands are considered jurisdictional (AECOM 2012b).

Water Quality

The NNEPA (2008) has identified designated uses of Morgan Lake to include primary and secondary human contact, fish consumption, aquatic and wildlife habitat, and livestock watering. The NNEPA conducted water quality sampling of Morgan Lake in 2002, 2006, 2008, 2009, and 2010. The sampling included field parameters (temperature, pH, dissolved oxygen, TDS, and salinity) as well as laboratory analysis for metals and nutrients. With regard to field parameters, data for all years collected was similar. Temperature ranged between 32 and 33 degrees Celsius at the surface with little change with depth for all years. The only year with any noticeable change in temperature with depth was 2008, which was 33.5 degrees at the surface and decreased to 25 degrees at approximately 23 meters below surface. Similarly, pH for all years ranged between 8.3 and 8.6 at the surface and 7 and 7.5 at depth. The largest range between sampling events appeared for dissolved oxygen which ranged between 59 and 87 percent saturation at the surface and decreased to 0 to 8 percent saturation at depth. For all years, a steep decrease in dissolved oxygen levels began at 12 to 14 meters below surface. TDS levels varied year to year. In 2002 and 2010, TDS levels were between 725 and 750 mg/L. In 2006 and 2008, TDS concentration was approximately 825 mg/L. While in 2009, the concentration of TDS averaged 1,000 mg/L.

APS and NNEPA also collected samples for metals and nutrients between 2003 and 2010. Figure 4.5-8 displays the results of sampling for those parameters that were detected in comparison to Navajo Nation Water Quality Standard for Aquatic and Wildlife Habitat and Secondary Fish Consumption.

Water quality data for samples collected in the Chaco River both upstream and downstream of the FCPP discharge location were also available (see Figure 4.5-9). Samples were collected between October 2008

and August 2009. An independent comparison of the upstream and downstream sample data (APS 2013) was conducted and found no statistically significant difference between the sample sets for any of the constituents tested.

Designated uses of the Chaco River include aquatic and wildlife habitat, livestock watering, fish consumption, and secondary human contact. No reaches of Chaco River are defined as a drinking water source. The concentration of chemical constituents varies according to the sediment load in the river. For example, the total aluminum concentrations at the upstream station varied from 0.44 to 613 mg/L with a median concentration of 2.98 mg/L. The dissolved concentrations for the same location varied from 0.12 to 0.53 mg/L. Aluminum is found within the natural clays in the area; therefore, it is likely that instances of high aluminum in the samples are indicative of high sediment load in the river. The high concentrations of aluminum also correspond with high TDS in the river, further indicating the correlation between sediment loading and aluminum concentration (APS 2013). A comparison of the sample results indicates that aluminum exceeded the Navajo Nation standard for aquatic and wildlife habitat (both acute and chronic) in all upstream samples and all but two of the downstream samples. The lead standard for livestock watering was exceeded on two occasions (the same date for both upstream and downstream samples). The standard for aquatic and wildlife habitat for lead is dependent on the hardness value at the time of sampling. A comparison of the sample data found that the average standard for lead was 3.74 mg/L and all samples, both upstream and downstream, were well below this limit. The chronic aquatic and wildlife habitat standard for mercury was exceeded in all samples, while the acute standard was exceed only in two upstream samples and three downstream samples over the monitored period. The results for all other constituents were met Navajo Nation standards over the entire monitoring period (APS 2013).

Water Use

The main uses of water for the FCPP are for heat transfer in the primary cooling systems, for steam production in the turbine systems, and as cooling water for the condenser cooling system. Water supply for the power plant comes from Morgan Lake which draws water from the San Juan River. The power plant's San Juan River water rights were confirmed in the late 1990s in an adjudication of the Navajo Nation's San Juan River water rights. Water is fed from the river to man-made Morgan Lake, adjacent to the FCPP. Water is then directed to a water treatment plant where it is treated in a lime/soda water softener to reduce the overall dissolved solids. From the treatment plant, the water is moved to cooling ponds, and then enters the on-site closed loop circulating water system. Oil-free power plant wastewater is drained to the circulating water discharge canal and released back into Morgan Lake. Water discharged into Morgan Lake is typically around 40.5°C (105° F). Water from Morgan Lake is released via canal into Chaco Wash, which flows back into the San Juan River.

The circulating water system provides cooling water flow through the condensers and provides water for ash sluicing. The water comes from the cooling pond through an intake canal extending from the canal feeding the other three units. The canal is an unlined earth channel designed to sustain a flow of 1,850 cubic feet per second (cfs) for the two units at a velocity of three feet per second at a 5,327.5-foot low water elevation. The concrete intake structure has four wells for four vertical, half-capacity, mixed flow pumps, each rated at 206,000 gpm.

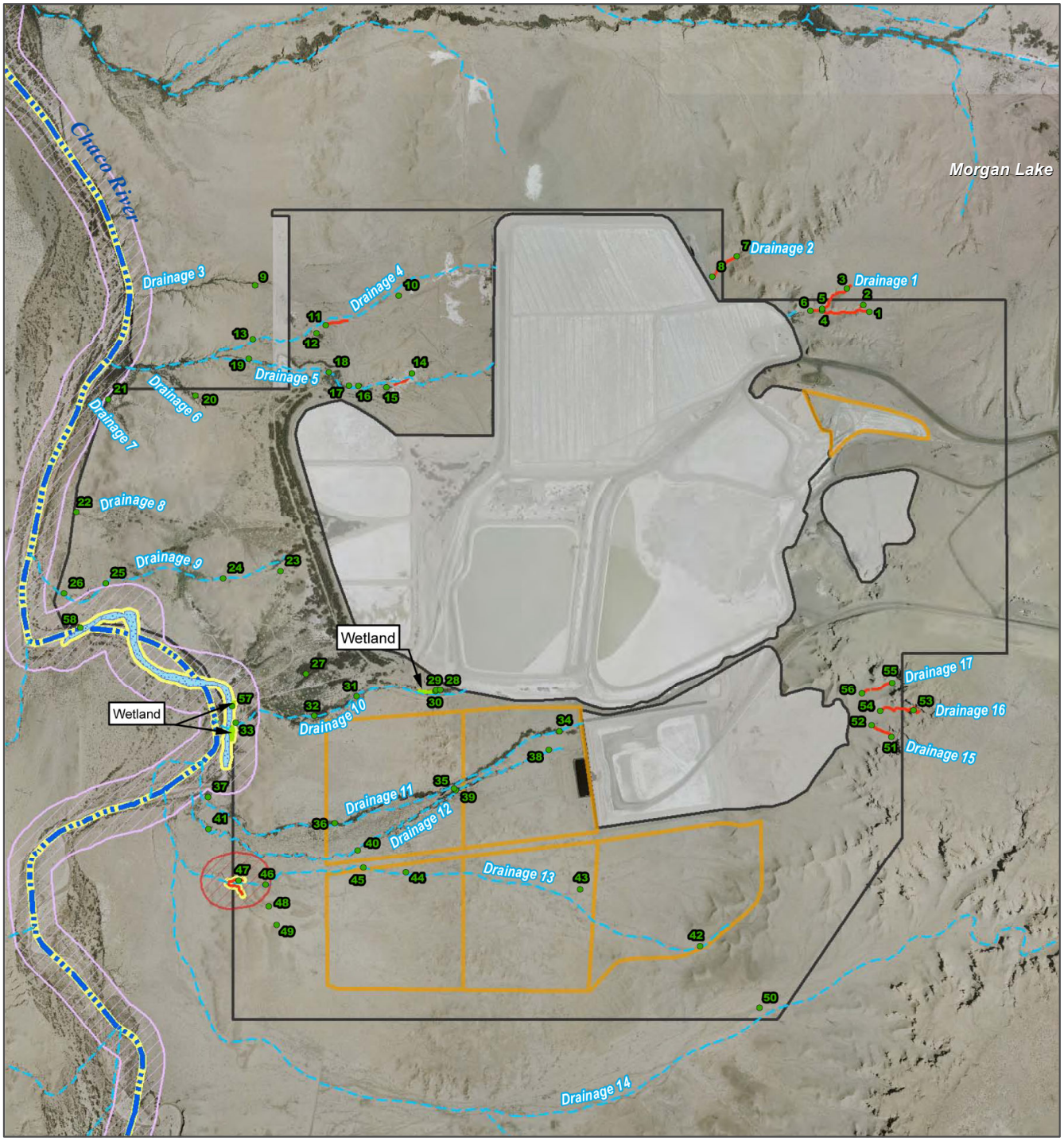

Figure 4.5-7

Jurisdictional Waters of the US
in the Vicinity of the FCPP
Proposed Ash Disposal Facility

- GPS Survey Point (#)
- Wetland
- Chaco River OHWM
- Ephemeral
- Intermittent
- Ordinary High Water Mark Observed*
- Jurisdictional (highlighted)
- Waters of the U.S. Delineation Boundary
- Existing Fly Ash Disposal Facilities
- Proposed Fly Ash Facility
- Chaco River Avoidance Area
- Avoidance Area

*Observed Ordinary High Water Mark without jurisdiction is considered isolated.

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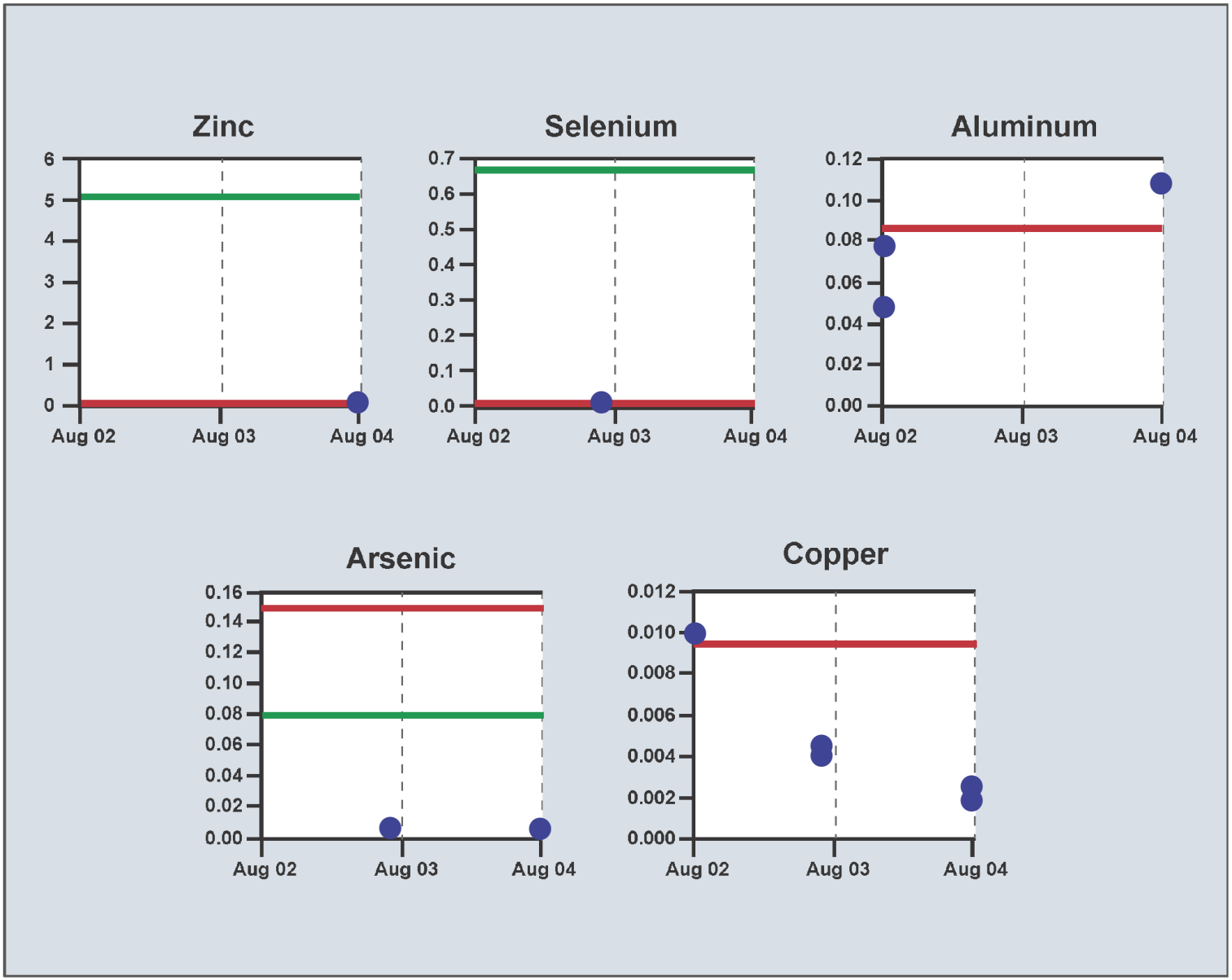

Aquatic & Wildlife Habitat
Fish Consumption
Sampling Point

All units are measured in mg/L

Figure 4.5-8
Comparison of
Morgan Lake Sampling
to Navajo Nation Standards

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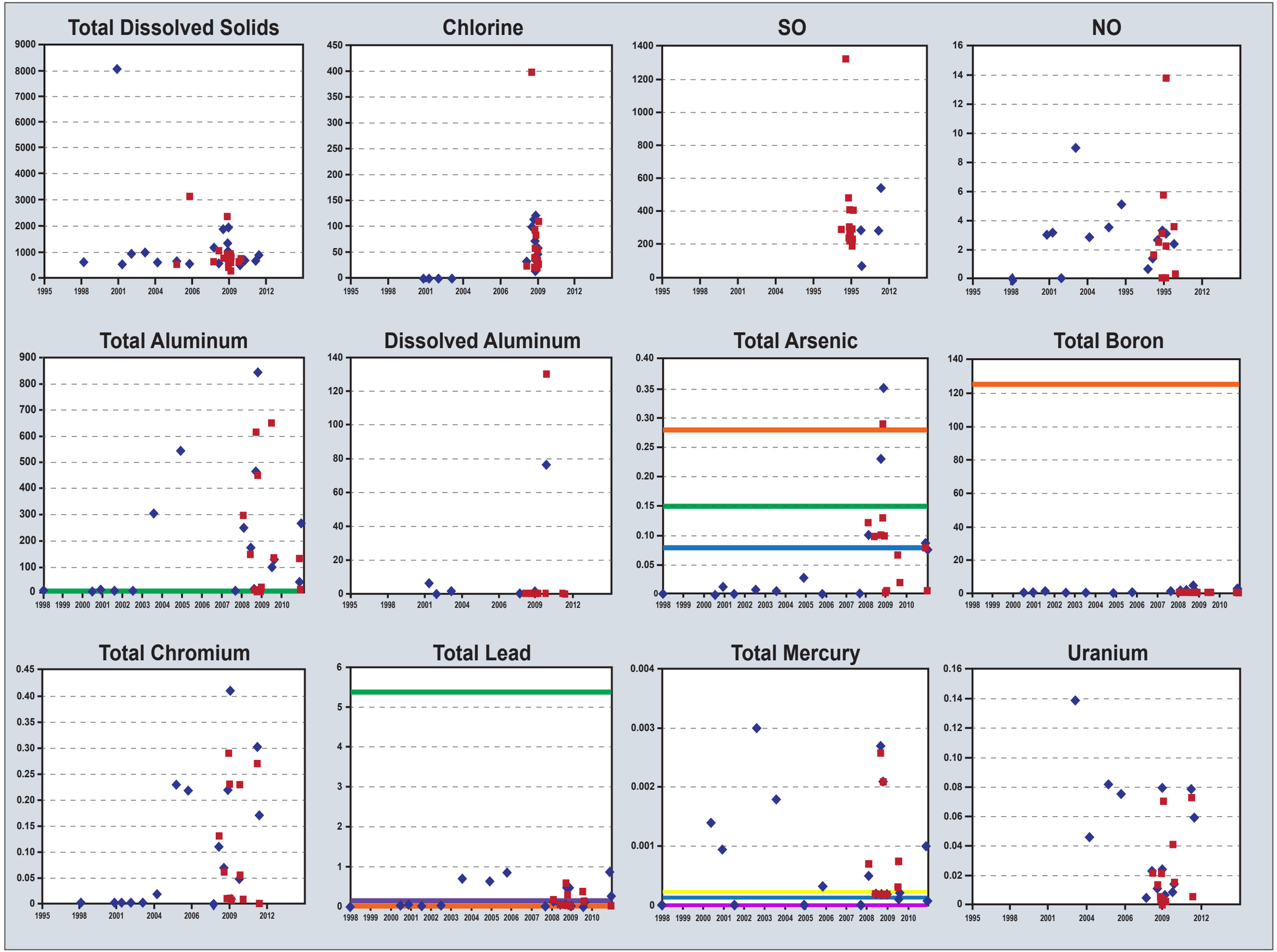
Figure 4.5-9

Chaco River Water Quality in the Vicinity of the FCPP



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Transmission Lines

With the exception of the FCPP to San Juan Generating Station line, which only crosses the San Juan River, the associated existing transmission lines and associated ROWs cross numerous surface water features as displayed in Table 4.5-10 and shown on the regional surface water features map (Figure 4.5-2).

Table 4.5-10 Surface Waters that Intersect with the Subject Transmission Lines

FCPP-Moenkopi	FCPP-Cholla	FCPP-West Mesa
Shiprock Wash	Sanostee Wash	Gallegos Canyon
Little Shiprock Wash	Tocito Wash	Alamo Wash
Lukachukai Wash	Kinlichee Creek	Kimdeto Wash
Agua Sal Wash	Canyon de Chelly	Betonnie Tsosie Wash
Sheep Dip Creek	Lone Tule Wash	Escavada Wash
Chinde Wash	Pueblo Colorado Wash	De na-zin Wash
Polacca Wash	Little Colorado River	Canada Alemita
Wepo Wash		Chaco Wash
Oraibi Wash		Torreon Wash
Dinnebito Wash		San Isidro Wash
Ha Ho No Geh Canyon		Rio Puerco Creek
Little Colorado River		Arroyo de las Calabacillas
Tappan Wash		Numerous unnamed creeks, washes, and arroyos

4.5.3 Changes to Water Resources/Hydrology Affected Environment Post-2014

Two completed Federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions, and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed Federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Action are compared in the following section. Neither of these completed Federal actions would change the affected environment for water resources/hydrology.

4.5.4 Environmental Consequences

This section provides an analysis of potential environmental effects on groundwater and surface water resources (including waters of the US) that could occur under each of the Project alternatives. Information on existing water resources was used as the baseline to measure and identify potential impacts from the Proposed Action and alternatives. The primary focus of this impact assessment is to predict the effects of the Project alternatives on the prevailing hydrologic balance with respect to the quality and quantity of surface water and groundwater systems. The impact assessment considers the severity of potential direct and indirect impacts as well as the geographic extent, duration, and overall context of potential impacts. Magnitude of impacts to water resources (both surface water and groundwater) are determined by the following criteria:

- *Major.* Adverse impacts: effects that would likely result in a violation of water-quality standards (e.g., NPDES permit limits or NNEPA Surface Water Quality Standards for Beneficial Uses) or that economically, technically, or legally eliminate use of the resource. Beneficial impacts: those

that would improve water quality or contribute to or restore water resources capability to the region, such as to greatly increase the potential for human or ecological use.

- *Moderate.* Effects that are outside of the random fluctuations of natural processes but do not cause a significant loss of the use of the resource. Moderate beneficial impacts would simply extend the beneficial use beyond natural variations about the current mean value.
- *Minor.* Changes that would affect the quantity or quality but not the use of water or are similar to those caused by random fluctuations in natural processes.
- *Negligible.* Impacts of lesser magnitude, but still predictable under current technology (e.g., computer models) or measurable under commonly employed monitoring technology.
- *None.* Effects that are not discerned or cannot be measured.

The assessment of impacts related to the Navajo Mine (both during mining and after reclamation) builds on the baseline hydrologic and geologic information contained in the Navajo Mine Permit (NM003F), Pinabete Permit Application (BNCC 2012a), the Cumulative Hydrologic Impact Assessment of the Navajo Mine (OSMRE 2012c), and observations of hydrologic consequences of mining at the adjacent areas of the Navajo Mine. This impact assessment also couples those data with detailed SEDCAD™ 4 (SEDCAD) modeling of surface flows, sediment yields, spoil leaching test results, and groundwater flow and chemical transport modeling, to develop projections about potential hydrologic impacts in the Pinabete Permit Area. SEDCAD is 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. The impact assessment from past mining relied upon relevant published and unpublished reports and papers, experience from past mining, reclamation operations at Navajo Mine and other mines located along the western rim of the San Juan Basin, observations made by BNCC staff during day-to-day operations of the mine, and surface water and groundwater monitoring performed in conjunction with historic, ongoing mining, and reclamation activities at Navajo Mine.

The analysis of potential impacts to groundwater from FCPP operations is based on a qualitative assessment of water use at the power plant and a statistical analysis (Mann-Kendall Test) of groundwater movement beneath the DFADAs. The impact assessment relies upon limited groundwater monitoring and site characterization, as well as information on groundwater use and hydrogeology at the FCPP lease site provided by APS. The analysis of potential impacts to surface water from FCPP operations are based on a qualitative assessment of water use at the power plant as well as the incorporation of the results of air deposition modeling conducted by EPRI.

The analysis of potential impacts to water quality is based on a comparison of water quality monitoring data at the FCPP and Navajo Mine to NNEPA standards. These standards, although not applicable to the FCPP, provide a consistent metric against which to evaluate potential changes to water quality as a result of the project alternatives.

The impact analysis of continued operation of the subject transmission lines is a qualitative assessment of potential effects of ongoing maintenance activities to water quality. No impacts to surface water hydrology would occur as a result of continued operation of the transmission lines because operation of the transmission lines would not involve water use or require any surface water diversions; therefore, these effects are not discussed within the analysis.

4.5.4.1 Alternative A – Proposed Action

Navajo Mine

Groundwater

The analysis below is separated into two discussions. The first addresses potential impacts to groundwater quantity and the second addresses potential impacts to groundwater quality.

Groundwater Quantity Impacts

The primary groundwater impact due to mining operations would be the loss of the coal-seam aquifers within the Fruitland Formation. Mining the coal would remove the portion of the aquifer supported by the coal seam and any permeable interburden. The amount of groundwater encountered during the proposed mining is expected to be limited based on prior mining operations at the Navajo Mine and observations at existing monitoring wells. No water supply wells are located in the Fruitland Formation within the ROI. Additionally, the projected drawdown during mining would not affect any existing or anticipated future use based on drawdowns from the modeling simulations. The projected drawdown in the Pictured Cliffs Sandstone would not be expected to affect any existing or anticipated future use; therefore, impacts to coal seam aquifers would be considered negligible (BNCC 2012a).

Drawdown in the Fruitland Formation could result in the subsequent groundwater drawdown in the alluvium in areas where the saturated Fruitland Formation is hydraulically connected to the alluvium. Locations may exist in Cottonwood Arroyo where drawdown could occur as a result of the proposed mining. This drawdown would likely be along the South Fork of Cottonwood Arroyo and would be short-term as precipitation and surface flow events would recharge the groundwater within the Cottonwood Arroyo once mining operations cease. Two livestock wells, W-0618 and QACW-2, could be affected by a reduction in flow, but because the water quality exceeds livestock criteria, neither well is used for livestock watering.

As discussed in the Environmental Setting, there is limited water of suitable quality and quantity in the proposed mine areas. Proposed mining would be expected to result in limited drawdown of groundwater within the Pinabete Arroyo alluvium based on BNCC surveys of nested wells and the location of perched groundwater in the alluvium. Existing water use of the Chaco River alluvium is limited and based on drawdown modeling conducted by BNCC, groundwater in the Chaco River alluvium would not be affected by mining, as it is beyond the projected drawdown of water levels in the Fruitland Formation expected to occur as a result of mining (BNCC 2012a).

The post-mine groundwater gradients are predicted to change slightly from an overall northeastern gradient to a northwest gradient flowing towards the Cottonwood Arroyo. Based on a review of the model input parameters and results, impacts to groundwater flow within the permit area would be expected to be moderate due to the long rate of groundwater recovery (OSMRE 2012c). Mining and reclamation activities in the ROI would not adversely impact the groundwater recharge capacity of the disturbed area, as the pits are replaced with unconsolidated backfill material. BNCC modeled the post-reclamation recharge rate for the Pinabete Permit Area as approximately 0.04 inch per year, about twice the modeled pre-mine groundwater recharge rate. The pre-mine groundwater recharge rate estimated by Stone et al. (1983) for undisturbed areas at Navajo Mine ranged from 0.002 to 0.09 inch per year. Once water levels rise sufficiently in the mine backfill, groundwater would flow at a slow rate from the backfill into the lower coal seams of the Fruitland Formation, into the Pictured Cliffs Sandstone, and toward the topographic lows along the alluvial channels of Cottonwood Arroyo. NTEC would use unconsolidated backfill material, which has a higher hydraulic conductivity than the undisturbed formation (i.e. the backfill would be less compact than the undisturbed formation and allow for quicker recharge of the aquifer). It is anticipated that the recharge rate would approximately double the historic rate (0.04 inch per year).

BNCC developed a groundwater monitoring plan, which NTEC will implement as part of its SMCRA application, to monitor changes in the quantity of the groundwater resource during mining and subsequent

reclamation. The monitoring plan will collect groundwater information from specified hydrogeologic units (coal seams from Fruitland Formation, PCS, and alluvium of the Chaco River, Cottonwood Arroyo, and Pinabete Arroyo) as well as backfill locations. The goal of the monitoring plan is to collect data on groundwater quality and quantity to monitor any changes that may occur as a result of mining and reclamation such that if changes are detected mining and reclamation operations can be adjusted and BMPs installed to prevent adverse effects (BNCC 2012a). However, based on the lack of usable groundwater (both quality and quantity), no adverse effects are anticipated to result from mining or reclamation operations. Any impacts would be minor.

Potential use of groundwater, (i.e., livestock needs) within and adjacent to the ROI is limited, due to low permeability, low yield, and poor water quality; therefore, the potential future use of groundwater in the reclaimed area would be negligible due to the low yield and poor water quality.

Groundwater Quality Impacts

It is expected that mining operations may slightly alter groundwater quality; however, water quality studies of the few coal-seam aquifers at Navajo Mine indicate that the water available is of limited quantity and of poor water quality, with TDS up to 17,800 parts per million (Thorn 1993).

Consequently, the coal-seam aquifers are not currently used for drinking or other domestic purposes. Based on water quality data collected, some of these aquifers meet Navajo Nation standards for irrigation or other nondrinking water uses; however, alternate sources of higher quality water (e.g., Chaco River) can accommodate the current projected demand in the area.

Modeling conducted to assess the impact of historic CCR placement near alluvial systems showed it is unlikely that any detrimental future effect will occur from past CCR placement. This is due to very slow groundwater movement and the attenuation of contaminates of concern as they percolate through the subsurface. Therefore, impacts to groundwater from historic placement of CCR are negligible (OSMRE 2012c). Past mitigation efforts included reclamation of approximate original contour, mining limited in ephemeral channels, mixing of overburden/ backfill materials, and proper material classification and handling procedures (OSMRE 2012c). As shown in Table 4.5-5, a comparison of monitoring data from wells within the areas of CCR placement to the baseline Fruitland coals (see Figure 4.5-2) showed a negligible impact for chloride; minor impacts for conductivity and manganese; moderate impacts for total iron and TDS; and major impacts for pH, boron, selenium, fluoride and sulfate. While the median pH and concentrations of selenium values met the criteria for livestock watering. The median concentrations for boron, fluoride, sulfate, and TDS exceeded livestock criteria. Therefore, groundwater beneath the reclamation areas is considered to be of concern relative to baseline and livestock criteria for boron, fluoride, sulfate and TDS.

While high levels of chemical constituents of concern exist within the wells in the historic mining area, there are no current economic uses of the Fruitland Formation in or adjacent to this area and no foreseeable uses other than oil and gas extraction. In order for disposal areas to have a major impact, CCR leachate would need to have sufficient mobility to reach alluvial strata within the vicinity of the historic disposal sites at high concentrations. A simple advection/dispersion modeling exercise was conducted to assess the impact of historic CCR placement relative to nearby alluvial systems, which could impact current and reasonably foreseeable uses. Modeling showed that it is unlikely that any major future effects would ensue from the CCR placement at the Navajo Mine because of the very slow groundwater movement and the likely attenuation of contaminants of concern as they migrate through the subsurface (OSMRE 2012c). Based on this analysis the potential impacts to current and future water uses from CCR placement at the Navajo Mine are minor.

With regard to potential impacts of continued operations of the mine, changes to groundwater quality beyond the ROI would be minimal during mining and reclamation operations. Since groundwater flow would be in the direction of the mining pits, little change to groundwater quality would be expected beyond

the mining pit limits during mining operations. The impacts to water quality due to mine backfilling were determined through leaching tests.

The test results for spoil leached with coal seam water are believed to provide the best estimates for the groundwater source concentrations for long-term post-reclamation transport modeling. Based on the leaching test results, the concentrations of sulfate, calcium, magnesium, sodium, TDS, boron, and manganese would be expected to initially increase in surface water infiltration or groundwater as they saturate mine spoils. Fluoride, sulfate, and TDS concentrations were above the livestock water criteria in background groundwater collected from the Pictured Cliffs Sandstone, alluvial deposits, and the Fruitland Formation. The groundwater yields from wells completed in the Fruitland Formation and in the Pictured Cliffs Sandstone, which underlies the Fruitland Formation, are quite low and wells are typically pumped dry during testing and well purging for sampling. Also, the water quality in the Pictured Cliffs Sandstone and Fruitland Formation is poor and is generally unsuitable for domestic or livestock use (BNCC 2012a). In summary, groundwater in the mine spoils, after reclamation, is predicted to have higher TDS concentrations than the pre-mine Fruitland Formation and Cottonwood Arroyo alluvium. However, the TDS concentrations in the alluvium of Cottonwood Arroyo are not expected to increase substantially as a result of mining because the contribution from spoil water is much smaller than the contribution from alluvial recharge and up-gradient alluvial flows.

The groundwater FEFLOW flow model was also used to quantify groundwater impacts due to the mining and reclamation operations for the chemical transport simulations. The transport model simulated the TDS migration from the mine spoil backfill. The results from the leaching tests were used as the groundwater source concentrations for the transport modeling. The primary factor controlling the fate and transport of water in mine spoils is the extremely low rate of flow from the mine backfill that would occur as a result of the low recharge rates and low hydraulic conductivity of the mine backfill. Based on these results, mining is estimated to have little effect on the long-term post-reclamation TDS concentrations in the groundwater within the Pictured Cliffs Sandstone and the Cottonwood Arroyo alluvium down-gradient of the mine areas.

With the implementation of this alternative, groundwater beneath mine spoils is expected to have higher concentrations of TDS and sulfate than the pre-mine Fruitland Formation coal seams. This water would contribute to higher TDS and sulfate concentrations in the Cottonwood Arroyo alluvium. However, any increase in the post-reclamation concentrations of TDS and sulfate or in the trace constituents of aluminum, boron, iron, and manganese in the Cottonwood Arroyo alluvium are estimated to be minor and within the variation measured baseline concentrations of these constituents in alluvial monitoring wells. This increase however, is not expected to materially affect the suitability of the alluvial groundwater for livestock use. As stated previously, the Cottonwood Arroyo alluvium is an unreliable supply for stock water because the quality is a poor source for livestock supply due to high TDS and sulfate concentrations (BNCC 2012a).

Therefore, impact to groundwater due to a potential increase in TDS in the Cottonwood Arroyo alluvium is minor due existing poor groundwater quality (above recommended livestock use criteria) and limited water quantity.

The modeling results for the TDS transport in the Pictured Cliffs Sandstone show that the primary direction of TDS migration from the mine spoils is vertically into the Pictured Cliffs Sandstone. This direction signifies the migration is moving into a water-bearing zone that has TDS concentrations similar to, if not higher than, the TDS levels expected from the spoil water. Groundwater flow and TDS transport in the Pictured Cliffs Sandstone then flows toward the alluvium and topographic lows along Cottonwood Arroyo. Transport to the north and east is limited.

Surface Water Quality

Several recharge mechanisms influence surface water quality within the Navajo Mine Lease Area. Precipitation and NAPI discharges generate runoff in the ephemeral washes, entraining sands, silts, and clays, inducing elevated concentrations of total suspended solids. The elevated total suspended solid concentrations influence the chemical composition of the surface water. Active mining and reclamation involve use of a number of activities that could potentially affect surface water quality, including topdressing removal; overburden drilling, storage, and stripping; pits; spoil rows or piles; regraded spoils; and primary/final regrading of the last spoil row. Ground disturbance associated with construction, mining, and reclamation also has the potential to increase sediments carried by stormwater during or after a rain event. Interaction between stormwater runoff and newly exposed overburden, interburden, coals, and mine spoils may result in increases in contaminants in surface runoff. The largest source of potential runoff from the proposed mining operation is stormwater.

In accordance with OSMRE, EPA, and NNEPA regulations for surface water discharges, no surface water from disturbed areas is permitted to commingle with stormwater and discharge offsite without an NPDES permit. As described in Section 4.5.1, discharges from disturbed areas would occur only after the area is adequately reclaimed (i.e., area is regraded to approved topography, topsoil replaced, and area is revegetated) and the operator has demonstrated using established models (e.g., SEDCAD) that post-mine sediment yields would vary slightly from pre-mine levels (in the instance of Pinabete Arroyo and South Fork Cottonwood Arroyo, post-mine yields would be greater than pre-mine yields), although NPDES Regulations (40 CFR 434 Subpart H) require that post-mine yields are equal to or less than pre-mine levels. Variation in sediment yield is dependent on amount and duration of the rain event in the disturbed area. Table 4.5-11 compares sediment yield variations of the pre-mine with mine operations and post-reclamation in the Pinabete Arroyo, Cottonwood Arroyo, and the Unnamed Tributary to the Chaco River.

NTEC would implement a Sediment Control Plan to help minimize sediment loss from water and wind erosion. The Plan includes such methods as, stabilizing stockpiles by mulching and seeding, retaining sediment in disturbed areas using berms, sumps, or sediment ponds to capture runoff. The primary control measure to decrease sediment runoff would be the use of sedimentation ponds. Sedimentation ponds are designed to retain the surface runoff and sediment from either the 100yr-6hr or 10yr-24hr storm event. There would be no discharge onto undisturbed areas or beyond the permit area from precipitation events up to and including the 10yr-24hr event. All discharges from the disturbed areas would be covered under an NPDES permit where required. MMCo would acquire general NPDES stormwater permits as applicable, such as the MSGP under Sector H for coal mining (i.e., haul roads and access roads). Professional Engineers would design and certify that sedimentation ponds would contain runoff from a 100-year, 6-hour or 10-year, 24-hour storm event. Should discharges occur from these ponds, they would be subject to the applicable NPDES discharge effluent limitations of MSGP Subpart H. The watershed areas for the NPDES individual permit outfall points and sediment control structures are presented in Table 4.5-11.

Ponds 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, and 426 are sediment ponds, within the proposed Pinabete permit area, that would retain the surface runoff and sediment from the disturbed area associated with current and proposed mining and reclamation operations. Berms, v-ditches, or channels would be used to divert flows from the disturbed areas into the ponds. Retaining the effluent or surface runoff from the disturbed areas in the pond for evaporation would ensure compliance with the applicable effluent standards set forth in the NPDES permit.

Pond 427 is a sediment pond located at NPDES Outfall #12 that would retain the surface runoff and sediment from the disturbed area associated with proposed Topdressing Stockpile TS-404. Pond 428 is a sediment pond located at NPDES Outfall #14 that would retain the surface runoff and sediment from the disturbed area associated with future Topdressing Stockpile TS-406. A perimeter berm adjacent to the toe of each stockpile would divert flows from the stockpile area to the respective pond. Retaining the surface runoff from the disturbed areas in the pond for evaporation would ensure compliance with the applicable effluent standards.

Table 4.5-11 NPDES Outfall Points and Sediment Control Measures

Watershed ID	NPDES Outfall Point ID	Watershed Area (acres)	Disturbed Area (acres)	Disturbance Type	Type of Control Measure	Structure ID
Area IV North Pond 415	NPDES Outfall #1	5.6	5.6	Disturbed area surface drainage	Sedimentation Pond	Pond 415
Area IV North Pond 416	NPDES Outfall #2	128.1	128.1	Disturbed area surface drainage	Sedimentation Pond	Pond 416
Area IV North Pond 417	NPDES Outfall #3	261.8	261.8	Disturbed area surface drainage	Sedimentation Pond	Pond 417
Area IV North Pond 418	NPDES Outfall #4	233.5	233.5	Disturbed area surface drainage	Sedimentation Pond	Pond 418
Area IV North Pond 419	NPDES Outfall #5	199.3	199.3	Disturbed area surface drainage	Sedimentation Pond	Pond 419
Area IV North Pond 420	NPDES Outfall #6	387.4	387.4	Disturbed area surface drainage	Sedimentation Pond	Pond 420
Area IV North Pond 421	NPDES Outfall #7	148.8	148.8	Disturbed area surface drainage	Sedimentation Pond	Pond 421
Area IV South Pond 422	NPDES Outfall #8	476.7	464.3	Disturbed area surface drainage	Sedimentation Pond	Pond 422
Area IV South Pond 423	NPDES Outfall #9	949.3	900.3	Disturbed area surface drainage	Sedimentation Pond	Pond 423
Area IV South Pond 424	NPDES Outfall #10	45.0	45.0	Disturbed area surface drainage	Sedimentation Pond	Pond 424
Area IV South Pond 425	NPDES Outfall #11	218.2	190.4	Disturbed area surface drainage	Sedimentation Pond	Pond 425
Area IV South Pond 426	NPDES Outfall #12	81.5	70.0	Disturbed area surface drainage	Sedimentation Pond	Pond 426
Area IV South Pond 427	NPDES Outfall #13	23.1	23.1	Disturbed area surface drainage	Sedimentation Pond	TS-404 Pond 427
Area IV North Pond 428	NPDES Outfall #14	5.4	5.4	Disturbed area surface drainage	Sedimentation Pond	TS-406 Pond 428

Source: BNCC 2012a

SEDCAD modeling was performed to evaluate sediment generation under pre-mine, operational, and post-reclamation conditions for drainages traversing or intersecting the permit area. Projections on sediment yield were developed based on storm-specific flows and six parameters associated with sediment yield: soil texture, soil erodibility constants, representative slopes of overland flow within the watershed, representative lengths, cover, and management practices. Operational and pre-mine sediment yield projections from SEDCAD modeling are summarized and compared in Table 4.5-12. Results are quantified by sediment yield in tons/event.

The effects were assessed with the modeling of Pinabete Arroyo at the confluence with the Chaco River, Cottonwood Arroyo at the confluence with the Chaco River, and the unnamed tributary to Chaco River downstream of the permit boundary. As detailed in Table 4.5-12, sediment yields reaching the Chaco River from Pinabete Arroyo, Cottonwood Arroyo, and the Unnamed Tributary to Chaco River would be lower under operational conditions in comparison with the pre-mine baseline yields. In addition, the results suggest that the replacement of poor quality sodic soils with suitable topdressing materials would reduce sediment generation from pre-mine to post-reclamation levels. The exception to this appears in the Pinabete Arroyo watershed, where the additional drainage area combined with a slight increase in the slope/length factor resulted in slightly larger sediment yields.

As part of reclamation, NTEC would remove temporary post-reclamation structures. After erosion control measures sufficient to minimize the erosion rate to less than or equal to pre-mine levels have been installed, the reclamation areas would be reconnected to the native drainages that surround the permit area in accordance with SMCRA regulations. If the surface runoff from an active mining area has the potential to leave the permit area, or enter a reclaimed area downstream, a sediment pond would be constructed to retain the surface runoff and sediment. The pond would be located in either an existing drainage adjacent to the disturbed area or a reestablished drainage in the reclamation area. As reclamation progresses and drainages are reestablished, watershed sizes can increase. NTEC may need to place additional ponds in series to retain the runoff and meet 40 CFR Part 434 standards until the area can be completely reclaimed. In such cases, NTEC would submit a revision to the Reclamation Plan to OSMRE for review and approval at least 60 days prior to initiating construction activities for additional ponds. Berms may be used to prevent sediment and flows from leaving the disturbed area and to convey flows to sedimentation ponds.

As mining progresses, disturbed areas would be reclaimed as described in Chapter 2. To prevent possible degradation of the downstream reclaimed or topdressed and seeded areas, berms and ditches would remain in place as long as practicably possible during topdressing placement. Generally, berms would be removed by blending the material into the adjacent regraded spoils. In the process of removing the berms, positive drainage must be maintained in the drainage ways and on sloping surfaces. To achieve such drainage, the area or distance adjacent to the berm must be sufficient to spread and blend in the material. Therefore, as topdressing placement approaches a berm, the berm would be removed while sufficient distance still remains to spread and blend in the material. Impacts to surface water quality would be minor due to erosion control measures and adherence to SMCRA regulations.

If a large storm event were to occur, excess water accumulated in the pit would be pumped to one or more sediment ponds. The design volume of the ponds would be maintained; the pumping would be only to ponds with sufficient capacity to accommodate additional water without jeopardizing the design volume. If the ponds have no extra capacity, the water or effluent could be pumped to an existing drainage for discharge if the standards of the appropriate NPDES permit are met.

Table 4.5-12 Comparison of Sediment Yield Pre-mine with Mine Operations and Post-reclamation for Pinabete Arroyo, Cottonwood Arroyo, and Unnamed Tributary to Chaco River

SEDCAD Designation	Watershed Location	Sediment Yield (tons)				
		Area (square miles)	2yr-6hr event (0.85 inch)	10yr-6hr Event (1.28 inches)	25yr-6hr event (1.56 inches)	100yr-6hr event (2.04 inches)
Structure 7	Pinabete upstream, pre-mine	43.88	2,703	9,489	15,694	28,885
Structure 9	Pinabete at mouth, pre-mine	59.37	2,821	9,886	16,325	25,646
Structure 9	Pinabete at mouth, post-reclamation	60.25	2,847	9,923	16,470	30,085
Structure 21	South Fork Cottonwood, pre-mine	21.08	4,561	11,292	16,455	26,631
Structure 21	South Fork Cottonwood, post-reclamation	20.80	4,574	11,265	16,378	26,635
Structure 37	Cottonwood at mouth, pre-mine	80.11	10,744	27,242	40,586	67,180
Structure 37	Cottonwood at mouth, post-reclamation	78.77	10,662	26,929	40,054	66,396
Structure 1	Chaco Trib , pre-mine	0.45	158	497	788	1,380
Structure 2	Chaco Trib, post-reclamation	0.93	19	331	572	1,094

After reclamation, the following water quality changes would be anticipated:

- Sediment contribution from reclaimed areas would be likely to increase slightly in Pinabete and South Fork Cottonwood Creeks and decrease at the mouth of the Cottonwood and in the Chaco tributary relative to baseline due to the overall reduction in slopes and improvement in the permanent vegetation cover.
- Sediment contribution from channel erosion would be likely to decrease as incised unstable channels are replaced by stable channel and floodplain configurations.
- Poor quality and sodic soils would be buried within the backfill, and overland flow from the reclaimed areas would be expected to exhibit lower sodium and TDS concentrations.
- Aluminum concentrations should decline with the reduction in suspended solids associated with reduced surface and channel erosion.

A spoil testing program was conducted (i.e., Synthetic Precipitation Leaching Procedure [SPLP]) to generate the information on spoil properties and leaching characteristics. The leaching test results indicate that interaction between stormwater runoff and newly exposed overburden, interburden, coals, and mine spoils may result in increases in the concentrations of sulfate, calcium, magnesium, sodium, TDS, boron, and manganese. These constituents are expected to initially increase in surface water infiltration or groundwater as they saturate mine spoils (BNCC 2012a). However, surface runoff from disturbed areas would be retained in the mine pit, sediment ponds, or berms. Thus, potential impacts to surface water quality would be expected to be negligible in Pinabete Arroyo, Cottonwood Arroyo, and the Chaco River during mining and reclamation operations as mine water is unlikely to reach these arroyos except during extreme precipitation events that exceed the designs of the containment structures.

With regard to potential impacts of mining, including coal dust, on water quality of stock ponds, two samples were obtained in 2008 from Stevenson's Well Pond located immediately adjacent to Area IV North. The results of these samples are presented in Table 4.5-13. 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 criterion for the estimated hardness of the pond water. These results indicate that impacts to stock ponds located adjacent to active mining operations would be minor with respect to livestock use.

Table 4.5-13 Surface Water Quality at Stevenson's Well Pond

	Sample Date	
Analysis Parameter	**July 21, 2008**	**August 12, 2008**
Arsenic, T (mg/L)		<0.0025
Barium, D (mg/L)	0.208	-
Barium, T (mg/L)	-	0.1550
Bicarbonate as $CaCO_3$ (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 $CaCO_3$ (mg/L)	<10	
Chloride (mg/L)	19	-
Chromium, D (mg/L)	<0.01	<0.01
Cobalt, D (mg/L)	-	0.00030

Analysis Parameter	Sample Date	
	July 21, 2008	**August 12, 2008**
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	
TDS (mg/L)	380	-
Total suspended solids (mg/L)	9200	-
Vanadium, D (mg/L)	-	0.0064
Zinc, D (mg/L)	0.02	0.006

Source: BNCC 2012a

µS/cm = microSiemen(s) per centimeter
D = Dissolved
mg/L = milligram(s) per liter
su = standard unit(s)
T = Total

NTEC would implement BMPs to avoid and minimize water quality impacts during mining by controlling runoff and sedimentation into nearby channels, including minimization of disturbance footprints, establishment of stream buffer zones, employment of upstream diversions or highwall impoundments, use of sediment ponds, perimeter berms or containment features, and reseeding of areas prepared for reclamation as soon as practicable. NTEC would comply with SMCRA requirements and EPA NPDES permits under CWA Section 402 to control the discharge of sediment within the active mining sectors of the Pinabete and Navajo Mine permit areas. In addition, NTEC would conduct regular monitoring of surface water quantity and quality in Pinabete and Cottonwood arroyos for the duration of the permit period. Monitoring would be conducted at five stations (three historic and two new stations) and would be collected quarterly in accordance with the Surface Water Monitoring Plan submitted as part of the Pinabete Permit Application to OSMRE. Water quality monitoring results would be submitted quarterly to OSMRE. Motor fuel storage and equipment maintenance would be provided at the Navajo Mine facilities located outside of the permit area. Nevertheless, equipment repair may on occasion need to be conducted within the active mining or reclamation areas. NTEC maintains and implements a Spill Prevention, Control, and Countermeasure (SPCC) Plan that identifies areas of risk, specifies appropriate controls for bulk storage areas, identifies control strategies for managing potential spills, and lists procedures for safely disposing of any contaminated materials.

With regard to potential water quality impacts associated with the realignment of Burnham Road, no perennial water resources exist in the form of rivers, lakes, ponds, or streams within the proposed realignment of Burnham Road, nor do any wetlands or riparian habitats. However, the proposed realignment crosses six intermittent or ephemeral drainages, including Cottonwood Arroyo, with stream channels ranging from approximately one to three feet wide by approximately one foot deep. Each of the crossings would be constructed with culverts to ensure safe travel during precipitation events. Specifically, culverts would be installed where drainages cross the road. The Burnham Road crossings were designed and constructed to minimize their effect on channel flow hydraulics and sediment transport ability. Water would continue to flow past each culvert road crossing with only minimal and localized hydraulic effect. Culvert crossings would be constructed to ensure that no downstream headcutting occurred and that flow was not affected. All primary culverts would be designed to safely pass peak discharge from 10 year-6 hour event or larger and installed with erosion prevention measures (i.e. riprap at end of culvert). The culverts' length and diameter would be determined by watershed area and location. Road construction would not commence until regulatory authorities approve proposed designs (BNCC 2012a).

To control erosion, riprap would be placed in steep sloping relief and side ditches. 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. During construction activities, any spilled petroleum products would be cleaned up immediately. Should petroleum be absorbed into the soil, the stained area would be shoveled out and disposed of at an approved disposal site. Potential impacts resulting from hazardous substances spilled during construction would be negligible and short term. Overall, hydrologic and water quality impacts would be minor.

Impacts to Waters of the US

A delineation of potential waters of the US within the Pinabete Permit Area was conducted in April 2012. The survey area included approximately 10,133 acres of the Navajo Mine Lease Area. Overall 29.8 miles and 45.5 acres of waters of the US were delineated within the Pinabete Permit Area, 2.05 acres of stock ponds, as described previously. The delineation did not identify any potential wetland areas. Any mining activities that occur in jurisdictional waters of the US within the ROI would require a permit from the USACE pursuant to CWA Section 404 (33 CFR Section 320-331). Implementation of the Proposed Action would result in permanent impacts to 5.0 acres of waters of the US. Table 4.5-14 describes the impacts to waters of the US by activity. BNCC applied for an Individual Permit from the USACE, which will be transferred to MMCo. With the implementation of post-mining compensatory mitigation requirements that

would be required by the permit, impacts to waters of the US would be minimized to the extent feasible (see Section 4.5.5 for details).

Table 4.5-14 Impacts to Waters of the US by Activity

Type of Activity	Impacts to Waters of the US (acres)	Type of Disturbance
Area IV North and Area IV South Mining Activity	2.98	Permanent
Haul Roads, Light Vehicle Roads, and the Burnham Road Realignment	0.92[3]	Permanent
Transmission Line[1]	0	None
Infrastructure (Sediment and Drainage Control Ponds, Soil and Coal Stockpiles)[2]	1.1[3]	Permanent
Total	**5.0**	**Permanent**

Notes:

[1] The power line crosses four jurisdictional channels, but no poles would be placed within the ordinary high water mark and no access roads would cross the channels

[2] No buildings would be located within jurisdictional streams. Retention ponds or stockpiles could be located within jurisdictional channels.

[3] Estimated acreage of impacts to waters of the US resulting from construction of haul roads, light vehicle roads, and sediment ponds.

The NPDES General Permit for Discharges of Storm Water Runoff Associated with Industrial Activity (General Industrial Permit) regulates stormwater and non-stormwater discharges of 10 specific activities, including mining operations. Accordingly, prior to operation of the Pinabete Permit Area, MMCo would be required to obtain coverage under the General Industrial Permit. Similar to the General Construction Permit, MMCo must prepare and file a Notice of Intent with the EPA and prepare and implement a SWPPP for the operation of the mine area. MMCo would also be required to conduct monitoring to determine the amount of pollutants, if any, leaving the site. The mine would be required to amend their existing NPDES permit for potential discharges from the Pinabete Permit Area, apply for a new individual permit or apply for coverage under EPA's MSGP. For the mine to be covered under the MSGP, a Notice of Intent must be submitted to the EPA to certify that the mine meets eligibility requirements.

Realignment of Burnham Road would require greater than one (1) acre of ground disturbance; therefore, prior to implementation of the proposed construction activities, both MMCo would be required to obtain coverage under the General Construction Permit and a construction SWPPP would be prepared.

Surface Water Quantity

The primary changes in the hydrologic balance during the surface mining and reclamation operations would be changes in intermittent stream flows in Pinabete and Cottonwood arroyos that would occur as a result of the containment of surface runoff within the mine area. These changes in flow would not be expected to measurably affect the Chaco River due to the intermittent nature of tributary flows and the relatively small drainage area of the tributaries relative to the drainage area of the Chaco River. The drainage areas of Pinabete and Cottonwood arroyos represent only 1.4 and 1.8 percent, respectively, of the total Chaco River drainage basin.

Cottonwood and Pinabete arroyos would not be mined under this alternative. Mining operations would temporarily intercept precipitation runoff from the tributary drainages that flow into Cottonwood and Pinabete arroyos from the permit area. No stream diversions would be required for the Pinabete Mine Plan. The up-gradient areas that drain to the mine pits are small and would either be intercepted by the mine pit or captured in temporary pit protection ponds located up-gradient of mining. Precipitation runoff collected in the

pit or in the pit protection ponds could be used for dust suppression, other mine needs, or would naturally diminish from evaporation and seepage. Once reclamation is completed within the permit area, precipitation runoff from these reclaimed areas would flow through reclaimed channels to Cottonwood Arroyo, Pinabete Arroyo, and the unnamed tributary to the Chaco River, and then into the Chaco River.

Prior to reclamation, NTEC would contain all mine-disturbed area drainage in the mine pit or in designed runoff containment structures. The bermed containment structures and the mine pit would function to contain the runoff from a 100-year, 6-hour precipitation event or larger. During reclamation, sediment ponds would be designed to retain at a minimum the volume of runoff from a 10-year storm, for 24 hours plus additional volume for sediment storage. Sediment ponds would be used to contain and treat water until approval is obtained for use of alternative sediment controls in accordance with 40 CFR Part 434 Subpart H, which applies to alkaline mine drainage from reclamation areas, brushing and grubbing areas, topsoil stockpiling area, and regraded areas at western coal mines. It allows operations to employ alternative sediment controls that are established in accordance with a sediment control plan that is designed to prevent an increase in the average annual sediment yield from pre-mine undisturbed conditions.

Post-reclamation standards include SMCRA requirements on Indian Land for restoring the affected land (30 U.S.C. 1265), including surface area stabilization/erosion control, revegetation, creating impoundments for water quality, minimizing disturbance to original hydrologic balances, and proper disposal of mine waste products and other requirements. These measures are designed to reduce surface erosion and sediment yield. BNCC has designed the post-reclamation topography and drainages to conform to existing drainages along the mine's perimeter to safely convey water from upstream, off-lease watersheds to either Pinabete Arroyo or Cottonwood Arroyo.

SEDCAD modeling was performed to evaluate peak flows and storm volumes under pre-mine, operational, and post-reclamation conditions on Pinabete Arroyo, Cottonwood Arroyo, and the unnamed tributary to the Chaco River. This tributary is located south of Cottonwood Arroyo and north of Pinabete Arroyo and drains an area of about 0.45 square mile on the western side of the permit area. The 2-year, 10-year, 25-year, and 100-year, 6-hour events were modeled with SEDCAD. The SEDCAD modeling results are presented in Table 4.5-15. The worst-case results in this table are based on no discharge up to the flows from a 100-year, 6-hour precipitation event in the mine area.

The SEDCAD results indicate that peak flows and runoff volumes to Pinabete and Cottonwood arroyos would be reduced during operations with worst-case projections. These direct impacts would be long-term (lasting for the duration of the mining operations, yet negligible in severity, because the mine site is in a desert environment, and the Pinabete and Cottonwood arroyos are a small portion (1.4 percent and 1.8 percent respectively) of the regional Chaco watershed. Results show little difference between pre-mine conditions and post-reclamation conditions, except for the unnamed tributary to the Chaco River, where post-reclamation flows would increase due to an increase in drainage area following reclamation. However, the impact on the unnamed tributary and Chaco River would be considered negligible because the predicted change is considered to be within background levels.

During surface coal mining operations, a temporary reduction in surface water flows could occur in Pinabete and Cottonwood arroyos. Three ponds located within the permit area would also be removed by mining operations: Stevenson's Well Pond, Pond 4N/4S, and one unnamed pond located within the northwestern portion of the permit area on a tributary to Cottonwood Arroyo. Pond 4N/4S and Stevenson's Well Pond are located on tributaries to Pinabete Arroyo. No surface water right filings exist within the permit area, although livestock may occasionally use these ponds when water is available. Livestock grazing does not occur within permit area during active mining. An alternate water supply (e.g., water tanks) would be provided for any off-lease livestock grazing that has used these ponds located within the permit area.

Following reclamation, the water supplies for existing livestock use would be replaced. Additional water supplies may be available if new ponds are constructed or some of the sediment and/or drainage control

ponds are converted to permanent stock water use at the request of the Navajo Nation or local water users in accordance with the Hydrologic Reclamation Plan (BNCC 2012a). Should pond retention occur, on-channel ponds would modify the hydrograph associated with each storm event by lowering the peak flows, extending the runoff over a longer period of time, and reducing storm runoff volumes. For small runoff events, the ponds may retain all of the storm runoff from upstream. Pond reconstruction would be performed to approximate the storage capacity and surface area of the original pre-mine impoundment. Accordingly, minor changes in intermittent or ephemeral flow may occur if some of the sediment and drainage control ponds are converted to permanent replacement livestock water ponds at the request of the Navajo Nation or the local water user.

Channel Morphology

Changes in runoff or in sediment yield from watersheds affected by mining have the potential to disrupt the existing stability of receiving streams, and in extreme circumstances, cause major changes in the existing channel pattern and geometry. Sediment control systems for mining operations are typically designed to yield a sediment load below equilibrium with the natural hydraulic regime. Erosion of streambeds and banks is usually expected for a short distance downstream of any discharge point, as the stream regains geomorphic equilibrium. Sediment pond discharge structures are designed in anticipation of this behavior, and allow the water (using grade-control structures, gabion aprons, and bank stabilizers) to attain equilibrium in a gradual and nondestructive fashion.

Diversions of natural stream flow also are designed to preserve geomorphic stability and prevent uncontrolled or destructive erosion and sedimentation. Channel diversions on the Navajo Mine Lease Area are designed using quantitative hydraulic modeling programs (e.g., SEDIMOT II) that simulate the geometry required to maintain geomorphic equilibrium in a natural channel. Where not possible, specific structures (such as grade-control structures) are designed and constructed in the channel to correct the problem. As with pond discharges, these channels and structures are regularly inspected and maintained by NTEC staff and reviewed by OSMRE and tribal inspectors.

BNCC has prepared, and NTEC would implement, a Hydrologic Reclamation Plan (BNCC 2012a) for the Pinabete and Navajo Mine permit areas. These plans are predicated on the use of geomorphic principles that have been employed to create the reconstructed landforms, drainage density, and channels. Drainages and watersheds that had previously been mined or altered would be restored in accordance with the Reclamation Plan. Although many of the pre-mine channels are incised with little or no active floodplain, reclaimed channels for higher-order drainages are designed for long-term stability with a low-flow or pilot channel capable of accommodating average annual peak flows or flows from a 2-year, 6-hour event and a floodplain to contain more extreme flows, as appropriate, based on slope. Post-reclamation channels for first-order drainages are typically designed as vegetated swales. Accordingly, any impacts of the mine drainage system on natural stream patterns would be temporary and confined to the ROI. Because these variations would be far less than the natural variability of these arroyos and washes and would include a small proportion of the affected washes, the impact of the mine on the geometry, morphology, or location of the natural stream patterns is expected to be negligible post-reclamation.

Table 4.5-15 Pre-mine, Operation, and Post-reclamation Flows for Pinabete Arroyo, Cottonwood Arroyo, and Unnamed Tributary to Chaco River in Area IV North

SEDCAD Designation	Watershed Location	Area (square miles)	2-year, 6-hour Event (0.85 inch)		10-year, 6-hour Event (1.28 inches)		25-year, 6-hour Event (1.56 inches)		100-year, 6-hour Event (2.04 inches)	
			Flow (cfs)	Volume (acre-feet)	Flow (cfs)	Volume (acre-feet)	Flow (cfs)	Volume (acre-feet)	Flow (cfs)	Volume (acre-feet)
Structure 7	Pinabete upstream, pre-mine	47.80	401	293.5	1,113	801.7	1,698	1,217.1	2,851	2,033.0
Structure 9	Pinabete at mouth, pre-mine	59.37	390	371.8	1,081	1,010.7	1,649	1,531.5	2,767	2,033.0
Structure 9	Pinabete at mouth, during mine operations	56.24	390	282.4	1,091	764.8	1,649	1,157.7	2,767	1,928.0
Structure 9	Pinabete at mouth, post-reclamation	60.25	390	372.1	1,081	1,017.5	1,649	1,544.4	2,767	2,578.5
Structure 21	South Fork Cottonwood, pre-mine	21.08	729	194.9	1,588	411.2	2,220	627.0	3,439	971.4
Structure 21	South Fork Cottonwood, post-reclamation	20.80	707	185.2	1,542	423.4	2,182	602.8	3,387	938.0
Structure 37	Cottonwood at mouth, pre-mine	80.11	1,250	459.5	2,839	1,165.0	4,049	1,732.0	6,325	2,836.0
Structure 37	Cottonwood at mouth, during mine operations	75.70	1,240	418.8	2,828	1,071.0	4,033	1,598.0	6,292	2,628.3
Structure 37	Cottonwood at mouth, post-reclamation	78.31	1,249	428.4	2,847	1,101.1	4,058	1,645.4	6,331	2,710.1
Structure 1	Chaco Trib , pre-mine	0.45	50	2.3	137	6.4	205	9.8	334	16.3
Structure 2	Chaco Trib, during mine operations	0.07	7.2	0.35	20	1.00	30	1.51	49	2.5
Structure 2	Chaco Trib, post-reclamation	0.93	7.2	0.35	92	5.45	153	15.3	276	27.1

Source: BNCC 2012a

cfs = cubic feet per second

Four Corners Power Plant

Groundwater

The continued operation of Units 4 and 5 would not affect groundwater quantity. The water demands for the operation of the power plant come from Morgan Lake, and no groundwater is pumped or otherwise used for this operation. No injection of material into the subsurface is planned. FCPP would continue monitoring groundwater quality and level. However, operation of the ash disposal facility, including existing trenches and extraction wells would result in a decline in groundwater flow. This is described below.

As described in the Affected Environment, selenium concentrations beneath the DFADA exceed EPA drinking water quality standards. Boron, nickel, and uranium are also elevated in some instances. Although boron and uranium are naturally-occurring elements found in the geologic formations of the region, it is unclear if the ash ponds or native material is the source of these and the other constituents. Total dissolved solids concentration is a general indicator of total metals within the groundwater. A statistical analysis was conducted of TDS data (APS 2013) for ten wells selected in order to cover the entire ash pond area. Mann-Kendall time series tests were conducted to analyze TDS levels over time to determine if there is any trend in the data. For those monitoring wells near Ash Pond 6 and heading west, all selected wells showed a statistically significant downward trend in TDS, thus indicating that metals have decreased over time. South of Ash Pond 6, monitoring wells nearest to the lined evaporation ponds showed no correlation between TDS concentration and time; however, wells further west did. The lack of correlation could be due to a disconnect between CCR in the lined ponds and the groundwater (i.e. little to no seepage into groundwater beneath these ponds, thus TDS concentrations may be indicative of background levels).

Previous studies found two primary areas of groundwater seepage beneath the ash disposal areas, the “north seep” and “south seepage area” (APS 2013). In 1977, APS constructed an open ditch system to collect seepage water from the ash disposal facilities as part of the NPDES permits for the FCPP. In 1993 and 2011 extraction wells were installed. These systems are designed to prevent contamination of the Chaco wash. In October 2011, APS constructed a north intercept trench excavated to the bottom of the shale formation. A review of groundwater level data and water quality data in three wells located downgradient of the trench show declines in all constituents and groundwater level. APS is currently in the process of installing a second south intercept trench to remediate groundwater (2013). With the operation of the intercept trenches, continued operation and expansion of the DFADAs would have less potential to contaminate local groundwater and water quality in Chaco Wash.

Surface Water Quality

Water used at the FCPP is cycled from Morgan Lake through the power plant condenser for cooling and discharged back into the lake. The continued operation of Units 4 and 5 would result in no changes to the quality of water released to Morgan Lake or ultimately the San Juan River. The temperature of the water discharged into Morgan Lake and ultimately No Name Canal and the Chaco River is greater than that brought into the FCPP. However, this increase in temperature allows for year-round recreation at Morgan Lake and does not increase temperature in No Name Canal or Chaco River above water quality standards. Therefore, continued operations regarding uptake and discharge of water from Morgan Lake would not adversely affect surface water quality of water bodies in the vicinity of the plant.

The operation of selective catalytic reduction devices on Units 4 and 5 requires the use of ammonia. Any potential spills of ammonia during transport could drain to nearby surface water features; the potential likelihood of such a spill and its associated impacts are discussed in Section 4.17, Health and Safety. Once at the FCPP, the ammonia would be used to operate the selective catalytic reduction devices and would be contained within a closed system. No ammonia would mingle with water cycled through the power plant or discharged to Morgan Lake. Therefore, no adverse effects on surface water quality from ammonia use would be anticipated. In the unlikely event of a spill, a Spill Containment and

Countermeasures Plan, as described in Section 4.15, would be implemented in order to prevent and contain any adverse effects of the spilled material to the surrounding environment.

In accordance with their NPDES permit, FCPP operates under a SWPPP. As described above, stormwater within the lease area either is contained via berms, discharged to Morgan Lake, or drains to one of three outfalls on site.

In addition, the following Structural Controls are used on site:

- Oil and chemicals stored inside buildings at Main and Chemical Warehouses;
- Reduced number of oil and chemicals stored outside, at the 345 switchyard;
- Concrete apron over the dirt bank at 4/5 Intake (SW1);
- Prompt cleanup of spills and leaks using absorbents to prevent the discharge of pollutants;
- Drip pans and absorbents are used under or around leaky vehicles and equipment;
- Washwater drains to a proper collection system; and
- Rock and concrete barriers surrounding the perimeter of the plant proper next to Morgan Lake and cooling water canals leaving and entering the Lake (APS 2012b).

Should this alternative be implemented, FCPP would continue to operate in accordance with the existing NPDES permit and the SWPPP. Therefore, stormwater discharge during continued operations would have no adverse effects on water quality.

Similar to the existing ash pond facilities, berms would be constructed around the proposed new DFADAs to contain stormwater. These berms would contain surface runoff within the DFADAs until it is pumped to the combined waste treatment pond for treatment. Therefore, no adverse impacts to water quality would result from stormwater runoff associated with the proposed new DFADAs.

In 2009, a survey was conducted of the existing Lined Ash Impoundment and lined decant water impoundment located on top of old Ash Pond 3. The impoundments were assessed for their potential for failure, as discussed in greater detail in Section 4.17, Health and Safety; however, the assessment also provides insight into the potential for surficial runoff from the facilities to Chaco River. The assessment found no evidence of substantial seepage from the embankments. At the time of the survey, some minor seepage was observed at the southern toe of the lined ash impoundment embankment, which was associated with construction activity occurring at the time (GEI Consultants 2009). The embankment serves as an impediment to discharge of stormwater or drainage from the two areas. APS plans to raise the embankment in 10-foot rise construction intervals until the embankment is 70 feet. Continued operation of these facilities would, therefore, have no adverse impact on nearby surface waters.

Ash Pond 6, located on the northwest side of the existing Ash Disposal Area, is currently inactive, and was used to impound the fly ash and solids from Units 1, 2, and 3. The final lift of Ash Pond 6 is approximately 80 feet higher than natural grade on the West Embankment. This embankment serves as an impediment to discharge of stormwater or drainage from this area; therefore, no adverse impacts to nearby surface waters would result from the existence of this area.

In addition to potential water quality impacts resulting from operations at the plant lease site itself, coal-fired power plants represent a source of atmospheric mercury and selenium in the Four Corners region. As emissions deposit in the region, recent studies have determined that emissions from coal-fired power plants in the region contribute mercury, selenium, and other pollutants to local surface waters (EPRI 2013). Because prevailing winds are generally from the southwest to the north and northeast, emissions from the FCPP have the potential to affect surface water quality beyond the Navajo Nation. Air quality modeling and emissions deposition modeling conducted by EPRI have defined the area that would be affected by FCPP emissions as less than 50 km (31 miles). As described in Section 4.1, Air Quality, it is

estimated that the FCPP would emit approximately 136 pounds of mercury and 566 pounds of selenium annually for the duration of the Project. The emitted mercury and selenium would consist of both particulates and vapors. However, as described in Air Quality, these emissions would represent a 72 and 93 percent reduction over baseline conditions. Therefore, while mercury and selenium would continue to be deposited into the San Juan River watershed, surface water quality impacts would be minor compared to baseline conditions.

Impacts to Waters of the US

Construction of the new ash pond facilities would result in the permanent filling of three ephemeral drainages that discharge to the Chaco River, which is located approximately 1,000 feet west of the proposed facility. The drainages are ephemeral arroyos and swales, likely conveying stormflows to the Chaco River. Of these drainages, only a portion of one is considered a jurisdictional Water of the US. APS would avoid impacts to this portion of the drainage and maintain a 300-foot buffer from it during construction of the proposed ash pond. The USACE, in coordination with the EPA, has concurred with the findings of the delineation (USACE 2013). Therefore, no impacts to waters of the US would result from the Proposed Action. Based on a review of the delineation and the Project plans, removal of the non-jurisdictional segments of these drainages would alter stormwater runoff and hydrology in the ROI; however, these impacts would not adversely affect surface water quantity or quality. Further, expansion of the ash pond facilities would disturb greater than 1 acre; therefore, APS would be required to obtain coverage under a General Construction NPDES Permit and prepare and implement a construction SWPPP.

Surface Water Quantity

Surface water drawn from the San Juan River into Morgan Lake for use at the FCPP is obtained according to water rights held by BBNMC. The final disposition of the water rights is still pending and will be resolved between BNCC and NTEC. No changes to the water use would occur under the Proposed Action and NTEC (and the FCPP) would maintain the ability to draw as much water as the rights allow for the Project life. Given the current water right appropriations, water drawn from the San Juan River would continue as stated in the agreement; therefore, impacts to surface water quantity in the San Juan River would be negligible and would not change under the Proposed Action.

Transmission Lines

Groundwater

Continued operation of the existing transmission lines would not be expected to impact groundwater quality or quantity. No water demands or groundwater use exist for the existing transmission lines. General maintenance of the transmission lines could affect groundwater resources by way of contamination from equipment and activities infiltrating the subsurface. To protect groundwater, hazardous fluid spill prevention and protection practices would be implemented (see Section 4.15, Hazardous and Solid Wastes). Therefore, impacts to groundwater would be considered negligible as maintenance activities and normal operation would not involve any ground disturbing activities.

Surface Water

The associated existing transmission lines and their ROWs cross numerous surface water features as displayed in Table 4.5-7. Short-term impacts to surface water from the operation of the transmission lines would occur only during maintenance and repair to the lines. Clearing of natural vegetation would be required on an as needed basis to ensure electrical safety, long-term maintenance, and reliability of the transmission line.

General transmission line maintenance activities could indirectly affect surface water resources by increased stormwater runoff from the site carrying sediment and contamination loads into surface water, and by contamination from construction equipment and activities infiltrating area surface waters. However, implementation of standard construction BMPs would prevent degradation of surface waters.

During site clearing and grading activities, soils in the construction area could become exposed, rutted, and compacted. Soil exposure, rutting, and compaction have the potential to increase water yields from the site, concentrate and channelize sheetflow, increase erosion rates, and increase sediment delivery to nearby water bodies.

General maintenance activities within the ROWs could indirectly affect surface water resources by increased stormwater runoff from the site carrying sediment and contamination loads into surface water and by contamination from construction equipment and activities infiltrating area surface waters. Mitigation for these possible impacts would include revegetation of temporarily disturbed areas. Proper native seed selection would result in grasses with deep root systems and denser foliage, which would increase local retention times and reduce site outflows. Internal site drainage would be accomplished through the use of open ditches and culverts. The ditches would be constructed to encourage infiltration of stormflows and would further reduce site outflows. Specific plans or proposed measures for fugitive-dust control, erosion, and sedimentation control, site reclamation, and stormwater-runoff control would be implemented as part of the construction process.

BMPs would be implemented requiring that temporary measures, such as silt fences and straw bales, should be placed in ditches and along portions of the site perimeter to control erosion and meet NPDES requirements during all maintenance activities that involve construction or site disturbance (e.g., tower replacement, ROW clearing). To protect the water quality of area surface waters during maintenance activities, any and all of the BMPs required by the appropriate authorities should be implemented and maintained. These BMPs could include such measures as the installation of a double-walled silt curtain in the river or wash surrounding construction activities and installation of silt fencing and other erosion and sediment control measures when working in the floodplain to protect all adjacent wetland and drainage ways.

4.5.4.2 Alternative B – Navajo Mine Extension Project

Navajo Mine

Groundwater

Under Alternative B, NTEC would implement an alternative mine plan for the Pinabete Permit Area. The mining for the current Navajo Mine Permit Area would occur as described for the Proposed Action. Alternative B would directly affect a portion of Pinabete Arroyo, thereby requiring diverting the flows from the arroyo around mining activities into No Name Arroyo for the duration of the mine period. Groundwater impacts due to the diversion would be negligible; therefore, impacts to groundwater quantity and quality during operation would be as described for the Proposed Action. Operation and reclamation activities would be the same as described for the Proposed Action.

Surface Water Resources

Under Alternative B, NTEC would implement a revised mine plan for the Pinabete Permit Area; the mining for the Navajo Mine Permit Area would occur as described for the Proposed Action. Under this alternative, long-term impacts to waters of the US would be greater than described for the Proposed Action. Mining would occur within Pinabete Arroyo; therefore, flows from the arroyo would be diverted around mining activities into No Name Arroyo for the duration of the mine period (through 2041). Based on the delineation of waters of the US conducted in April 2012, approximately 33 acres of waters of the US would be affected under Alternative B, in comparison to 5 acres that would be affected under the Proposed Action. To implement this mine plan, MMCo would be required to obtain a permit from the USACE under CWA Section 404. If a permit is granted, it would include required compensatory mitigation to offset impacts to waters of the US such as rehabilitation or creation of an agreed upon acreage of waters of the US at an off-site location. Under Alternative B MMCo would submit a mitigation plan to OSMRE, BIA and the USACE for review with the USACE Section 404 permit application.

In addition to long-term impacts associated with the Pinabete Arroyo diversion, under this alternative a greater number of miles of roadway and transmission lines would require construction. As with the Proposed Action, erosion and leaks from construction equipment could result in potential impacts to surface water quality. Although the duration and extent of construction activities under Alternative B would be greater than the Proposed Action, implementation of BMPs as described in an Erosion Control and Sediment Plan and SWPPP, would minimize impacts to water quality; therefore, no greater intensity of short-term impacts to surface water quality would be anticipated. Following completion of short-term construction activities, mining would occur as described for the Proposed Action. Therefore, impacts to surface water quality and hydrology, during operation would be as described for the Proposed Action. Following completion of the mining activities, NTEC would reclaim mined areas in accordance with an approved reclamation plan. NTEC would prepare a Hydrologic Reclamation Plan for this alternative. Drainages and watersheds that were mined or altered would be restored in accordance with the Reclamation Plan. Therefore, impacts to surface water quality and channel morphology would be the same as described for the Proposed Action.

Four Corners Power Plant

Under Alternative B, the lease for the FCPP would be renewed, and the FCPP would continue to operate as described in Chapter 2. Impacts to both surface water and groundwater resources would be as described for the Proposed Action.

Transmission Lines

Under Alternative B, the ROW for the subject transmission lines would be approved and the transmission lines would operate as described in Chapter 2. Impacts to surface water resources and groundwater would be negligible, as described for the Proposed Action.

4.5.4.3 Alternative C – Alternative Pinabete Mine Plan

Navajo Mine

Groundwater

Although Alternative C would have a greater disturbance footprint than the Proposed Action, the groundwater impacts of quantity and quality during operation would be as described for the Proposed Action. Operation and reclamation activities would be the same as described for the Proposed Action.

Surface Water Resources

Under Alternative C, NTEC would seek a SMCRA permit for an alternative mine plan for the Pinabete Permit Area; the mining for the Navajo Mine Permit Area would occur as described for the Proposed Action. Under Alternative C, long-term impacts to waters of the US would be greater than described for the Proposed Action. Based on the delineation of waters of the US conducted in April 2012, approximately 6.6 acres of waters of the US would be affected under this alternative, in comparison to 5 acres that would be affected under the Proposed Action. To implement this mine plan, NTEC would be required to obtain a permit from the USACE under CWA Section 404. If a permit was granted, it would include required compensatory mitigation to offset impacts to waters of the US, such as rehabilitation or creation restoration of an agreed upon acreage of waters of the US at an off-site location. Under Alternative C, MMCo would submit a mitigation plan to OSMRE, BIA and the USACE for review with the USACE Section 404 permit application.

In addition, under Alternative C a greater number of miles of roadway and transmission lines would require construction. As with the Proposed Action, erosion and leaks from construction equipment could result in potential impacts to surface water quality. Although the duration and extent of construction activities under Alternative C would be greater than the Proposed Action, implementation of BMPs as

described in an Erosion Control and Sediment Plan and SWPPP would minimize impacts to water quality; therefore, no greater intensity of short-term impacts to surface water quality would be anticipated. Following completion of short-term construction activities, mining would occur as described for the Proposed Action. Therefore, impacts to surface water quality and hydrology, during operation would be as described for the Proposed Action. Following completion of the mining activities, NTEC would reclaim mined areas in accordance with an approved Reclamation Plan. As part of the SMCRA permit application, NTEC would prepare a Hydrologic Reclamation Plan for the Alternative Pinabete Mine Plan. Drainages and watersheds that had previously been mined or altered would be restored in accordance with the Reclamation Plan. Therefore, impacts to surface water quality and channel morphology would be the same as described for the Proposed Action.

Four Corners Power Plant

Under Alternative C, the lease for the FCPP would be renewed, and the FCPP would continue to operate as described in Chapter 2. Impacts to both surface water and groundwater would be as described for the Proposed Action.

Transmission Lines

Under Alternative C, the ROW for the subject transmission lines would be approved and the transmission lines would operate as described in Chapter 2. Impacts to surface water resources and groundwater would be negligible, as described for the Proposed Action.

4.5.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action.

Groundwater

The groundwater impacts of quantity and quality during operation would be as described for the Proposed Action. Operation and reclamation activities would be the same as described for the Proposed Action. As such, impacts would be the same as described for the Proposed Action.

Surface Water Resources

Impacts to surface water would be as described under the Proposed Action.

Four Corners Power Plant

Under this alternative, the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The 10% reduction in surface area of the DFADAs would result in the same ground water and surface water related impacts as described for the Proposed Action. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

Under this alternative, the transmission line ROWs would be approved and they would continue to be operated and maintained as described for the Proposed Action. As such, impacts would the same as described for the proposed action.

4.5.4.5 Alternative E – No Action Alternative

Navajo Mine

Groundwater

During demolition activities associated with the Navajo Mine, short-term impacts to near-surface groundwater quality could occur; however, prior to conducting any demolition activities NTEC would be required to obtain the necessary permits which prescribe BMPs to minimize impacts to groundwater.

Areas that had previously been mined or altered would be restored in accordance with the Reclamation Plan; therefore, impacts to subsurface hydrogeology would be beneficial over the long-term. In addition, reclamation of mined lands would potentially restore natural groundwater flow.

Surface Water Resources

Under the No Action Alternative, mining at the Navajo Mine would cease when the ROD is issued in 2015 and previously mined areas would be reclaimed in accordance with approved reclamation plans. During demolition activities associated with the Navajo Mine, short-term impacts to surface water quality could occur; however, prior to conducting any such demolition (building removal, etc.) MMCo would be required to obtain a Construction Stormwater General Permit under CWA Section 402. Compliance with this permit requires the preparation of an Erosion Control and Sediment Plan and SWPPP describing BMPs to prevent discharge into waters of the US. Implementation of the plans would minimize impacts to nearby waters of the US. In addition, NTEC would be required to satisfy existing USACE mitigation requirements as specified in the pre-2016 Individual 404 permit for the Navajo Mine Permit Area.

Drainages and watersheds that had previously been mined or altered would be restored in accordance with the Reclamation Plan; therefore, impacts to surface water hydrology would be beneficial over the long-term. In addition, reclamation of mined lands would restore surface water drainage and natural stormwater flow; therefore, impacts to water quality would likely be beneficial as well.

Four Corners Power Plant

Under the No Action Alternative, FCPP Units 4 and 5 would shut down and remain in place until such time that a decommissioning plan is approved and implemented. Under the No Action Alternative, APS would cease drawing water from the San Juan River to operate the plant and would also cease discharges into Morgan Lake. If the river pumping plant and the pipeline to Morgan Lake were removed, Morgan Lake would evaporate and cease to exist over time. If APS chooses to leave the river pumping plant and the pipeline intact, and the Navajo Nation took possession of those facilities, it is not known the extent to which the river pump station would be operated. If the river pump station was not operated to provide water to Morgan Lake, it would evaporate and cease to exist over time. As a result of the evaporation there may be concentrations of metals in the resultant salts overlaying the remaining sediment. To address this concern OSMRE has recommended a mitigation measure to sample the lake bed sediments. Without the warm discharge from Morgan Lake, water temperature in San Juan River and Chaco Wash would be reduced.

Similarly, with the shutdown of the power plant, emissions of criteria pollutants and GHGs would cease (see Section 4.1, Air Quality); deposition of mercury, selenium, and other pollutants from the FCPP would also stop. As a result, water quality in surface water bodies within the deposition area, particularly the San Juan River, would improve at least incrementally, since deposition from FCPP was only one of the sources of deposition into these water bodies. With regard to groundwater, since the current ash ponds and other facilities would remain in place, impacts would be similar as described for the Proposed Action.

Transmission Lines

Under the No Action Alternative, the ROWs for the transmission lines would not be approved. The transmission lines may be decommissioned or left in place. Short-term impacts to surface water and

groundwater quality during decommissioning could occur; however, as with the Navajo Mine, APS and PNM would be required to comply with all environmental laws and obtain necessary permits, including a Stormwater General Permit prior to implementing such activities. Compliance with the Stormwater General Permit would include development of an Erosion Control and Sediment Management Plan and a SWPPP. Implementation of these plans would minimize runoff from decommissioning activities into waters of the US. Therefore, impacts would be negligible. If the transmission lines are left in place, no impacts to water resources would occur.

4.5.5 Water Resources/Hydrology Mitigation Measures

The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific mitigating measures for certain environmental impacts, standard operating procedures that reduce or avoid environmental impacts, and best management practices for specific activities. These are described in Section 3.2.6.5. These measures are part of their application materials and are enforceable through permit or lease conditions. In addition, the Project Applicants must comply with additional protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section for each resource category. Where the environmental analysis in this EIS recommends additional protective measures, over and above the applicant proposed measures and regulatory compliance, they are listed below as specific mitigation measures.

The Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects to water resources or hydrology. Therefore, no additional mitigation is recommended.

With regard to the proposed permanent impacts to waters of the US that would occur at the Navajo Mine, the USACE will consider these impacts in its decision to approve a Clean Water Act 404 Individual Permit. In addition, consistent with USACE guidance provided in the Final Compensatory Mitigation Rule (April 10, 2008), Regulatory Guidance Letter No. 02-2 (December 24, 2002), and the Memorandum of Agreement Between the EPA and USACE Concerning the Determination of Mitigation Under the Final Compensatory Mitigation Rule, the USACE will include compensatory mitigation requirements as part of the 404 Permit for the Navajo Mine that are designed to compensate for the loss of jurisdictional areas in the Project Area, so as to ensure no net loss of functions and services of waters of the US as a result of the permitted activity. The primary mechanisms for mitigating the loss of jurisdictional areas are re-establishment and creation.

To offset the loss of functionality impacts of waters of the US during active mining, MMCo has proposed the re-establishment of native riparian habitat and the creation of wetland habitat. Because MMCo's impacts to waters of the US would occur incrementally per year of operation, the USACE is working with MMCo to prepare a phased approach when addressing compensatory mitigation requirements. Among the compensatory mitigation measures proposed, are: reestablishing wetland habitat in a section of the San Juan River; removing exotic species (e.g., tamarisk, knapweed, and Russian olive); and planting riparian species along the banks of the river.

MMCo plans to complete its compensatory mitigation requirements in two phases that correlate to the two coal supply agreements anticipated with APS. Phase I would involve mitigation either at a site located within the Navajo Nation just south of Highway 64 and the Hogback or another site located along the San Juan River within the Nenahnezad Chapter of the Navajo Nation. Mitigation at either site would include the removal of tamarisk, knapweed, and Russian olive along the banks of the San Juan River, planting native riparian shrubs and trees, and creating a wetland area connected to the San Juan River. During Phase 2, MMCo would reclaim the remainder of the Area III mining disturbance with a hybrid geomorphic reclamation approach based on the fluvial geomorphic principles in hydrologic restorations.

Impacts to waters of the US anticipated for the initial 15-year coal supply agreement are estimated at 2.0 acres. To achieve the goal of no net loss of aquatic species for the initial coal supply agreement, the USACE will establish a compensatory mitigation ratio in the Individual 404 Permit that includes specified acres of reestablishment or creation.. The second 10-year coal supply agreement would result in approximately 3.0 acres of impacts to waters of the US. Similar to the initial coal supply agreement, the USACE will establish a compensatory mitigation ratio in the Individual 404 Permit that will include specified acres of reestablishment of native riparian habitat and specific acres of wetland creation. The ratios will be determined by analyzing the function loss of ephemeral streams in the Project Area to the functional gain proposed by mitigation efforts along the San Juan River and Areas III and Areas IV North of the Navajo Mine, as illustrated in the South Pacific Division Mitigation Ratio-Setting Checklist. The compensatory mitigation ratio will also take into account any delays in the establishment of planted trees and shrubs, the location of the proposed mitigation sites, and any other pertinent factors. As a point of reference, the USACE required a compensatory mitigation ratio of 3.9:1 in the 2011 Pre-2016 Area III and Area IV North Mining Individual Permit (SPA-2011-00122-ABQ).

Under the No Action Alternative, the remaining salts in the evaporated Morgan Lake lakebed could potentially contain elevated levels of metals. To address this concern, OSMRE recommends that APS conduct sediment sampling and analysis for salts and metals. If the results indicate elevated levels above EPA Preliminary Remediation Goals, the need for remediation of the lakebed should be evaluated and implemented, if necessary.

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4.6 Vegetation

The FCPP, Navajo Mine, and subject transmission lines are located in the Colorado Plateau physiographic region of northwestern New Mexico and northeastern Arizona. This area has a variety of physical features that offer a diverse range of habitat types, represented by a characteristic assemblage of vegetative cover classes, vegetation communities, and associated plant species identified in this section. The large size of this region, together with geology, soils, climate, and anthropogenic influences, has combined to produce a mosaic of floristic components and habitats. Dry air masses, high summer temperatures, infrequent precipitation, and a high rate of evaporation characterize the climate. Precipitation in the area averages approximately 7 inches annually and occurs primarily during the late summer months. For most of the region, the availability of water and soil moisture is a critical factor that determines the broad distribution of vegetation types across the region.

This section presents a description of vegetation communities that exist on and in the vicinity of the Project facilities. For the purposes of this analysis, and to identify broad patterns in vegetation structure, vegetation modeling and mapping has been conducted across the ROI, which is defined for potential effects to vegetation as those areas occurring within 1 mile of the Navajo Mine, 1 mile of the FCPP Lease Area, and 0.5 mile of the PNM and APS transmission lines.

4.6.1 Regulatory Compliance Framework

SMCRA is the primary regulation that applies to vegetation management at the Navajo Mine. Federally and tribally designated sensitive (endangered or threatened) plant species and critical habitat areas are regulated by the Federal ESA and the Navajo Tribal Code, which contains a Navajo Endangered Species List. These resources are under the jurisdiction of the USFWS and NNEPA, respectively, and are discussed in detail in Section 4.8, Special Status Species. The Federal Government, States of Arizona and New Mexico, and Navajo Nation all also have developed lists of plant species considered invasive and noxious and have programs to limit the spread of these species. Plant species not designated as sensitive (e.g., critical habitat, threatened, or endangered) by Federal or tribal agencies located within the FCPP Lease Area or the transmission ROWs are not afforded any protection, and are considered common throughout the area.

4.6.1.1 Surface Mining Control and Reclamation Act

Under SMCRA, NTEC is required to provide an adequate description of the existing pre-mining environmental resources within the Project Area and proposed disturbance area(s). OSMRE uses this information to determine whether the applicant can comply with the performance standards of the regulations for surface coal mining and whether reclamation of these areas is feasible (30 CFR Part 779.10). NTEC is required to map and delineate existing vegetative types and provide descriptions of the plant communities within the permit area (30 CFR Part 779.19).

NTEC must also determine the productivity of the proposed permit area before mining. This productivity should be expressed as an average yield of food, fiber, forage, or wood products by yield data or estimates for similar sites based on current data from the US Department of Agriculture, state agricultural universities, or appropriate state natural resource or agricultural agencies (30 CFR Part 780.23).

A reclamation plan is required to describe the proposed land use within the permit area following reclamation, including a discussion of the utility and capacity of the reclaimed land to support a variety of alternative uses, and the relationship of the proposed use of existing land use policies and plans (30 CFR Part 780.23).

Pursuant to 30 CFR Part 816.111, NTEC must meet revegetation success standards. The standards for determining success of revegetation are measured on the basis of reference areas or such other success standards approved by OSMRE. Reference areas are land units of varying size and shape identified and

maintained under appropriate management for the purpose of measuring ground cover, productivity, and species diversity that are produced naturally (30 CFR Part 715.20 (f)). A revegetation plan that includes a description of the measures proposed to be used to determine the success of revegetation is required. Success of revegetation is judged on the effectiveness of the vegetation for the approved post-mining land use, the extent of cover compared to the cover occurring in natural vegetation of the area, and other general requirements (30 CFR Part 816.111 - 816.115).

Site-specific revegetation specifications, including reference areas, seed mixes, success criteria and noxious weed control are summarized in the existing NTEC mine permits and the Pinabete Mine Plan permit application package (BNCC 2009, 2012a).

4.6.1.2 Noxious and Invasive Weeds

Executive Order 13112, Invasive Species (February 3, 1999), mandates that Federal agencies take actions to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species cause. Also, pursuant to the Noxious Weed Management Act of 1998, New Mexico Department of Agriculture has identified several species to be targeted as noxious weeds for control or eradication.

The BLM, the BIA Navajo Region, and New Mexico Department of Agriculture have all developed lists of invasive noxious weeds (Ecosphere 2012c, Arizona Department of Agriculture 2005). The species are grouped into three management classifications:

- *Class A:* Nonnative plants that have a limited distribution within or have not yet invaded the state. Some are found on public lands within the planning area, and preventing and eliminating infestations of these weeds has the highest priority in the BLM management plan.
- *Class B:* Nonnative plants that are presently limited to a particular part of the planning area. The management priorities are to contain them within their current areas and prevent new infestations.
- *Class C:* Nonnative plants that are widespread throughout much of the public land within the planning area. Long-term programs of management and suppression are encouraged (BLM 2003).

4.6.2 Affected Environment Pre-2014

4.6.2.1 General Vegetation Communities and Land Cover

Vegetation communities in the ROI were identified using the USGS National Gap Analysis Program (GAP) Land Cover Data, Version 2 (USGS 2011). The GAP analysis was used to provide broad geographic estimates on the status of ordinary species and their habitats to provide consistency in identification and management of vegetation communities over the large geographic area covered by the subject transmission lines. The following vegetation characterization methods were used to classify land cover during vegetation surveys:

- Society for Range Management's 1974 *Range Management*, 2nd Edition. Vegetation communities were characterized using this method for the Navajo Mine, Pinabete Permit Area, and Burnham Road realignment;
- Dick-Peddie's 1993 treatment of the vegetation of New Mexico; vegetation was characterized using this method for the PNM transmission lines.
- FCPP DFADAs and APS transmission lines were both evaluated using the USGS GIS data noted above, and referenced specific vegetation communities associated with the regional GAP analysis.

Table 4.6-1 lists the six broad vegetation cover classes (as well as two additional cover classes) identified within the vicinity of Project features and provides an overview of the size and percent of each cover class

identified within the buffer area for each feature. Figure 4.6-1 illustrates the geographic distribution of the major land cover classes identified in the ROI for each Project component.

Based on the GAP analysis, land cover data were classified per the National Vegetation Classification System nomenclature. The respective vegetation communities associated with these land cover classes are discussed by Project component below. Full descriptions of these land cover classes and associated vegetation communities can be found on the USGS SWReGAP land cover descriptions (USGS 2005).

Table 4.6-1 Land Cover Classes Occurring within 1 Mile of Navajo Mine Lease Area, 1 Mile of FCPP Lease Area, and 0.5 Mile of Transmission Line ROWs

Cover Class	Acres	Percent of ROI
Agricultural Vegetation	6,544.5	1.6
Developed & Other Human Use	9,209.6	2.3
Forest & Woodland	75,668.9	18.7
Introduced & Semi-Natural Vegetation	1,269.1	0.3
Nonvascular & Sparse Vascular Rock Vegetation	22,707.4	5.6
Open Water	2,826.3	0.7
Semi-Desert	262,371.4	64.9
Shrubland & Grassland	23,391.6	5.8
Grand Total	403,988.9	100.0

Source: USGS 2005

Agricultural Vegetation

The Agricultural Vegetation cover type is an aggregated land cover type that includes both pasture/hay, where pasture/hay vegetation accounts for more than 20 percent of total vegetation, and cultivated crops, where crop vegetation accounts for more than 20 percent of total vegetation. This cover type also includes all actively tilled land.

Developed & Other Human Use

Developed & Other Human Use includes land cover classes and associated vegetation communities that are disturbed, mined, or otherwise developed; impervious surfaces comprise between 20 to 100 percent of the total cover, and a mixture of constructed material and vegetation persists.

Forest & Woodland

Forest & Woodland cover class represent 12 distinct vegetation cover communities listed below. These vegetation communities include forested lands of coniferous or deciduous vegetation representing a wide array of moisture regimes and elevation differences present in the region.

- Colorado Plateau Pinyon-Juniper Woodland
- Inter-Mountain Basins Juniper Savanna
- Rocky Mountain Aspen Forest and Woodland
- Rocky Mountain Lower Montane Riparian Woodland and Shrubland
- Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland

- Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland
- Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland
- Southern Rocky Mountain Juniper Woodland and Savanna
- Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland
- Southern Rocky Mountain Pinyon-Juniper Woodland
- Southern Rocky Mountain Ponderosa Pine Woodland
- Western Great Plains Riparian Woodland and Shrubland

Introduced & Semi-Natural Vegetation

The Introduced & Semi-Natural Vegetation cover class includes two subclasses of vegetation cover communities closely associated with introduced or invasive species. These two subcategories represent vegetation communities that have been altered, disturbed, or are dominated by nonnative grasses, forbs, or woody vegetation, and where natural vegetation types are no longer recognizable.

- Introduced Riparian and Wetland Vegetation
- Introduced Upland Vegetation- Perennial Grassland and Forbland

Nonvascular & Sparse Vascular Rock Vegetation

Nonvascular & Sparse Vascular Rock Vegetation cover class consists of vegetation communities that consist of barren or sparsely vegetated (10 to 30 percent) open-canopy landscapes associated with steep cliff faces, narrow canyons, sand dunes, shale, siltstone and mudstone deposits, and barren bedrock deposits. These cover communities include:

- Colorado Plateau Mixed Bedrock Canyon and Tableland
- Inter-Mountain Basins Active and Stabilized Dune
- Inter-Mountain Basins Shale Badland
- Rocky Mountain Cliff, Canyon and Massive Bedrock
- Undifferentiated Barren Land

Open Water

This land cover class identifies areas of open water, generally with less than 25 percent cover of vegetation or soil, and includes all naturally occurring and man-made impoundments, ponds, and rivers.

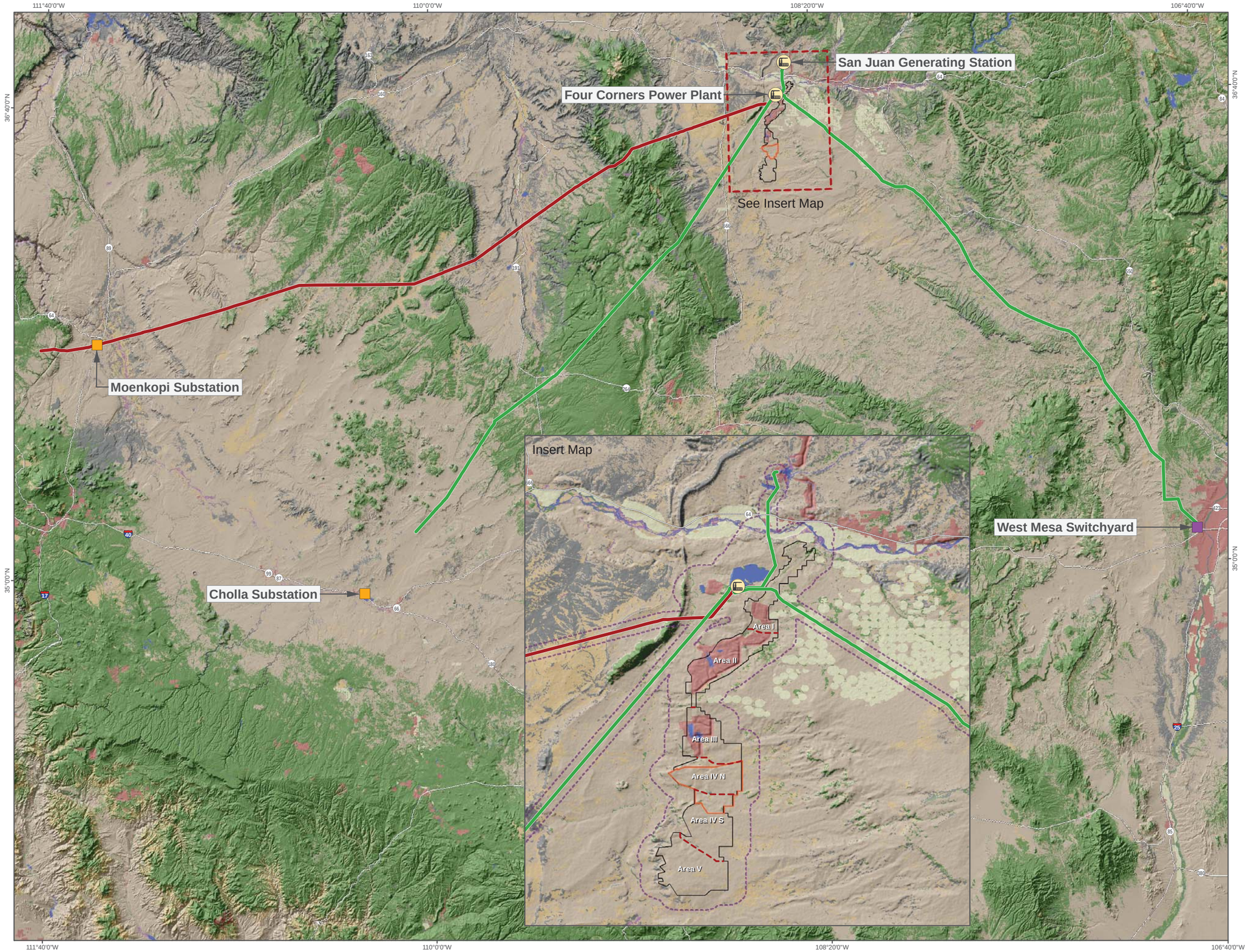

Figure 4.6-1

Habitat Types in the Project Vicinity

PROJECT FACILITIES

- Four Corners Power Plant
- Substation
- Switchyard

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Navajo Mine Resource Areas
- Proposed Pinabete Permit Boundary
- ROI Boundary

TRANSMISSION LINES

- 345kV
- 500kV

HABITAT TYPES

- Agricultural Vegetation
- Developed & Other Human Use
- Forest & Woodland
- Introduced & Semi Natural Vegetation
- Nonvascular & Sparse Vascular Rock
- Open Water
- Semi-Desert
- Shrubland & Grassland

Data Source: US Geological Survey, Gap Analysis Program (GAP), Land Cover Data, Version 2.

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Scale in Miles

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Semi-Desert

The Semi-Desert cover class includes a wide range of arid to semiarid vegetation communities, including grassland and shrubland transition areas in low elevation to subalpine environments across the western US. These vegetation communities are typically characterized as extensive open-canopied shrublands and occur on a variety of soil types ranging from rocky to fine sedimentary deposits. Ten vegetation communities from this cover class were identified within the region.

- Apacherian-Chihuahuan Mesquite Upland Scrub
- Colorado Plateau Blackbrush-Mormon-tea Shrubland
- Colorado Plateau Mixed Low Sagebrush Shrubland
- Inter-Mountain Basins Big Sagebrush Shrubland
- Inter-Mountain Basins Mixed Salt Desert Scrub
- Inter-Mountain Basins Montane Sagebrush Steppe
- Inter-Mountain Basins Semi-Desert Grassland
- Inter-Mountain Basins Semi-Desert Shrub Steppe
- Inter-Mountain Basins Wash
- Southern Colorado Plateau Sand Shrubland

Shrubland & Grassland

The Shrubland & Grassland cover class represents a diverse group of vegetation communities that occurs in a broad range of ecological areas ranging from arid lowlands to wet alpine meadows. These vegetation communities occur at a range of elevations along the transition zone among the Rocky Mountains, Great Plains, Sonoran Desert, Chihuahuan Desert, and Inter-Mountain West.

- Inter-Mountain Basins Greasewood Flat
- North American Arid West Emergent Marsh
- Rocky Mountain Alpine-Montane Wet Meadow
- Rocky Mountain Gambel Oak-Mixed Montane Shrubland
- Southern Rocky Mountain Montane-Subalpine Grassland
- Western Great Plains Foothill and Piedmont Grassland

4.6.2.2 Navajo Mine

A more detailed evaluation of land cover classes and associated vegetation communities within 1 mile of the Navajo Mine Lease Area is provided in Table 4.6-2 This evaluation includes the identification of land cover classes and associated vegetation communities occurring within the approximately 78,000-acre Navajo Mine ROI. Vegetation within the Navajo Mine and in the general vicinity is composed of 15 vegetation communities. Semi-Desert accounts for 77.2 percent of the land cover in the ROI, followed by 12.3 percent land cover classes associated with human development within the Navajo Mine, and adjacent agricultural development. Dominant vegetation communities in the ROI include Inter-Mountain Basins Semi-Desert Grasslands, Inter-Mountain Basins Mixed Salt Desert Scrub, and Inter-Mountain Basins Semi-Desert Shrub Steppe communities, which represent 76.3 percent of the total area. These vegetation communities are extensive, and the majority of ecological communities consist of open-canopied to moderately dense shrublands and grasslands in saline basins, alluvial slopes, and plains

across the Inter-Mountain West, including a suite of commonly occurring shrubs, subshrubs, and grasses common to the Inter-Mountain West (USGS 2005).

Table 4.6-2 GAP-Identified Land Cover Classes, Associated Vegetation Communities, and Acreage, Including a 1-Mile Buffer around the Navajo Mine Permit Area

Cover Class Vegetation Community/Ecological Region	Acres	Percent of Navajo Mine ROI
Agricultural Vegetation	**1,949.1**	**2.5**
Developed & Other Human Use	**7,651.0**	**9.8**
Forest & Woodland	**2,001.8**	**2.6**
Colorado Plateau Pinyon-Juniper Woodland	1,071.1	
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	930.7	
Introduced & Semi-Natural Vegetation	**257.8**	**0.3**
Introduced Riparian and Wetland Vegetation	231.3	
Introduced Upland Vegetation - Perennial Grassland and Forbland	26.4	
Nonvascular & Sparse Vascular Rock Vegetation	**966.2**	**1.2**
Colorado Plateau Mixed Bedrock Canyon and Tableland	915.1	
Inter-Mountain Basins Shale Badland	51.1	
Open Water	**1,165.0**	**1.5**
Semi-Desert	**60,297.9**	**77.2**
Colorado Plateau Blackbrush-Mormon-tea Shrubland	462.8	
Colorado Plateau Mixed Low Sagebrush Shrubland	5.8	
Inter-Mountain Basins Big Sagebrush Shrubland	110.4	
Inter-Mountain Basins Mixed Salt Desert Scrub	13,847.1	
Inter-Mountain Basins Semi-Desert Grassland	40,593.3	
Inter-Mountain Basins Semi-Desert Shrub Steppe	5,276.3	
Inter-Mountain Basins Wash	1.1	
Southern Colorado Plateau Sand Shrubland	1.1	
Shrubland & Grassland	**3,983.3**	**5.1**
Inter-Mountain Basins Greasewood Flat	3,983.3	
Navajo Mine Lease Area – Plus 1-Mile Buffer	**78,272.0**	

Source: USGS 2005

While the GAP analysis provides a broad overview of existing vegetation communities, more detailed vegetation analysis was required within the Pinabete Permit Area to quantify existing vegetation communities. This analysis identified six vegetative communities: Alkali Wash, Arroyo Shrub, Badlands, Dunes, Sands, and Thinbreaks (Table 4.6-3) (BNCC 2012a).

Table 4.6-3 Vegetation Types within the Proposed Pinabete Permit Area

Vegetation Type	Acres
Alkali Wash	1,273
Arroyo Shrub	31
Badlands	836
Dunes	267
Sands (Sandy Soils)	1,094
Thinbreaks	603
Total	**4,104**

Source: BNCC 2012a

Alkali Wash

Alkali Wash is a vegetation community associated with minor waterways, typically located in washes and drainages, as well as the base of badlands, and is most closely associated with the Semi-Desert cover class and associated vegetation communities identified in Table 4.6-2. Alkali wash represents the largest community type in the Pinabete Permit Area at 31.0 percent. Alkali wash communities are typically broad and level with occasional small, dense patches of galleta grass (*Pleuraphis jamesii*) and alkali sacaton (*Sporobolus airoides*). Other plants that are locally common in alkali wash include tansy mustard (*Descurainia pinnata*), Russian thistle (*Salsola tragus*), scorpion weed (*Phaceila crenulata*), mound saltbush (*Atriplex obovata*), alkali sacaton, woolly plantain (*Plantago patagonica*), and annual Townsend daisy (*Townsendia annua*) (BIA 2007; BNCC 2012a; OSMRE 2012a).

Arroyo Shrub

Arroyo Shrub communities are commonly found in major drainages and are generally flat and level in the Pinabete Permit Area. This community is closely associated with the Semi-Desert cover class and associated vegetation communities identified in Table 4.6-2. The Arroyo shrub community is the smallest vegetation type in the Pinabete Permit Area, comprising 0.8 percent (BNCC 2012a). Vegetation characteristic of this community includes greasewood (*Sarcobatus vermiculatus*), Russian thistle, tansy mustard, alkali sacaton, four-winged saltbush (*Atriplex canescens*), cryptantha (*Cryptantha* sp.), and snakeweed (*Gutierrezia sarothrae*) (BIA 2007; BNCC 2012a; OSMRE 2012a).

Badlands

Badlands have the least vegetation of any vegetation community in the Project Area and are associated with the Semi-Desert cover class and associated vegetation communities identified in Table 4.6-2. The Badlands vegetation community accounts for 20.4 percent of the Pinabete Permit Area. This community type is the most unproductive, and none of the soil material is suitable for salvage because of the high clay content and high sodium values (BNCC 2012e). Badland vegetation communities consist of exposed weathered shale with moderate to steep topography. Common plants along the small relief channels of these barren areas are Powell's saltbush (*Atriplex powellii* var. *powellii*), mound saltbush, annual Townsend daisy, stickseed (*Lappula occidentalis),* woolly plantain, salty buckwheat (*Stenogonum salsuginosum*), Gordon's buckwheat (*Eriogonum gordonii*), scorpion weed, and globemallow (*Sphaeralcea parvifolia*) (BIA 2007; BNCC 2012a; OSMRE 2012a).

Dunes

The deep sands found in dune communities allow for more consistent water availability and are most closely associated with the Semi-Desert cover class and associated vegetation communities identified in

Table 4.6-2. The dunes represent the second to the smallest vegetation community in the permit area, covering 6.5 percent. The dunes community type is one of the more productive found in the Navajo Mine Lease Area (BNCC 2012e). Dune vegetation communities occupy flat to rolling terrain. Due to the sandy nature of the dunes vegetation community, unique plant species are present, including San Juan milkweed (*Asclepias sanjuanensis*), as well as canaigre dock (*Rumex hymenosepalus*) and sand sagebrush (*Artemisia filifolia*). Other common species include cryptantha (*Cryptantha crassisepala*), tansy mustard, twinpod (*Dimorphocarpa wislizeni*), globemallow, Indian ricegrass (*Achnatherum hymenoides*), galleta grass, and evening primrose (*Oenothera pallida*) (BIA 2007; BNCC 2012a; OSMRE 2012a).

Sands

The Sands vegetation community contains predominantly sandy soils, which allows for greater water availability and increases plant species diversity. It is most closely associated with the Semi-Desert cover class and associated vegetation communities identified in Table 4.6-2. The sands vegetation community makes up 26.7 percent of the Pinabete Permit Area. The types of sand in this vegetation community can vary from saline to calcareous. The sands community often transitions to and can be mixed with the thinbreaks community. In years with high amounts of spring rainfall, sandy soils display an abundance of annuals, especially scorpion weed, annual Townsend daisy, and cryptantha. Other common species include Russian thistle, pincushion *(Chaenactis stevioides*), galleta grass, and wire lettuce (*Stephanomeria exigua*) (BIA 2007; BNCC; 2012a; OSMRE 2012a).

Thinbreaks

Thinbreaks are characteristic of rocky areas with loose rock and occasionally with large pieces of rock, usually shale, that are firmly embedded in the ground and associated with the Semi-Desert cover class and associated vegetation communities identified in Table 4.6-2. The Thinbreaks vegetation community comprises 14.7 percent of the Pinabete Permit Area. Thinbreaks are typically upland vegetation communities with surface rock as a unifying feature. Thinbreaks plant species can occur in rock fissures and include Russian thistle, tansy mustard, cryptantha, shadscale saltbush (*Atriplex confertifolia*), alkali sacaton, stickseed, dwarf gilia (*Ipomopsis pumila*), and scorpion weed (BIA 2007; BNCC 2012a; OSMRE 2012a).

Noxious Weeds

Two noxious weeds were identified within the Navajo Mine Lease Area, Pinabete Permit Area, including portions of the Burnham Road Realignment. Halogeton (*Halogeton glomeratus*) and saltcedar (*Tamarix* sp.) were documented as common occurrences within the within these areas during the baseline vegetation community surveys (BIA 2007; BNCC 2012a; OSMRE 2012a). Halogeton was also documented within the Burnham Road realignment.

4.6.2.3 FCPP

An evaluation of land cover classes and associated vegetation communities within 1 mile of the FCPP Lease Area is provided in Table 4.6-4. The dominant land cover class within and around the FCPP is the Semi-Desert cover class, which accounts for 65.4 percent of the ROI. The dominant vegetation communities found within this vegetation class include Inter-Mountain Basins Semi-Desert Grassland and Inter-Mountain Basins Mixed Salt Desert Scrub. These vegetation communities are extensive and commonly occurring ecological communities consisting of open-canopied to moderately dense shrublands and grasslands in saline basins, alluvial slopes, and plains across the Intermountain West including a suite of commonly occurring shrubs, subshrubs, and grasses common to this area (USGS 2005). The second largest land cover class is human development (directly associated with the FCPP) and agricultural development, which accounts for 15.1 percent of the land cover in the ROI. The ROI covers 15 vegetation communities, which represent a wide range of arid to semiarid vegetation communities, including grassland and shrubland transition areas in low elevation to subalpine environments. These vegetation communities are typically characterized as extensive open canopied shrublands and

woodlands that occur on a variety of soil types ranging from rocky to fine sedimentary deposits. In addition to the GAP analysis, a survey of existing vegetation was conducted in the proposed DFADA. These results were compared to the GAP analysis, and results were found to corroborate each other (AECOM 2012b; Ecosphere 2012b).

Table 4.6-4 GAP-Identified Land Cover Classes, Associated Vegetation Communities, and Acreage, Including a 1-Mile Buffer around the FCPP Lease Area

Cover Class Vegetation Community/Ecological Region	Acres	Percent of FCPP ROI
Agricultural Vegetation	**2462.4**	**11.4**
Developed & Other Human Use	**794.9**	**3.7**
Forest & Woodland	**901.3**	**4.2**
Colorado Plateau Pinyon-Juniper Woodland	532.6	
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	368.7	
Introduced & Semi-Natural Vegetation	**467.3**	**2.2**
Introduce Riparian and Wetland Vegetation	382.3	
Introduced Upland Vegetation – Perennial Grassland and Forbland	85.0	
Nonvascular & Sparse Vascular Rock Vegetation	**371.2**	**1.7**
Colorado Plateau Mixed Bedrock Canyon and Tableland	346.3	
Inter-Mountain Basins Shale Badland	24.9	
Open Water	**1,957.8**	**9.1**
Semi-Desert	**14,124.0**	**65.4**
Colorado Plateau Blackbrush-Mormon-tea Shrubland	776	
Colorado Plateau Mixed Low Sagebrush Shrubland	1.3	
Inter-Mountain Basins Big Sagebrush Shrubland	22.4	
Inter-Mountain Basins Mixed Salt Desert Scrub	2,011.6	
Inter-Mountain Basins Semi-Desert Grassland	10,912.9	
Inter-Mountain Basins Semi-Desert Shrub Steppe	355.2	
Inter-Mountain Basins Wash	1.1	
Southern Colorado Plateau Sand Shrubland	43.5	
Shrubland & Grassland	**527.8**	**2.4**
Inter-Mountain Basins Greasewood Flat	527.8	
Four Corners Power Plant – Lease Boundary Plus 1-Mile Buffer	**21,606.6**	

Source: USGS 2005

4.6.2.4 Transmission Lines

Vegetation analysis completed for the APS and PNM transmission line ROWs, support facilities, and half-mile buffer area represents an approximately 320,000-acre ROI. The results of the GAP analysis are provided in Table 4.6-5.

Table 4.6-5 GAP-Identified Land Cover Classes, Associated Vegetation Communities, and Acreage, Including a Half-Mile Buffer Around the APS and PNM Transmission Line ROWs

Cover Class Vegetation Community/Ecological Region	Acres	Percent of Transmission Line ROI
Agricultural Vegetation	**3,688.4**	**1.2**
Developed & Other Human Use	**1,293.3**	**0.4**
Forest & Woodland	**73,452.1**	**22.9**
Colorado Plateau Pinyon-Juniper Woodland	47,987.5	
Inter-Mountain Basins Juniper Savannah	1,668.4	
Rocky Mountain Aspen Forest and Woodland	484.5	
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	1,106.7	
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	125.6	
Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland	77.8	
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	136.9	
Southern Rocky Mountain Juniper Woodland and Savannah	2,857.9	
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	52.8	
Southern Rocky Mountain Pinyon-Juniper Woodland	1,574.1	
Southern Rocky Mountain Ponderosa Pine Woodland	17,368.8	
Western Great Plains Riparian Woodland and Shrubland	11.3	
Introduced & Semi-Natural Vegetation	**871.41**	**0.3**
Introduced Riparian and Wetland Vegetation	533.0	
Introduced Upland Vegetation – Perennial Grassland and Forbland	**338.4**	
Nonvascular & Sparse Vascular Rock Vegetation	**21,601.59**	**6.7**
Colorado Plateau Mixed Bedrock Canyon and Tableland	16,320.2	
Inter-Mountain Basins Active and Stabilized Dune	80.0	
Inter-Mountain Basins Shale Badland	4,517.8	
Rocky Mountain Cliff, Canyon and Massive Bedrock	25.9	
Undifferentiated Barren Land	657.7	
Open Water	**1,044.3**	**0.3**
Semi-Desert	**199,465.1**	**62.2**
Apacherian-Chihuahuan Mesquite Upland Scrub	846.4	
Colorado Plateau Blackbrush-Mormon-tea Shrubland	2,589.3	

Cover Class Vegetation Community/Ecological Region	Acres	Percent of Transmission Line ROI
Colorado Plateau Mixed Low Sagebrush Shrubland	1,495.0	
Inter-Mountain Basins Big Sagebrush Shrubland	22,526.8	
Inter-Mountain Basins Mixed Salt Desert Scrub	24,680.7	
Inter-Mountain Basins Montane Sagebrush Steppe	237.9	
Inter-Mountain Basins Semi-Desert Grassland	74,948.3	
Inter-Mountain Basins Semi-Desert Shrub Steppe	61,588.6	
Southern Colorado Plateau Sand Shrubland	10,552.1	
Shrubland & Grassland	**19,423.24**	**6.1**
Inter-Mountain Basins Greasewood Flat	18,762.5	
North American Arid West Emergent Marsh	13.1	
Rocky Mountain Alpine-Montane Wet Meadow	149.2	
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	435.6	
Southern Rocky Mountain Montane-Subalpine Grassland	7.1	
Western Great Plains Foothill and Piedmont Grassland	55.7	
Transmission Lines – Plus One-Half Mile Buffer	**320,839.4**	

Source: USGS 2005

The dominant land cover class within and around the transmission lines is the Semi-Desert cover class, which accounts for 62 percent of the ROI, followed by 23 percent land cover classes associated with forest and woodland cover classes. The ROWs traverse 32 vegetation communities, which represent a wide range of arid to semiarid vegetation communities, including grassland and shrubland transition areas in low elevation to subalpine environments. These vegetation communities are typically characterized as extensive open canopied shrublands and woodlands that occur on a variety of soil types ranging from rocky to fine sedimentary deposits.

Noxious Weeds

Eight noxious weeds were identified within the APS ROW and include cheatgrass, spotted knapweed, Canada thistle, bull thistle, Russian olive, halogeton, saltcedar, and spiny cocklebur (AECOM 2013f). Eight noxious weeds were identified within the PNM ROW and include Russian olive, tamarisk, cheat grass, Siberian elm, cocklebur, musk thistle, and Canada thistle (Marron and Associates 2012a, b, 2013; New Mexico Department of Agriculture 2009; Arizona Department of Agriculture 2005).

4.6.3 Changes to Vegetation Affected Environment Post-2014

Two completed Federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions, and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed Federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Action are compared in the following section. Neither of these completed Federal actions would change the affected environment for vegetation.

4.6.4 Environmental Consequences

Impacts of the Proposed Action and alternatives were based on a qualitative comparison achieved by overlaying the location of proposed activities and disturbance areas on known vegetated areas, to determine potential acreages of impacts. For vegetation resources, an impact would be considered major 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. The following criteria are used to determine impacts:

- *Major.* Effects that result in economically, technically, or legally eliminating the resource and subsequently eligible for listing under the Federal ESA, or limit recovery of a listed species.
- *Moderate.* Effects that are outside of the random fluctuations of natural processes but do not cause a significant loss of the resource.
- *Minor.* Changes that would affect the quality of vegetation but are similar to those caused by random fluctuations in natural processes.
- *Negligible.* Impacts of less magnitude, but still predictable under current technology (e.g., computer models) or measurable under commonly employed monitoring technology.
- *None.* Effects that are not predicted or cannot be measured.

The evaluation of the potential effects of future emissions from the FCPP was based on two ERAs conducted to evaluate potential ecological impacts associated with future emissions from the combustion of coal at the FCPP (AECOM 2013c,h). One ERA was conducted for both terrestrial and aquatic environments within the area identified by air dispersion modeling as having a 1 percent future increase in soil metals concentrations above current condition (baseline) metals concentrations (AECOM 2013c). This area was defined as the deposition area, and the ERA is hereafter referred to at the Deposition Area ERA. The other ERA was conducted for the aquatic environment of the San Juan River within the deposition area and downstream of the deposition area into the Lake Powell arm of the San Juan River (AECOM 2013h). This ERA is hereafter referred to as the San Juan River ERA

Both the Deposition Area ERA and the San Juan River ERA were conducted following USEPA (1997, 1998) guidance whereby the ERA framework comprises four key elements: (1) Problem Formulation, (2) Exposure Assessment, (3) Toxicity Assessment, and (4) Risk Characterization.

For both ERAs baseline conditions were determined through review of existing datasets (USGS gages, Simpson and Lusk 1999, APS 2011, USFWS 2005, Esplain 1995, USGS 2012 PLUTO database, URS 2008, all as cited in AECOM 2013c) and collection of project specific soil, sediment and water samples within the deposition area (AECOM 2013c). Project specific samples were collected from different soil and vegetation types within the deposition area. Eight sediment samples were collected from Morgan Lake to supplement existing information.

The two ERAs were conducted following the same methodology with the following key exceptions.

1. The Deposition Area ERA evaluated potential ecological risks to both terrestrial and aquatic receptors within the deposition area while the San Juan River ERA evaluated potential ecological risks only to aquatic receptors in the San Juan River within depositional area as well as in the San Juan River downstream to within the Lake Powell arm of the San Juan River.
2. The Deposition Area ERA identified 20 metals, 17 polycyclic aromatic hydrocarbon (PAH) compounds, 17 polychlorinated dibenzo(p)dioxin and dibenzofuran (dioxin/furan) congeners, acrolein, benzene, sulfuric acid, hydrogen chloride, and hydrogen fluoride were identified as COPECs. The San Juan River ERA only evaluated ecological risks associated with exposure to three metals: arsenic, mercury, and selenium.

3. Air dispersion and deposition modeling was conducted by AECOM for the Deposition Area ERA using the AERMOD short-range dispersion model, whereas air dispersion and deposition modeling for the San Juan River ERA was conducted by EPRI using a global-scale model (GEOS-Chem) and a regional-scale model (CEMQ-APT). The air dispersion and deposition modeling conducted by AECOM is described in the two AECOM ERAs (AECOM 2013a, 2013b). The air modeling and deposition conducted by EPRI is described in EPRI (2014).
4. Fate and transport modeling for the Deposition Area ERA was conducted by AECOM using IRAP-h software, developed by Lakes Environmental, which implements the USEPA (2005) Human Health Risk Assessment Protocol (HHRAP) for Hazardous Waste Combustion Facilities. Fate and transport modeling for the San Juan River ERA was conducted by EPRI using the Watershed Analysis Risk Management Framework (WARMF) model.
5. In the Deposition Area ERA, mercury exposure to fish was estimated using literature-based bioaccumulation factors. In the San Juan River ERA, mercury exposure to fish was estimated using a food web model.
6. The Deposition Area ERA evaluated and compared ecological risks associated with current conditions and future FCPP emissions. The San Juan River ERA evaluated and compared ecological risks associated with current conditions, FCPP emissions, and regional/global emissions.

It is important to recognize that these ERAs do not directly address potential impacts to communities or populations, but rather address potential impacts to individuals. For generic ecological receptors population-level effects may be of greater relevance than impacts to individuals. Thus, potential risks to individuals are likely not representative of risks to populations; in general, for the same exposures, population risk tends to be lower than individual risk. However, for special status species, and in particular, federally listed species, potential effects to individuals may be relevant, especially for immobile early life stage individuals. For both ERAs, the aquatic environment may include receptors that live in the aquatic environment as well as those that forage within the aquatic environment.

4.6.4.1 Alternative A – Proposed Action

Navajo Mine

The following activities associated with the Proposed Action at the Navajo Mine would result in removal of existing vegetation and are discussed in greater detail below:

- Renewal of existing Navajo Mine SMCRA permit and associated mining activities in Area III
- Mining activities in Areas IV North and IV South
- Realignment of Burnham Road and construction of other access roads
- Construction of additional transmission lines

The renewal of the existing Navajo Mine SMCRA Permit would allow mining in Area III to continue until the resource was depleted (anticipated in 2016). As a result of mining activities, vegetation in the permit area would be removed until reclamation commenced. Surface disturbance within the Navajo Mine would also remove existing vegetation communities within the Pinabete Permit Area. The removal of vegetation for both the Navajo Mine Permit and the Pinabete Permit would take place in areas of active mining and in areas where support roads are required. No removal of vegetation communities is proposed for the continued use of the coal-handling and transportation facilities associated with the continued operation of Navajo Mine. Mining would physically remove native vegetation, resulting in direct impacts to existing vegetation communities by reducing overall vegetative cover and causing a short-term loss of productivity during the active mining phase. Soil disturbance could negatively impact naturally occurring seed sources

by reducing seed yield and/or viability and, subsequently, decreasing the success of native plant re-colonization. Vegetation removal would result in short-term impacts until disturbed areas were reclaimed in accordance with OSMRE reclamation standards.

Vegetation within the permit areas would gradually be removed and reclaimed on an ongoing basis as mining activities occurred over time. As proposed within the Pinabete Permit Area, 4,104 acres of the 5,570 acres would be disturbed as a result of mining activities (see Table 4.6-3 for a breakdown of the vegetation types identified within the Pinabete Permit Area). The density and diversity of vegetation species would be modified in areas reclaimed following mining activities. However, reclamation would restore vegetation within the disturbed areas using topsoil salvage practices to maximize vegetative regrowth and using the approved NTEC Revegetation Plan. NTEC would implement a geomorphic approach to reclamation by creating landforms that possess compatible topography and comparable erosional stability. A geomorphic approach would create topographic variability. Revegetation species may show preference for certain topographic conditions, such as nearly level slopes, north or south aspects, or locations within the landscape such as in low-lying areas. This approach would ultimately help to meet the revegetation goals by creating a diverse, stable, and self-sustaining vegetation community.

Vegetation communities not directly impacted by mining activities within the permit areas may be affected by wind-borne dust, offroad travel, and weed invasion (OSMRE 2012a). Fugitive dust that settles on plants can block photosynthesis, respiration, and transpiration and can cause physical injuries to plants (OSMRE 2012a). Air-borne dust concentrations decrease with increasing distance from the source, with the majority that can impact plant photosynthesis settling within 100 meters in arid conditions (OSMRE 2012a). Potential impacts from fugitive dust would be localized and decreased through the implementation of fugitive dust control measures (see Section 4.1, Air Quality).

With surface disturbance, the potential for the spread or introduction of noxious weeds increases by wind, water, and vehicles. Noxious weed seeds would be deposited and may germinate in disturbed soils and could extend beyond the immediate area of disturbance. NTEC's Noxious Weed Management Plan employs multiple measures to minimize the introduction and spread of noxious weeds within Navajo Mine (BNCC 2012a).

The proposed realignment of Burnham Road would include permanent removal of 13.6 acres of vegetation for the road surface and an estimated additional 33.9 acres of temporary disturbance during roadway development. The affected vegetation generally would be associated with badlands and alkali wash vegetation types (BIA 2007). Additionally, approximately 86.7 acres of vegetation would be disturbed for the development of other ancillary dirt roads that would be used during mining activities. This acreage would be reclaimed upon completion of mining activities.

NTEC would implement all BMPs and protective measures as required by the SMCRA permit, including the following:

- An Environmental and/or Biological Resource Compliance Monitoring Plan would be prepared for all construction projects to ensure implementation of mitigation measures. The plan would identify the frequency and type of monitoring required by qualified natural/biological resources personnel. The plan would be submitted to Navajo Nation Department of Fish and Wildlife (NNDFW) for approval prior to any construction.
- All construction personnel would attend an environmental protection briefing prior to working on any construction site in the Project Area. This briefing is designed to familiarize workers with statutory and contractual environmental requirements and the recognition of and protection measures for sensitive vegetation community and wildlife habitats.
- Protective barriers would be placed around specified sensitive vegetation communities as identified by the NNDFW. Barriers would be installed prior to construction and field inspected by NNDFW or OSMRE personnel to verify proper placement.

- Imported soils, fills, or aggregates would be free of deleterious materials (i.e., trash, construction debris, noxious weeds). Sources of imported materials would be submitted for OSMRE or Navajo Nation approval prior to construction.

With the implementation of these measures, as well as the Noxious Weed Management Plan, indirect impacts to vegetation during construction of ancillary facilities would be minor.

All areas proposed to be mined under the Proposed Action would be reclaimed. NTEC performs reclamation at Navajo Mine pursuant to its SMCRA permit (BNCC 2012a), 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. Under the Proposed Action, both the Pinabete Permit Area and Navajo Mine Permit Area would be reclaimed such that:

- total vegetative cover is at least equal to the annual mean cover of reference area,
- total production is at least equal to the annual mean production of reference area,
- shrub density is equal to or greater than 190 shrubs per acre on 80 percent of the area and greater than or equal to 500 shrubs per acre on 20 percent of the area in shrub islands and corridors,
- species diversity includes two perennial grass species, where at least one perennial grass species has a relative perennial herbaceous cover value equal to or greater than 5 percent, and a second perennial grass speices will have a relative perennial herbaceous cover value equal to or greater than 3 percent. No one species shall account for more than 85 percent relative herbaceous cover,
- species diversity includes perennial forbs, where perennial forbs on the reclamation area are greater than or equal to 0.5 percent relative perennial herbaceous cover. This forb standard would be adjusted in drought years when cumulative total precipitation for January through April is less than or equal to 0.85 inch, the forb component will be successful if at least one perennial forb is observed within at least one of the 100 square meter shrub density belt transects, and
- species diversity includes two shrub species, where in addition to the dominant shrub species, there would be a minimum of 20 shrubs per acre of additional combined species (BNCC 2012a).

Revegetation would replace existing plant communities with native grass, forb, and shrub species to establish post-mining land uses of livestock grazing and wildlife habitat. As a result, species composition within the existing vegetation communities would change from vegetation areas described in Section 4.6.2 and be replaced with native seed mix that would increase the vegetative cover in most areas reclaimed.

BNCC has developed and NTEC will implement comprehensive revegetation plans in both the Navajo Mine Permit Area and Pinabete Permit Area based on experience reestablishing vegetation on previously disturbed areas at the Navajo Mine. Implementation of the revegetation plans would establish a diverse, stable, and self-sustaining vegetation community composed of native species capable of meeting the post-mining land use. Both plans have been reviewed by OSMRE and would satisfy the following criteria:

- Adequate cover capable of stabilizing the soil surface from erosion
- Adequate forage to sustain the post-mining land uses (i.e., livestock grazing and wildlife habitat)
- Suitable species composition for enhancement of wildlife forage and cover

NTEC would implement revegetation success comparisons. The revegetated areas would be compared to an arithmetic mean of the reference area vegetation communities. Revegetation would be considered successful when the total vegetation cover, total vegetative production, and shrub density are not less than 90 percent of the revegetation success criteria. Table 4.6-6 describes NTEC's success criteria.

Table 4.6-6 Pinabete Permit Area Revegetation Success Criteria

Vegetation Sampling Parameter	Revegetation Areas Standard
Total vegetation cover[1]	• Annual mean
Total vegetative production[1]	• Annual mean
Shrub density	• 190 or 500 shrubs per acre[2]
Species diversity	• Two perennial grasses species[3] • Perennial forbs ≥ 0.5% relative perennial herbaceous cover[4] • Two shrub species[5]

Source: BNCC 2012a

Notes:
1 Total vegetation cover (i.e., percent cover of live plants plus litter) and total vegetation production (i.e., annual and perennial vegetation production) will reflect only current year's growth.
2 Shrub density is considered successful if the number of shrubs is equal to or greater than 190 shrubs per acre on 80% of the area and greater than or equal to 500 shrubs per acre on 20% of the area in shrub islands and corridors.
3 At least one perennial grass with a relative perennial herbaceous cover of greater than or equal to 5% and a second perennial grass species with a relative perennial herbaceous cover value greater than or equal to 3%. No one species will account for more than 85% relative herbaceous cover.
4 In drought years, when the cumulative precipitation between January and April is less than or equal to 0.85 inch, the forb parameter is successful if at least one perennial forb is observed within at least one of the 100-square-meter shrub density belt transects.
5 In addition to the dominant shrub species there will be a minimum of 20 shrubs per acre of additional combined species.

Four Corners Power Plant

Under the Proposed Action, FCPP would continue to operate and maintain existing facilities. The only areas of surface disturbance would be the DFADAs and areas proposed as borrow pits for the creation of impoundments in the DFADAs. Construction of the DFADAs would result in the permanent loss of up to 355 acres of existing vegetation communities, resulting in direct impacts to existing vegetation communities by reduction in overall vegetative cover and permanent loss of productivity during facility life. Further, use of the borrow areas to facilitate DFADA development would disturb an additional 697 acres, for a total disturbance of 1,052 acres in the DFADAs (Table 4.6-7).

Table 4.6-7 Disturbed Vegetation Types within the Ash Disposal and Borrow Areas

Vegetation Type	Acres
Inter-Mountain Basins Mixed Salt Desert Scrub	776
Inter-Mountains Basins Shale Badland	187
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	89
Total Ash Disposal Facility	**1,052**

Source: Ecosphere 2012c

Construction of the additional DFADAs would also alter natural seed dispersal patterns, which could indirectly impact recruitment of plant species in the immediate area. Disturbance of natural plant communities can lead to invasion of noxious weed species, which may be more likely to outcompete native species. Indirect impacts resulting from alteration of natural vegetation communities and the potential for the introduction of nonnative or exotic species would be permanent and minor due to the relatively small area involved and the ubiquitous nature of the vegetation communities within the area.

Vegetation communities adjacent to the DFADA construction areas may also be affected by wind-borne dust, offroad travel, and weed invasion. Fugitive dust that settles on plants can block photosynthesis,

respiration, and transpiration and can cause physical injuries to plants. Air-borne dust concentrations decrease with increasing distance from the source, with the majority that can impact plant photosynthesis settling within 100 meters in arid conditions (OSMRE 2012a). However, potential impacts from fugitive dust would be localized and minimized through the implementation of fugitive dust control measures; as a result impacts would be expected to be minor.

In addition to direct impacts of the construction of the DFADAs, potential indirect impacts to vegetation in the ROI would occur as a result of the deposition of air emissions from the FCPP. Ecological risks associated with future emissions from the FCPP were evaluated to address the impacts of direct contributions from the FCPP stacks under the Proposed Action that are deposited on nearby terrestrial and aquatic habitats. Total future risks were calculated by considering risks from constituents currently present in the environment, as well as constituents associated with future emissions from the FCPP for an additional 25 years, from 2016 to 2041. Based on this evaluation, no major risks to terrestrial plants are expected within the deposition area and impacts from the Proposed Action are not expected to increase current risks to a level of concern (AECOM 2013c).

Transmission Lines

Under the Proposed Action, no construction or changes in operations would be associated with the renewal of the APS or PNM transmission line ROWs.

Repair to transmission line infrastructure is completed regularly. While most inspections and repairs would not result in ground disturbance, larger repairs, such as tower replacement or anchoring, may result in limited ground disturbance in discreet areas within and directly adjacent to the ROWs. While regular maintenance and repair are expected to occur as a continued part of regular operation, ground-disturbing activities would be subject to agency consultation and permitting prior to construction.

Renewal of the ROWs would have no direct additional impacts on vegetation communities within the APS or PNM ROWs other than those occurring under current operations; therefore, impacts to vegetation from transmission lines are considered negligible.

4.6.4.2 Alternative B – Navajo Mine Extension Project Mine Plan

Navajo Mine

Vegetation communities occurring under Alternative B would be temporarily removed and reclaimed over the mine's life. Alternative B would result in a disturbance footprint approximately 894 acres larger than the Proposed Action (See Section 3, Table 3-7). For Alternative B, operations and reclamation would be conducted as described under the Proposed Action. Use of the existing Navajo Mine buildings, support facilities, and coal-handling areas would continue as described under the Proposed Action. Under Alternative B, 8 additional miles of transmission lines would be constructed. Fugitive dust and noxious weed management and control would be conducted as described under the Proposed Action. Therefore, impacts to vegetation under Alternative B would be similar to those described under the Proposed Action.

Under Alternative B, additional primary and ancillary roads would be required to support mining activities. Vegetation removal would be required for construction of these roads, but these roadways would be reclaimed upon closure of the Navajo Mine. Vegetation removal, reclamation, dust control, and noxious weed control associated with use of these support roads would be conducted as described under the Proposed Action.

Under Alternative B, the realignment of Burnham Road would be 6.2 miles long and would include permanent removal of 30.1 acres of vegetation for the road surface and an estimated 75.2 acres of temporary disturbance during roadway development. This vegetation impacted is generally associated with badlands and alkali wash vegetation types (BIA 2007). Additionally, approximately 173.2 acres of

vegetation would be disturbed for the development of other ancillary dirt roads that would be used during mining activities. This acreage would be reclaimed upon completion of mining activities.

Fugitive dust and noxious weed management and control would be conducted as described under the Proposed Action. Therefore, direct impacts to vegetation under Alternative B would be proportionally greater to those described under the Proposed Action.

Under Alternative B, the Pinabete Permit Area would be reclaimed as described under the Proposed Action. Therefore, impacts to vegetation under Alternative B would be similar to those described under the Proposed Action.

Four Corners Power Plant

Under Alternative B, all impacts for the FCPP would be as described under the Proposed Action.

Transmission

Under Alternative B, all impacts that would result from continued operation and maintenance of the transmission lines would be as described under the Proposed Action.

4.6.4.3 Alternative C – Alternative Pinabete Mine Plan

Navajo Mine

Under Alternative C, mining would be located in both Area IV North and Area IV South, as described for the Proposed Action. Alternative C would result in a footprint of 6,492.2 acres; approximately 2,388.7 acres larger than the Proposed Action (see Section 3, Table 3-8). Operations and reclamation would be conducted as described under the Proposed Action. Reclamation, dust control, and noxious weed control would be conducted as described under the Proposed Action. Therefore, short-term impacts to vegetation under Alternative C would be greater than (more acres disturbed) but similar to (all direct impacts would be revegetated) those described under the Proposed Action.

Use of the existing Navajo Mine buildings, support facilities, and coal-handling areas would continue as described under the Proposed Action. Under Alternative C, 8 more miles of transmission lines would be constructed than under the Proposed Action. Although fugitive dust and noxious weed management and control would be conducted as described under the Proposed Action, construction of a greater distance of transmission line would result in greater permanent vegetation removal. Therefore, impacts to vegetation under Alternative C would be similar to those described under the Proposed Action.

Also under Alternative C, additional primary and ancillary roads would be required to support mining activities. Vegetation removal would be required for construction of these roads, but these roadways would be reclaimed upon closure of the Navajo Mine. Reclamation, dust control, and noxious weed control associated with the construction and use of these support roads would be conducted as described under the Proposed Action.

Under Alternative C, the realignment of Burnham Road would be 6.2 miles long (same as Alternative B), and would include permanent removal of 30.1 acres of vegetation for the road surface, and an estimated 75.2 acres of temporary disturbance during roadway development. The affected vegetation is generally associated with badlands and alkali wash vegetation types (BIA 2007). Additionally, approximately 204.5 acres of vegetation would be disturbed for the development of other ancillary dirt roads that would be used during mining activities. This acreage would be reclaimed upon completion of mining activities.

Four Corners Power Plant

Impacts to vegetation under Alternative C would be the same as described for the Proposed Action.

Transmission Lines

Impacts to vegetation under Alternative C would be the same as described for the Proposed Action.

4.6.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action. Impacts would be the same as described for the Proposed Action.

Four Corners Power Plant

Under this alternative, the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The types of direct and indirect effects on the vegetation occurring as a result of the DFADAs would be of the same nature as those described for the Proposed Action, but would result in less impact to the local vegetative community. The 10% reduction in surface area of the DFADAs would result in less permanent loss of the existing vegetative community and less potential for indirect impacts, such as impacts to seed dispersal or introduction of invasive species. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

Under this alternative, the transmission line ROWs would be approved and they would continue to be operated and maintained as described for the Proposed Action. As such, impacts would the same as described for the proposed action.

4.6.4.5 Alternative E – No Action Alternative

Navajo Mine

Under the No Action Alternative mining would cease when the ROD is issued in 2015 and reclamation would be conducted through 2021. Removal of ancillary mining facilities could result in some temporary disturbance of vegetated areas during demolition but these areas would be revegetated according to the approved reclamation plan. No additional disturbance to vegetation would occur under the No Action Alternative.

Four Corners Power Plant

Under the No Action Alternative, the FCPP would shut down and the DFADAs would not be constructed. Demolition and dismantling of the power plant components is unlikely to result in disturbance to vegetation as power plant units and buildings are on paved areas. It is unknown if these areas would be revegetated following demolition. No direct adverse or beneficial impacts to vegetation would be anticipated as a result of the No Action Alternative.

FCPP shutdown would eliminate deposition of air emissions from the power plant, which would reduce potentially adverse indirect effects of mercury and selenium and other metal uptake by plants in the ROI over the long term. However, since the FCPP is only one of a number of power plants in the area, potential metal uptake by plants would not be eliminated and it is unknown if any beneficial impacts to vegetation would occur as a result of FCPP shutdown.

Transmission Lines

Under the No Action Alternative, the APS and PNM transmission lines would either be decommissioned and dismantled or left in place. If they were decommissioned and dismantled, direct impacts to vegetation surrounding the structures would occur; however, following completion of these activities it is expected

that vegetation would reestablish itself. Further, disturbance to vegetation resulting from decommissioning and dismantling activities would be coordinated with the Navajo Nation and the BLM to maintain that compliance with all environmental laws and regulations would occur throughout the demolition process. If the transmission lines are left in place, APS and PNM would be required to continue maintenance of the facilities for fire protection purposes (e.g., weed clearance and other vegetation clearance); therefore, impacts to vegetation would be as described for the Proposed Action.

4.6.5 Vegetation Mitigation Measures

The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific mitigating measures for certain environmental impacts, standard operating procedures that reduce or avoid environmental impacts, and best management practices for specific activities. These are described in Section 3.2.6.6. These measures are part of their application materials and are enforceable through permit or lease conditions. In addition, the Project Applicants must comply with additional protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section for each resource category. Where the environmental analysis in this EIS recommends additional protective measures, over and above the applicant proposed measures and regulatory compliance, they are listed below as specific mitigation measures.

The Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects to vegetation. Therefore, no additional mitigation is recommended.

4.7 Wildlife and Habitats

The Project Area is situated on the high desert terrain of the Colorado Plateau in northwestern New Mexico and northeastern Arizona. The area which a project could potentially adversely affect is known as the ROI. The ROI for potential effects to wildlife and habitat for this project is defined as those areas occurring within 1 mile of the Navajo Mine and FCPP lease areas, and those areas within 0.5 mile of the PNM and APS transmission line ROWs (see Figure 4.7-1). This section provides information on wildlife species expected to reside in the ROI or use the ROI as visitors or regular seasonal migrants.

A diverse range of terrain and vegetation communities are used by wildlife seasonally or year-round. It is difficult to identify all wildlife occurring in a particular area, even if regular and frequent wildlife surveys are conducted. This analysis relies on survey data to identify wildlife species in the ROI, but also relies on documentation of habitats in the ROI and vicinity to identify potential species occurrence.

4.7.1 Regulatory Compliance Framework

The proposed Project is subject to the requirements of Federal, state, and tribal regulations established to guide management of wildlife and their critical habitats.

4.7.1.1 Federal Regulations

Project activities are subject to the Federal regulations discussed in this section. This section does not specifically address threatened and endangered species and their habitats, which are regulated under the ESA; these species are addressed in Section 4.8, Special Status Species.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668c), enacted in 1940 and amended several times since enactment, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment (USFWS 2013a). Eagle breeding activities and nesting locations are afforded legal protection under the act.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA), originally passed in 1918, implements the US commitment to four bilateral treaties [with Canada, Mexico, Japan, and Russia], or conventions, for the protection of a shared migratory bird resource (16 USC 703-712). Each of the treaties protects selected species of birds and provides for closed and open seasons for hunting game birds. The MBTA protects bird species by implementing the four treaties within the US. The list of migratory bird species protected by the MBTA appears in 50 CFR 10.13. The MBTA provides that it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg of any such bird, unless authorized under a permit issued by the Secretary of the Interior. Some regulatory exceptions apply. “Take” is defined in regulations as: “pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt.” The MBTA protects over 800 species of birds that occur in the US (USFWS 2013b). Avian species breeding activities and nesting locations are afforded legal protection under MBTA.

Surface Mining Control and Reclamation Act of 1977

Under SMCRA, NTEC is required to provide fish and wildlife resource information for the proposed permit area and adjacent areas. OSMRE determines the scope and level of this information. However, site-specific resource information is required to address wildlife species or habitats with high value for fish and wildlife, such as important streams, wetlands, riparian areas, cliffs, areas offering special shelter or protection, migration routes, or reproduction and wintering areas [30 CFR 784.21(a)]. OSMRE uses an adequate description of the existing pre-mining environmental resources within the mining lease to determine whether the applicant can comply with the performance standards of the regulations for surface coal mining and whether reclamation of these areas is feasible (30 CFR 779.10). NTEC is also required to include a Protection and Enhancement Plan to minimize disturbances and adverse impacts on wildlife to the extent possible and to achieve enhancement of such resources where practicable [30 CFR 784.21(b)].

Under the SMCRA permit proposed for issuance for this Project, wildlife habitat would be a secondary post-mining land use; therefore, NTEC is required to select the plant species to be used on reclaimed areas based on the following criteria: (1) their proven nutritional value for fish and wildlife, (2) their use as cover for fish or wildlife, and (3) their ability to support and enhance fish or wildlife habitat after the release of performance bonds [30 CFR 816.97(g)]. The selected plants should also be grouped and distributed in a manner that optimizes edge effect, cover, and other benefits to fish and wildlife [30 CFR 816.97(g)].

4.7.1.2 Navajo Nation Programs

Those project activities are subject to the tribal requirements discussed in this section. Similar to the Federal ESA, the Navajo Mine is subject to compliance with protection of species on the Navajo Endangered Species List, which is addressed in Section 4.8, Special Status Species. The FCPP is exempt from these programs.

Navajo Nation Aquatic Resource Protection Program

The Navajo Nation Aquatic Resource Protection Program is designed to provide protection for sensitive aquatic features through application of ecosystem-level management techniques. The program consists of four primary efforts: 1) identification and inventory of existing resources; 2) development of an aquatic resource database; 3) evaluation, classification, and regulation of impacts to aquatic resources; and 4) monitoring, maintenance, and enhancement of ecosystem health and function. The program was developed to preserve and protect aquatic resources while retaining the flexibility to accommodate future human and economic growth (Navajo Natural Heritage Program 1994).

Biological Resource Land Use Clearance Policies and Procedures, RCS-44-08, Approved September 10, 2008

The Resources Committee of the Navajo Nation Council is the legislative oversight of the Division of Natural Resources that includes the Navajo Nation Department of Fish and Wildlife (NNDFW). It has the responsibility and authority to adopt policies, procedures, and regulations that protect the Navajo Nation's biological resources. The Resources Committee, by Resolution Number RCMA-34-03, dated March 13, 2003, approved the Biological Resource Land Clearance Policies and Procedures. The policies and procedures' purpose is to assist the Navajo Nation government and chapters in ensuring compliance with Federal and Navajo laws, which protect wildlife resources and their habitat.

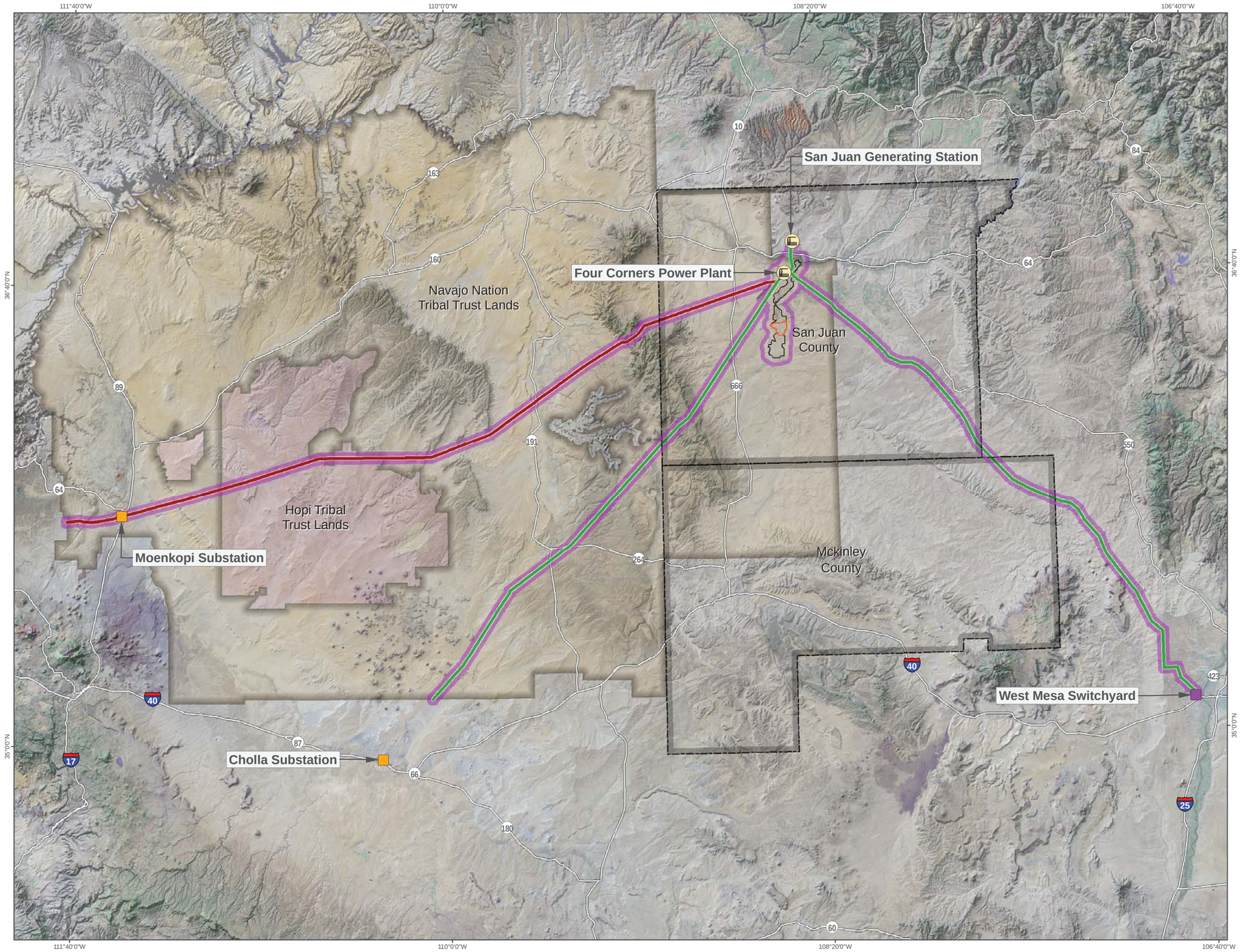

Figure 4.7-1

Region of Influence (ROI)
for Wildlife and Habitat

PROJECT FACILITIES

- Four Corners Power Plant
- Substation
- Switchyard

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Proposed Pinabete Permit Boundary
- Region of Influence

TRANSMISSION LINES

- 345kV
- 500kV

OTHER FEATURES

- County Boundaries
- Hopi Tribal Trust Lands
- Navajo Nation Tribal Trust Lands

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Scale in Miles

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4.7.1.3 State Regulations

The Navajo Mine and FCPP are located entirely on Navajo Nation trust lands and, therefore, are not subject to state law. Associated transmission lines, however, traverse state lands. The following regulations are applicable only to the operation and maintenance of the transmission lines.

Under New Mexico State Statutes Title 19 – Natural Resources and Wildlife, the State of New Mexico is responsible for management and conservation of New Mexico's game species and native species by tracking and processing wildlife permits and maintaining New Mexico's list of threatened and endangered species. As part of these statutes, New Mexico is responsible for enforcing New Mexico State Statutes as they apply to game species, wildlife administration, trapping, wildlife habitats and lands, hunting and fishing, endangered and protected species, and captive wildlife. New Mexico is also charged with maintaining the state's natural resources through New Mexico Department of Agriculture's management of plant species and range lands.

Under Arizona Administrative Code Title 12 Chapter 4, Natural Resources, and Title 17, Game and Fish, the State of Arizona is responsible for enforcing and permitting actions related to the taking and handling of wildlife, live wildlife, and managing the state's wildlife resources and wildlife areas. These regulations are enforced by the Arizona Game and Fish Department. Arizona's native plants are protected by state law and managed by the Arizona Department of Agriculture. Under Arizona state law, protected plants may not be removed from any lands, whether private or public, without the permission of the landowner and issuance of an Arizona Department of Agriculture permit.

4.7.1.4 Regional Plans

The San Juan River Recovery Implementation Program (SJRRIP) was established to support recovery of the Colorado pikeminnow and the razorback sucker, while allowing water development and management activities to continue in the San Juan River Basin in compliance with all applicable Federal and State laws. The SJRRIP was formed in recognition that the existing impacts associated with water development may be exacerbated by continued development of the waters of the San Juan River and that a program was needed whereby all entities that have a potential or opportunity to recover or protect the river environment are involved. The Program is intended to identify and implement actions that assist in the recovery of the species and provide compliance with sections 7 and 9 of the ESA for water development and water management activities in the Basin. The specific program goals are:

- To conserve populations of the Colorado pikeminnow and razorback sucker in the Basin consistent with recovery goals established under the Endangered Species Act, 16 U.S.C. 1531 et seq.
- To proceed with water development in the Basin in compliance with Federal and State laws, interstate compacts, Supreme Court decrees, and Federal trust responsibilities to the Southern Utes, Ute Mountain Utes, Jicarillas, and the Navajos.

The program includes representatives from Federal, and state government agencies, Native American tribes, water development interests, and other private groups. This program conducts research and management activities intended to recover the populations of Colorado pikeminnow and razorback sucker in accordance with the recovery plans for these two species developed under the ESA.

4.7.2 Affected Environment Pre-2014

4.7.2.1 Wildlife Habitats

The region surrounding the Navajo Mine, FCPP, and associated transmission lines support a variety of natural vegetation communities and landscape features that offer a diversity of wildlife habitat types. Section 4.6, Vegetation, details the vegetation communities in the ROI identified through implementation of the Gap Analysis Program, and Figure 4.6-1 illustrates their geographic distribution. Wildlife habitat types discussed in this section correspond with the vegetation community types and are further defined

by a number of distinct landscape features such as washes and gullies, rock outcrops and hillsides, cliffs and taluses, and cave and mine entrances. All contribute to the diversity of wildlife in the area as they provide microhabitats for wildlife uniquely adapted to or dependent on these features.

Most wildlife species in the region are adapted to xeric conditions, defined by sparse vegetative cover and limited sources of permanent water. Areas providing perennial and intermittent water support higher density of vegetative cover, contributing to increased wildlife diversity. Perennial water sources within the ROI include Morgan Lake, lower Chaco River below Morgan Lake, ponds and impoundments within the Navajo Mine and Pinabete Permit Area, and the San Juan River. Intermittent sources of water include agricultural ditches and seasonally wet arroyos occurring within the transmission line ROWs. Large mammals, small mammals, reptiles, fish, and avian species use these water sources regularly as seasonal or permanent residents.

Upland habitats capable of supporting a number of wildlife species dominate large portions of the ROI, including open desert scrub, open woodland, forest, agricultural, and developed areas. Habitats in the cover classes support breeding, foraging, and seasonal migration activities. Much of the ROI is dominated by the Semi-Desert (64.9 percent) cover class, which includes a number of shrubland vegetative types common to the southwestern desert. Forest & Woodland (18.7 percent) accounts for the second greatest cover class and is primarily located along the APS and PNM transmission ROWs. Tables in Section 4.6 list vegetation cover classes by Project component within the ROI (Navajo Mine, FCPP, and transmission lines).

4.7.2.2 Wildlife Species

Existing wildlife in the ROI (those areas occurring within 1 mile of the Navajo Mine and FCPP lease areas, and those areas within 0.5 mile of the PNM and APS transmission line ROWs; see Figure 4.7-1) was determined through biological surveys conducted during the spring and summer of 2012 and 2013. Because of the diversity of wildlife species identified and expected to occur within the ROI, wildlife presence and expected presence is presented by species group (e.g., raptors and carnivores) followed by a discussion of use of each of the Project components (Navajo Mine, FCPP, and transmission lines) by the species group.

Raptors

Raptors are expected to occur over every habitat type found in the ROI, as foraging and nesting habitats occur throughout. Foraging habitat for raptors occurs across all cover classes and vegetation communities identified in the region, including developed areas. Raptor nesting habitat generally occurs in the upland forested areas (Forest & Woodland) and along cliffs and canyons (Nonvascular & Sparse Vascular Rock Vegetation). Except for the transmission corridors, raptor nesting habitat represents less than 5 percent of the cover within the ROI's individual components areas. Some species, such as burrowing owl and northern harrier, nest on the ground in scrub and grassland habitat types closely associated with the Semi-Desert, Shrubland, and Grassland cover classes. Ground nesting is occasionally associated with riparian cover classes occurring in the ROI.

Raptor species observed or expected to occur within the ROI include the species identified in Table 4.7-1 (BNCC 2012a; Ecosphere 2008, 2012c; Marron and Associates 2012a, 2012b, 2013; AECOM 2013f; APS 2012c).

Table 4.7-1 Raptor Species Expected to Occur in the ROI

Species	Expected to Occur
American kestrel *(Falco sparverius*)	Year-round
bald eagle (*Haliaeetus leucocephalus*)	Winter Nonbreeding, Year-round
barn owl (*Tyto alba*)	Year-round
burrowing owl (*Athene cunicularia)*	Summer Breeding, Year-round
California condor *(Gymnogyps californianus)*	Year-round
Cooper's hawk (*Accipiter cooperii*)	Year-round
ferruginous hawk (*Buteo regalis*)	Summer Breeding, Year-round
golden eagle (*Aquila chrysaetos*)	Year-round
goshawk (*Accipiter gentilis*)	Year-round
great-horned owl (*Bubo virginianus*)	Year-round
Harris' hawk *(Parabuteo unicinctus)*	Year-round
Mexican spotted owl (*Strix occidentalis lucida*)	Year-round
northern harrier (*Circus cyaneus*)	Winter Nonbreeding, Year-round
osprey (*Pandion haliaetus*)	Migration
peregrine falcon (*Falco pergrinus*)	Year-round
prairie falcon (*Falco mexicanus*)	Year-round
red-tailed hawk (*Buteo jamaicensis*)	Year-round
rough-legged hawk (*Buteo lagopus*)	Winter Nonbreeding
sharp-shinned hawk (*Accipiter striatus)*	Year-round
turkey vulture (*Cathartes aura*)	Summer Breeding, Year-round

Navajo Mine

Raptor foraging and nesting habitat occurs in and around the Navajo Mine Lease Area, Pinabete Permit Area, and proposed Burnham Road realignment areas. Raptor foraging habitat occurs across all habitat types. Raptor nesting habitat is expected to be limited to the following cover classes identified in Table 4.6-2: Developed & Other Human Use (9.8 percent of the Navajo Mine ROI), Forest & Woodland (2.6 percent), and Nonvascular & Sparse Vascular Rock Vegetation (1.2 percent), or approximately 13.6 percent of the Navajo Mine ROI. Ground-nesting raptor species, particularly the burrowing owl and northern harrier, could occur in the Semi-Desert (77.2 percent) and Shrubland & Grassland (5.1 percent) cover classes within and around the Navajo Mine ROI.

Raptor surveys within the Navajo Mine Lease Area have been conducted over the last 2 decades. Ten species of raptors have been documented, including American kestrel, bald eagle, burrowing owl, Cooper's hawk, ferruginous hawk, golden eagle, great-horned owl, northern harrier, prairie falcon, and red-tailed hawk. These species are expected to forage and nest within and near the vicinity of the Navajo Mine Lease Area, Pinabete Permit Area, and the Burnham Road realignment (BNCC 2012a, Ecosphere 2008). Raptor nesting surveys completed between 2004 and 2007 within 1 mile of the Navajo Mine Permit Area identified and inventoried 12 historic hawk nests. Surveys of these nests in 2007 identified one active golden eagle nest. Burrowing owl nests occur in burrows and cavities around the Navajo Mine and Pinabete Permit Area, primarily near abandoned prairie dog colonies.

FCPP

Raptor foraging and nesting habitat occurs in and around the FCPP Lease Area, including undeveloped habitat and Morgan Lake, and the proposed DFADAs. Raptor foraging habitat occurs across all habitat types. Raptor nesting habitat is expected to be limited to the following cover classes identified in Table 4.6-4: Developed & Other Human Use (3.7 percent of the FCPP ROI), Forest & Woodland (4.2 percent), and Nonvascular & Sparse Vascular Rock Vegetation (1.7 percent), or 9.6 percent of the FCPP ROI. Ground-nesting raptor species, particularly the burrowing owl and northern harrier, could occur in the Semi-Desert and Shrubland & Grassland cover classes (67.8 percent collectively) and within riparian areas around Morgan Lake (1.8 percent). The FCPP itself offers limited foraging or nesting habitat as it is primarily industrial in nature and lacks vegetative cover capable of supporting prey species.

Habitat capable of supporting foraging activities of raptor species occurs within the entire proposed DFADA, including vegetation communities associated with Forest & Woodland, Nonvascular & Sparse Vascular Rock Vegetation, and Semi-Desert cover classes. Vegetation communities within the 1,052 acre DFADAs represent 4.9 percent of the FCPP ROI. While both the Forest & Woodland and Nonvascular & Sparse Vascular Rock vegetation communities are generally considered raptor nesting habitat, both of these cover classes were evaluated and determined to be inadequate for supporting nesting raptors (Ecosphere 2012c). Ferruginous hawk, golden eagle, and burrowing owl are identified as potentially occurring within the proposed DFADAs based upon known nesting data and the presence of potential nesting habitat occurring outside, but within 1 mile, of the proposed DFADAs (Ecosphere 2012c). Two species of raptors were documented in the FCPP DFADAs, including ferruginous hawk and turkey vulture (Ecosphere 2012c).

Transmission Lines

Habitat capable of supporting foraging and nesting activities of raptor species occurs in both the APS and PNM transmission ROWs. Foraging habitat exists across the entire length of both APS and PNM transmission corridors within all habitat types. Raptor nesting habitat is limited to the following cover classes identified in Table 4.6-5: Developed & Other Human use (0.4 percent of the transmission line ROI), Forest & Woodland (22.5 percent), and Nonvascular & Sparse Vascular Rock Vegetation (6.7 percent) or 29.6 percent of the transmission line ROI. Ground-nesting raptor species are expected to occur along the ROW's entire length, but more specifically nesting in Semi-Desert (62.2 percent) and Shrubland & Grassland (6.1 percent) cover classes.

Results of the APS habitat analysis and review of the APS avian database for Navajo and Coconino counties identified the following species expected or documented to occur within the APS transmission ROW: bald eagle, California condor, golden eagle, great-horned owl, ferruginous hawk, Harris' hawk, Mexican spotted owl, and red-tailed hawk (AECOM 2013f, APS 2012c).

Studies completed during 2012 identified the following raptor species within the PNM ROW: American kestrel, prairie falcon, peregrine falcon, red-tailed hawk, ferruginous hawk, Cooper's hawk, golden eagle, and burrowing owl (Marron and Associates 2012a, 2012b, 2013).

Nonraptor Avian Species

Nonraptor avian species occur across a wide range of habitat types occurring within the ROI and may occupy these habitats either seasonally or year-round, depending on species. Nonraptor avian species documented to occur within the ROI include those identified in Table 4.7-2.

Table 4.7-2 Nonraptor Avian Species Expected to Occur in the ROI

Species	Expected to Occur
American avocet (*Recurvirostra americana*)	Summer Breeding, Migration
American coot (*Fulica americana*)	Year-round, Summer Breeding
American crow (*Corvus brachyrhynchos*)	Year-round
American redstart *(Setophaga ruticilla*)	Migration
American robin (*Turdus migratorius*)	Year-round
American widgeon (*Mareca Americana*)	Year-round
ash-throated flycatcher (*Myiarchus cinerascerns*)	Summer Breeding
Audubon's warbler (*Setophaga coronata*)	Summer Breeding
barn swallow (*Hirundo rustica*)	Summer Breeding, Migration
Bewick's wren (*Thryomanes bewickii*)	Year-round
black-chinned hummingbird (*Archilochus alexandri)*	Summer Breeding
black-crowned night heron (*Nycticorax nycticorax*)	Year-round
black-headed grosbeak (*Pheucticus melanocephalus*)	Summer Breeding
black-throated sparrow (*Amphispiza bilineata*)	Summer Breeding
blue grosbeak (*Pheucticus melanocephalus*)	Year-round
blue-gray gnatcatcher (*Polioptila caerulea*)	Summer Breeding
blue-winged teal (*Anas discors*)	Summer Breeding
black tern (*Chlidonias niger*)	Migration
black-chinned hummingbird (*Archilochus alexandri*)	Summer Breeding
black-throated sparrow (*Amphispiza bilineata*)	Summer Breeding
blue grosbeak (*Passerina caerulea*)	Summer Breeding
Bonaparte’s gull (*Larus philadelphia*)	Migration
Brewer’s sparrow (*Spizella breweri*)	Year-round
broad-tailed hummingbird (*Selasphorus platycercus*)	Summer Breeding
brown-headed cowbird (*Molothrus ater*)	Year-round
Bullock's oriole (*Icterus bullockii*)	Summer Breeding
bushtit (*Psaltriparus minimus)*	Year-round
cactus wren (*Campylorhynchus brunneicapillus*)	Year-round
Canada goose (*Branta canadensis*)	Year-round
canyon towee (*Melozone fusca*)	Year-round
Cassin’s finch (*Carpodacus cassinii*)	Year--round
Cassin’s kingbird (*Tyrannus vociferans*)	Summer Breeding
cedar waxwing (*Bombycilla cedrorum*)	Winter Nonbreeding
chipping sparrow (*Spizella passerine*)	Summer Breeding
cinnamon teal (*Anas cyanoptera*)	Summer Breeding
cliff swallow (*Petrochelidon pyrrhonota*)	Summer Breeding

Species	Expected to Occur
common merganser (*Mergus merganser*)	Winter Nonbreeding
common nighthawk (*Chordeiles minor*)	Summer Breeding
common raven (*Corvus corax*)	Year-round
common yellowthroat (*Geothlypis tricha*)	Summer Breeding
curve-billed thrasher (*Toxostoma curvirostre*)	Year-round
dark-eyed junco (*Junco hyemalis*)	Year-round
Eared grebe (*Podiceps caspicus*)	Year-round
Eurasian collared-dove (*Streptopelia decaocto*)	Year-round
Eurasian widgeon (Anas penelope)	Migration
gadwall (*Anas strepera*)	Year-round, Winter Nonbreeding
Gamble's quail (*Callipepla gambelii*)	Year-round
gray flycatcher (*Empidonax wrightii*)	Summer Breeding
gray vireo (*Vireo vicinior*)	Summer Breeding
great blue heron (*Ardea Herodias*)	Year-round
greater yellowlegs (*Totanus melanoleucus*)	Migration
green-tailed towhee (*Chlorura chlorura*)	Year-round
green-winged teal (*Anas carolinensis*)	Year-round
horned lark (*Eremophila alpestris*)	Year-round
house finch (*Carpodacus mexicanus*)	Year-round
house sparrow (*Passer domesticus*)	Year-round
indigo bunting (*Passerina cyanea*)	Summer Breeding
killdeer (*Setophaga coronata*)	Year-Round
lark sparrow (*Chondestes grammacus*)	Summer Breeding
lesser goldfinch (*Spinus psaltria*)	Summer Breeding
loggerhead shrike (*Lanius ludovicianus*)	Year-round
MacGillivary's warbler (*Oporonis tolmiei*)	Migration
mallard (*Anas platyrhyncho)*	Year-round
mountain bluebird (*Sialia currucoides*)	Year-round
mourning dove (*Zenaida macroura*)	Year-round
northern flicker (*Colaptes auratus*)	Year-round
northern mockingbird (*Mimus polyglottos*)	Year-round
northern shoveler (*Anas clypeata*)	Year-round
pintail (*Anas acuta*)	Year-round, Winter Nonbreeding
pied-billed grebe (*Podilymbus podiceps*)	Year-round
pinyon jay (*Gymnorhinus cyanocephalus*)	Year-round
plumbeous vireo (*Vireo plumbeus*)	Summer Breeding
red-winged blackbird (*Agelaius phoeniceus*)	Year-round

Species	Expected to Occur
ring-billed gull (*Larus delawarensis*)	Winter Nonbreeding, Migration
rock dove (*Columba livia*)	Year-round
rock wren (*Salpinctes obsoletus*)	Year-round
ruddy duck (*Oxyura jamaicensis*)	Year-round
sage sparrow (*Amphispiza belli*)	Year-round
sage thrasher (*Oreoscoptes montanus*)	Year-round
savannah sparrow (*Passerculus sandwichensis*)	Year-round
Say's phoebe (*Sayornis saya*)	Year-round
scaled quail (*Callipepla squamata*)	Year-round
snowy egret (*Leucophoyx thula*)	Summer Breeding, Winter Nonbreeding
Scott's oriole (*Icterus parisorum*)	Summer Breeding
song sparrow (*Melospiza melodia*)	Year-round
spotted sandpiper (*Actitis macularius*)	Summer Breeding
spotted towhee (*Pipilo maculatus*)	Year-round
vesper sparrow (*Pooecetes gramineus*)	Year-round
violet-green swallow (*Hirundo rustica*)	Summer Breeding
Virginia warbler (*Oreothlypis virginiae*)	Migration
western flycatcher (*Empidonax difficilis*)	Migration
western grebe (*Aechmophorus occidentalis*)	Summer Breeding
western kingbird (*Tyrannus verticalis*)	Summer Breeding
western meadowlark (*Sturnella neglecta*)	Year-round
western mockingbird (*Mimus polyglottos leucopterus*)	Year-round
western sandpiper (*Ereunetes mauri*)	Winter Nonbreeding
western tanager (*Piranga ludoviciana*)	Summer Breeding
western wood-pewee (*Contopus sordidulus*)	Summer Breeding
white-crowned sparrow (*Zonotrichia leucophrys*)	Winter Nonbreeding
white-faced ibis (*Plegadis chihi*)	Migration
white-winged dove (*Zenaida asiatica*)	Summer Breeding
willet (*Tringa semipalmata*)	Summer Breeding, Migration
willow flycatcher (*Empidonax traillii*)	Year-round, Migration
Wilson's phalarope (*Phalaropus tricolor*)	Migration
Wilson's warbler (*Wilsonia pusilla*)	Migration
yellow-headed blackbird (*Xanthocephalus xanthocephalus*)	Year-round
yellow-breasted chat (*Icteria virens*)	Summer Breeding

Navajo Mine

Nonraptor avian species and their habitats have been evaluated across the Navajo Mine since 1975 with more recent studies conducted within the Pinabete Permit Area starting in 2008. Nonraptor avian species and their associated foraging and nesting habitats were documented to occur across the entire Navajo Mine, including areas within the Pinabete Permit Area and Burnham Road realignment. Nonraptor avian nesting habitat is expected to be limited to the following cover classes identified in Table 4.6-2: Agricultural Vegetation (2.5 percent of the Navajo Mine ROI), Developed & Other Human Use (9.8 percent), Forest & Woodland (2.6 percent), Introduced & Semi Natural Vegetation (0.3 percent), Nonvascular & Sparse Vascular Rock Vegetation (1.2 percent), Semi Desert (77.2 percent), and Shrubland & Grassland (5.1 percent), or 98.7 percent of the cover classes occurring within the Navajo Mine ROI. Upland nonraptor avian species were encountered in greater densities and diversity in the alkali wash and arroyo shrub communities within the Navajo Mine and Pinabete Permit Area (see Section 4.6 for specific detail on these communities). Riparian vegetation communities, identified in Table 4.6-2, including Rock Mountain Lower Montane Riparian Woodland & Shrubland (1.2 percent), Introduced Riparian & Wetland Vegetation (0.3 percent) and open-water (1.5 percent) habitats were documented to support a number of waterfowl and shorebirds during previous biological studies. Both the riparian habitat and open-water habitat within these areas are seasonal and do not serve as permanent water sources within the Navajo Mine, Pinabete Permit Area, and Burnham Road realignment (BNCC 2012a, Ecosphere 2008).

Common species documented within the Navajo Mine Permit Area, Pinabete Permit Area, and Burnham Road realignment include American avocet, ash-throated flycatcher, black-throated sparrow, brown-headed cowbird, Cassin’s finch, Cassin’s kingbird, common nighthawk, common raven, Gamble’s quail, horned lark, killdeer, mourning dove, northern mockingbird, rock wren, sage sparrow, Say’s phoebe, song sparrow, and white-crowned sparrow (BNCC 2012f).

FCPP

Nonraptor avian habitat occurs in and around the FCPP Lease Area including undeveloped upland habitat around the FCPP, habitat around Morgan Lake, and within the proposed DFADAs. Nonraptor avian nesting habitat is expected to be limited to the following cover classes identified in Table 4.6-4: Agricultural Vegetation (11.4 percent of the FCPP ROI), Developed & Other Human Use (3.7 percent), Forest & Woodland (4.2 percent), Introduced & Semi Natural Vegetation (2.2 percent), Nonvascular & Sparse Vascular Rock Vegetation (1.7 percent), Semi-Desert (65.4 percent), and Shrubland & Grassland (2.4 percent), or 91 percent of the cover classes occurring within the FCPP ROI. Morgan Lake (Open Water, 9.1 percent) and riparian vegetation communities identified in Table 4.6-4 including Rocky Mountain Lower Montane Riparian Woodland and Shrubland (1.7 percent), and Introduced Riparian and Wetland Vegetation (1.8 percent) support foraging and nesting habitat for a larger number of upland avian species, shorebirds, and waterfowl. The FCPP facilities could support nonraptor avian species, but offer limited foraging and nesting habitat as these areas are primarily industrial in nature and lack vegetative cover.

Species documented in the FCPP vicinity include American coot, American widgeon, barn swallow, black-throated sparrow, black crowned night heron, black tern, black-chinned hummingbird, blue grosbeak, Bonaparte 's gull, Brewer's sparrow, chipping sparrow, cinnamon teal, common raven, eared grebe, great blue heron, greater yellowlegs, green-tailed towhee, green-winged teal, horned lark, killdeer, loggerhead shrike, mallard, MacGillivray 's warbler, mourning dove, pintail, pied-billed grebe, red-winged blackbird, ring-billed gull, rock wren, ruddy duck, sage sparrow, sage thrasher, Say's phoebe, shoveler, snowy egret, song sparrow, vesper sparrow, violet-green swallow, Virginia's warbler, western flycatcher, western sandpiper, white-crowned sparrow, white-faced Ibis, Wilson’s warbler, and yellow-headed blackbird (BOR 1975).

Habitat capable of supporting foraging and nesting activities of nonraptor avian species occurs within the entire proposed DFADAs, including vegetation communities associated with Forest & Woodland, Nonvascular & Sparse Vascular Rock Vegetation, and Semi-Desert cover classes. While both the Rocky Mountain Lower Montane Riparian Woodland and Shrubland and Inter-Mountains Basins Shale Badlands

vegetation communities identified in the proposed DFADAs (Table 4.6-7) are generally considered avian nesting habitat, these two cover classes were evaluated and determined to be inadequate for supporting a wide array of nonraptor avian species (Ecosphere 2012c).

Observations of avian species occurring within the DFADAs upland habitats include blue grosbeak, Brewer's sparrow, bushtit, horned lark, house finch, mourning dove, raven, western king bird, and western mockingbird. Raven and horned lark were identified as the most commonly occurring species in the DFADAs. No permanent water occurs within the proposed DFADAs; therefore, no shorebirds or waterfowl are expected to occur (Ecosphere 2012c).

Transmission Lines

Habitat capable of supporting foraging and nesting activities of nonraptor avian species occurs within both the APS and PNM transmission ROWs. Given that avian species occupy a wide range of habitats, foraging and nesting habitats could occur across the entire length, and in all habitats, occurring within the APS and PNM transmission corridors. Nonraptor nesting habitat is expected to be limited to the following cover classes identified in Table 4.6-5 including: Agricultural Vegetation (1.2 percent of the transmission line ROI), Developed & Other Human Use (0.4 percent), Forest & Woodland (22.9 percent), Introduced & Semi-Natural Vegetation (0.3 percent), Nonvascular & Sparse Vascular Rock Vegetation (6.7 percent), Simi-Desert (62.2 percent), and Shrubland & Grassland (6.1 percent), or 99.8 percent of the transmission line ROI. Riparian cover classes identified in Table 4.6-5 including Rocky Mountain Lower Montane Riparian Woodland and Shrubland (0.3 percent), Western Great Plains Riparian Woodland and Shrubland (<0.1 percent), Introduced Riparian & Wetland Vegetation (0.2 percent), North American Arid West Emergent Marsh (<0.1 percent), Rocky Mountain Alpine-Montane Wet Meadow (<0.1 percent), and open-water habitats (0.3 percent), capable of supporting shorebirds and waterfowl, collectively represent approximately 2,800 acres or 0.9 percent of the transmission lines ROI.

A large variety of nonraptor avian species is expected to occur across habitats within both the APS and PNM ROWs. Studies completed during the 2012 PNM ROW inventory identified commonly occurring nonraptor avian species foraging and nesting along the PNM ROW. These species include American crow, ash-throated flycatcher, Cassin's kingbird, common raven, gray flycatcher, horned lark, mourning dove, northern mockingbird, pinyon jay, western kingbirds, and western meadowlark (Marron and Associates 2012a, 2012b, 2013; APS 2012c). No avian-specific field surveys were completed within the APS ROW; however, a list of approximately 250 nonraptor avian species expected to occur within the APS ROW is included in the FCPP and Navajo Mine Energy Project ERA (AECOM 2013c). Given the regional similarity in habitat types between the APS and PNM transmission lines, the common nonraptor avian species identified in Table 4.7-2 are also expected to occur within the APS ROW.

Small Mammals

This category includes animals from several families that are collectively referred to as "small mammals," including shrews, pocket mice, kangaroo rats, New World rats, mice, voles, muskrats, squirrels, pocket gophers, and prairie dogs. Small mammals are expected to occur across the entire ROI, using all vegetative cover classes (habitats) for foraging, burrowing and frequenting riparian areas or open water according to their lifecycle needs. While small mammals occupy a wide range of habitats within the ROI, small mammals occurring within the ROI would likely have the greatest association with Upland Semi-Desert land cover classes and associated vegetation communities. This cover class represents almost 65 percent (Table 4.6-1) of available habitat in the ROI. Industrial facilities within the ROI (Developed & Other Human Use cover class) offer limited habitat, as these areas are primarily industrial in nature lacking vegetative cover; however, several small species of mammals, primarily rats and mice, are known to occur around developed and urban areas where food and other resources are present. Small mammals documented or possibly occurring in the vicinity of the ROI are listed in Table 4.7-3.

Table 4.7-3 Small Mammal Species Expected to Occur in the ROI

Species	Expected to Occur
antelope ground squirrel (*Ammospermophilus nelson*)	Year-round
banner-tailed kangaroo rat (*Dipodomys spetabilis*)	Year-round
Botta's pocket gopher (*Thomomys bottae*)	Year-round
Abert's squirrel (*Sciurus aberti aberti*)	Year-round
Botta's pocket gopher (*Thomomys bottae albatus*)	Year-round
brush mouse (*Peromyscus boylii rowleyi*)	Year-round
canyon mouse (*Peromyscus crinituis*)	Year-round
canyon mouse (*Peromyscus crinitus auripectus*)	Year-round
cliff chipmunk (*Neotamias dorsalis dorsalis*)	Year-round
Colorado chipmunk (*Neotamias quadrivittatus quadrivittatus*)	Year-round
common porcupine (*Erethizon dorsatum couesi*)	Year-round
deer mouse (*Peromyscus maniculatus blandus*)	Year-round
deer mouse (*Peromyscus maniculatus*)	Year-round
dusky shrew (*Sorex monticolus monticolus*)	Year-round
golden-mantled ground squirrel (*Spermophilus lateralis lateralis*)	Year-round
grasshopper mouse (*Onychomys leucogaster*)	Year-round
Gunnison's prairie dog (*Cynomys gunnisoni gunnisoni*)	Year-round
Gunnison's prairie dog (*Cynomys gunnisoni*)	Year-round
house mouse (*Mus musculus*)	Year-round
kangaroo rat (*Dipodomys* sp.)	Year-round
least chipmunk (*Neotamias minimus operarius*)	Year-round
long-tailed vole (*Microtus longicaudus longicaudus*)	Year-round
meadow vole (*Microtus pennsylvanicus modestus*)	Year-round
montane vole (*Microtus montanus fusus*)	Year-round
muskrat (*Ondatra zibethicus*)	Year-round
northern grasshopper mouse (*Onychomys leucogaster arcticeps*)	Year-round
northern pocket gopher (*Thomomys talpoides fossori)*	Year-round
Ord's kangaroo rat (*Dipodomys ordii longipes)*	Year-round
Ord's kangaroo rat (*Dipodomys ordii*)	Year-round
pinyon mouse (*Peromyscus truei truei)*	Year-round
pinyon mouse (*Peromyscus truei*)	Year-round
plains pocket mouse (*Perognathus flavescens copei*)	Year-round
pocket gopher (*Thomomys* spp.)	Year-round
pocket mouse (*Perognathus apache*)	Year-round
red squirrel (*Tamiasciurus hudsonicus fremonti*)	Year-round
rock squirrel (*Spermophilus variegatus grammurus*)	Year-round

Species	Expected to Occur
rock squirrel (Spermophilus variegatus)	Year-round
silky pocket mouse (*Perognathus flavus flavus*)	Year-round
silky pocket mouse (*Perognathus flavus*)	Year-round
spotted ground squirrel (*Spermophilus spilosoma*)	Year-round
spotted ground squirrel (*Spermophilus spilosoma canescens)*	Year-round
western harvest mouse (*Reithrodontomys megalotis megalotis*)	Year-round
western harvest mouse (*Reithrodontomys megalotis*)	Year-round
white-tailed antelope squirrel (*Ammospermophilus leucurus pennipes*)	Year-round
white-tailed antelope squirrel (*Ammospermophilus leucurus*)	Year-round
white-tailed prairie dog (*Cynomys gunnisoni*)	Year-round
white-throated wood rat (*Neotoma albigula albigula*)	Year-round
wood rat (*Neotoma* sp.)	Year-round
yellow-bellied marmot (*Marmota flaviventris*)	Year-round

Navajo Mine

Small mammal surveys have been conducted throughout the Navajo Mine area since 1974. Small mammals commonly occurring within the Navajo Mine Permit Area, Pinabete Permit Area, and Burnham Road realignment include antelope squirrel, banner-tailed kangaroo rat, deer mice, grasshopper mouse, Gunnison's prairie dog, Ord's kangaroo rats, pinyon mouse, pocket gopher, rock squirrel, silky pocket mouse, and white-tailed antelope squirrels. Small mammal habitat is expected to be occur across all cover classes identified in Table 4.6-2 (98.5 percent of the Navajo Mine ROI), including Open Water (1.5 percent) throughout the Navajo Mine, Pinabete Permit Area, and Burnham Road realignment ROI. species most commonly occur within the alkali wash, sandy, and arroyo shrub habitat vegetation communities (Semi-Desert cover class, 77.4 percent) across the Navajo Mine (BNCC 2012a, 2012f)..

FCPP

Habitat supporting small mammals occurs in and around the FCPP Lease Area, including areas surrounding Morgan Lake, and within the proposed DFADAs. Cumulatively, small mammals are expected to occur across all cover classes identified in Table 4.6-4 ROI, including open water (9.1 percent). Small mammals identified in and around the FCPP ROI include white-tailed prairie dog, muskrat, spotted ground squirrel, canyon mouse, deer mouse, silky-pocket mouse, and western harvest mouse (BOR 1975).

Small mammals and their habitats occur within the entire proposed DFADAs. Small mammal habitat occurs across all vegetation cover classes within the proposed DFADAs. These habitats are generally characterized as Semi-Desert land cover, including Salt Desert Scrub, Badlands, and Riparian woodlands dominated by saltcedar. Biological inventories conducted in the proposed DFADAs documented the presence of white-tailed squirrel, kangaroo rat, and Gunnison's prairie dog (Ecosphere 2012c).

Transmission Lines

Habitat supporting small mammal species occurs within both the APS and PNM transmission ROWs in all cover classes, including Open Water (0.3 percent) documented within the ROW. Common potentially occurring and documented small mammal species within the PNM ROW include antelope ground squirrel, banner-tailed kangaroo rat, Botta's pocket gopher, Gunnison's prairie dog, Ord's kangaroo rat, and wood rat (Marron and Associates 2012a, 2012b, 2013). Wildlife habitat analysis completed for the APS transmission

corridor identified the following small mammals as possibly occurring with the ROW: Abert's squirrel, Botta's pocket gopher, brush mouse, canyon mouse, cliff chipmunk, Colorado chipmunk, common porcupine, deer mouse, dusky shrew, golden-mantled ground squirrel, Gunnison's prairie dog, house mouse, least chipmunk, long-tailed vole, meadow vole, montane vole, muskrat, northern grasshopper mouse, northern pocket gopher, Ord's kangaroo rat, pinyon mouse, plains pocket mouse, red squirrel, rock squirrel, silky pocket mouse, potted ground squirrel, western harvest mouse, white-tailed antelope squirrel, white-throated wood rat, and yellow-bellied marmot (AECOM 2013f).

Bats

This category contains members of the common bats and free-tailed bat species. Bats occur across a wide variety of habitat types that support foraging, but roosting habitat is limited to rock outcrops, cliff faces, mine shafts, and man-made structures such as buildings or ledges. Bats could use all cover classes and associated vegetation communities within the ROI for foraging and may frequent riparian areas or water sources. Habitat capable of supporting foraging of bat species occurs across the entire ROI and includes all cover classes, including developed areas. The ROI contains habitat to support roosting of bat species, limited to the following cover classes identified in Table 4.6-1: Developed & Other Human Use (2.3 percent of the ROI), Forest & Woodland (18.7 percent), and Nonvascular & Sparse Vascular Rock Vegetation (5.6 percent) cover classes. Collectively, these cover classes represent 26.6 percent of the total ROI. Within these roosting habitat cover classes, bat roosting is limited to specific crevices and overhang areas within these cover classes, which greatly reduces the amount of available roosting habitat with the ROI. Natural roosting habitats (cliffs, ledges, and forests) do not occur within the ROI, but do occur around the ROI perimeter within the analysis area (1-mile radius around the ROI). Species documented or expected to occur within the ROI are listed in Table 4.7-4 (BNCC 2012a; Marron and Associates 2012a, 2012b, 2013; AECOM 2013f).

Table 4.7-4 Bat Species Expected to Occur in the ROI

Species	Expected to Occur
big brown bat (*Eptesicus fuscus*)	Year-round
big-freetail bat (*Nyctinomops macrotis*)	Year-round
Brazilian free-tailed bat (*Tadarida braziliensis*)	Year-round
brown bat (*Myotis lucifugus occultus*)	Year-round
California myotis (*Californicus californicus*)	Year-round
fringed myotis (*Myotis thysanodes*)	Year-round
hoary bat (*Lasiurus cinereus cinereus*)	Year-round
little brown myotis (*Myotis lucifugus carissima*)	Year-round
long-eared myotis (*Myotis evotis evotis*)	Year-round
long-legged myotis *(Myotis volans interior*)	Year-round
pallid bat (*Antrozous pallidus pallidus*)	Year-round
silver-haired bat (*Lasionycteris noctivagans*)	Year-round
small-footed myotis (*Myotis ciliolabrum melanothinus*)	Year-round
spotted bat (*Euderma maculatum)*	Year-round
Townsend's pale big-eared bat (*Corynorhinus townsendii pallescens*)	Year-round
western pipistrelles (*Pipistrellus hesperus*)	Year-round
Yuma myotis (*Myotis yumanensis yumanens*)	Year-round

Navajo Mine

Bat species have been documented within the Navajo Mine and are expected to forage across all cover classes and associated vegetation communities within the Navajo Mine Permit Area, Pinabete Permit Area, and Burnham Road realignment. Roosting habitat is expected to be limited to the following cover classes identified in Table 4.6-2: Developed & Other Human Use (9.8 percent of the Navajo Mine ROI), Forest & Woodland (2.6 percent), and Nonvascular & Sparse Vascular Rock Vegetation (1.2 percent) or 13.6 percent of around the Navajo Mine ROI. No natural cliff or wooded habitat capable of supporting bats occurs within the Navajo Mine Permit Area, Pinabete Permit Area, or Burnham Road realignment. Roosting bats could be encountered within man-made structures and overhangs (bridges), represented by Developed & Other Human Use cover class, within the Navajo Mine Permit Area. Previous wildlife studies within the Navajo Mine Permit Area, Pinabete Permit Area, and Burnham Road realignment have documented the presence of foraging bats, including pipistrelles, pallid bat, silver-haired bat, and hoary bat (BNCC 2012f, Ecosphere 2008).

FCPP

Habitat supporting bat species foraging occurs in and around the FCPP Lease Area including Morgan Lake and proposed DFADAs. Bat foraging habit includes all cover classes and associated vegetation communities in the FCPP ROI. Roosting habitat is expected to be limited to the following cover classes identified in Table 4.6-4: Developed & Other Human Use (3.7 percent), Forest & Woodland (4.2 percent), and Nonvascular & Sparse Vascular Rock Vegetation (1.7 percent), or 9.6 percent of the FCPP ROI. No natural cliff or wooded habitat capable of supporting bat roosting occurs within the FCPP Lease Area; however, this habitat does occur within 1 mile of the FCPP. Roosting bats could be encountered within man-made structures and overhangs (e.g., bridges) within the FCPP area. Bat species occurring within the FCPP Lease Area are expected to be similar, if not identical, to those species documented at the Navajo Mine, and, therefore, could include pipistrelles, pallid bat, silver-haired bat, and hoary bat.

Transmission Lines

Bat species foraging and roosting habitat occurs in and around the APS and PNM transmission ROWs. Bat species are expected to forage across all areas and within all habitats that occur along both ROWs. Roosting habitat is expected to be limited to the following cover classes identified in Table 4.6-5: Developed & Other Human Use (0.4 percent), Forest & Woodland (22.9 percent, and Nonvascular & Sparse Vascular Rock Vegetation (6.7 percent), or 30 percent of the APS and PNM transmission line ROI. Bats identified as potentially occurring with the transmission line ROWs include big brown bat, big-freetail bat, Brazilian free-tailed, brown bat, California myotis, fringed myotis, hoary bat, little brown myotis, long-eared myotis, long-legged myotis, pallid bat, silver-haired bat, small-footed myotis, spotted bat, Townsend's pale big-eared bat, and Yuma myotis (Marron and Associates 2012a, 2012b, 2013; AECOM 2013f).

Rabbits and Hares

Rabbits and hares (lagomorphs) occur in a wide variety of habitats, including desert scrub, grassland, and sandy habitats. These species occupy habitats within the ROI across the entire range of cover classes and associated vegetative communities. These species, particularly jackrabbits, are habitat generalists and are capable of occupying disturbed areas and areas where humans commonly occur, but are less likely to occur in unvegetated areas within the ROI. Two species of lagomorphs have been documented in the ROI: desert cottontail (Sylvilagus audubonii) and black-tailed jackrabbit (Lepus californicus) (BNCC 2012a; Ecosphere 2012c; Marron and Associates 2012a, 2012b, 2013; AECOM 2013f).

Navajo Mine

Habitat supporting lagomorphs occurs within all cover classes and associated vegetation communities identified in Table 4.6-2 (98.5 percent), excluding Open Water (1.5 percent) within the Navajo Mine Lease Area, Pinabete Permit Area, and Burnham Road realignment ROI. Wildlife surveys conducted in the

Navajo Mine Lease Area and Pinabete Permit Area have been conducted in conjunction with other wildlife surveys for the last two decades. Desert cottontails and black-tailed jackrabbits as well as their tracks and scat are commonly observed. These two wildlife species are cited as the most abundant wildlife species observed in and around the Navajo Mine Permit Area, Pinabete Permit Area, and Burnham Road realignment (BNCC 2012a, 2012f).

FCPP

Habitat supporting lagomorphs occurs within all cover classes and associated vegetation communities within the FCPP Lease Area, including the proposed DFADAs identified in Table 4.6-4 (90.1 percent of the FCPP ROI), excluding Open Water (9.1 percent) within the FCPP ROI. Lagomorphs are expected to occur throughout upland habitats within the FCPP Lease Area and proposed DFADAs. Biological Surveys conducted in 2012 within the proposed DFADAs identified both desert cottontails and black-tailed jackrabbits and their habitat within the survey area (Ecosphere 2012c)

Transmission Lines

Habitat supporting lagomorphs occurs within all cover classes and associated vegetation communities identified in Table 4.6-5 (99.7 percent of the transmission line ROI), excluding Open Water (0.3 percent) within the APS and PNM transmission line ROI. These species are expected to occur throughout upland habitats within and immediately adjacent to the ROW. Biological Surveys conducted in 2012 within the PNM ROW documented desert cottontails and black-tailed jackrabbits as common occurrences (Marron and Associates 2012a, 2012b, 2013). Both of these species have been identified as possibly occurring within the APS ROW given the similar habitat types of the APS and PNM ROW corridors (AECOM 2013f).

Carnivores

Carnivores include foxes, coyotes, badgers, ferrets, skunks, weasels, and bobcats. These species occur across a wide range cover classes identified in Table 4.6-1 (99.3 percent), excluding Open Water (0.7 percent) within the ROI. Habitats capable of supporting carnivores range from solitary dense woodlands, riparian, near open water, to highly disturbed, and in some cases, developed landscapes. Generally, these species are expected to occur in greater densities in Semi-Desert and Shrubland Grassland cover classes where prey, such as small mammals and herptiles, occur. These species are not expected to occur in large numbers in unvegetated, developed areas, around buildings, or near facilities associated with the FCPP and Navajo Mine; however, some carnivores may frequent developed areas if food or water resources are readily available. Carnivore species documented or expected to occur within the ROI includes those species listed in Table 4.7-5 (BNCC 2012a; Ecosphere 2012c; Marron and Associates 2012a, 2012b, 2013; AECOM 2013f; BOR 1975).

Table 4.7-5 Carnivore Species Expected to Occur in the ROI

Species	Expected to Occur
badger (*Taxidea taxus*)	Year-round
black bear (*Ursus americanus amblyceps*)	Year-round
bobcat (*Lynx rufus*)	Year-round
Canada lynx (*Lynx canadensis*)	Year-round
coyote (*Canis latrans*)	Year-round
gray fox (*Urocyon cinereoargenteus*)	Year-round
kit fox (*Vulpes macrotis*)	Year-round
long-tailed weasel (*Mustela frenata arizonensis*)	Year-round
mountain lion (*Puma concolor Azteca*)	Year-round
raccoon (*Procyon lotor*)	Year-round
red fox (*Vulpes vulpes*)	Year-round
ringtail (*Bassariscus astutus arizonensis*)	Year-round
spotted skunk (*Spilogale putoris*)	Year-round
striped skunk (*Mephitis mephitis*)	Year-round

Navajo Mine

Habitat supporting carnivores exists within the cover classes identified in Table 4.6-2 (98.5 percent of the Navajo Mine ROI), excluding Open Water (1.5 percent) within and around the Navajo Mine Permit Area, Pinabete Permit Area, and proposed Burnham Road realignment ROI. Wildlife studies completed within the Navajo Mine Permit Area have been conducted routinely since the opening of the mine and have documented the presence of coyote, red fox, kit fox, and bobcat. Carnivore studies completed in conjunction with the Pinabete Permit Area identified coyotes, kit foxes, and one kit fox den within the Pinabete Permit Area (BNCC 2012a; OSMRE 2012a). Species expected to occur within the Burnham Road realignment include coyote, badger, and the same species identified in the nearby Navajo Mine and Pinabete Permit Areas (Ecosphere 2008). While these species are expected to occur across the ROI, their presence, location, and abundance will be closely associated with the presences of prey species such as small mammals, lagomorphs, and herptiles in the upland Semi-Desert and Grassland & Shrubland cover classes. These species are not expected to occur as residents in the active mine areas and support facilities within the Navajo Mine Lease Area, but could occur within reclaimed areas where available food resources are present.

FCPP

Habitat supporting carnivores occurs within FCPP lease area including the proposed DFADAs. This includes all cover classes and associated vegetation communities identified in Table 4.6-4 (90.9 percent of the FCPP ROI), excluding Open Water (9.1 percent) within the FCPP ROI. These species are not expected to occur within the developed industrial areas of the FCPP Lease Area as residents, but may occur as visitors to developed areas if food resources are available. Biological surveys conducted within the FCPP Lease Area documented the following species occurring, or expected to occur, within the FCPP Lease Area: bobcat, coyote, gray fox, kit fox, spotted skunk, and striped skunk (BOR 1975, OSMRE 2012a).

Carnivores expected to occur within the proposed DFADAs include those species documented or expected to occur around the FCPP Lease Area. All cover classes and associated vegetation communities within the proposed DFADAs are expected to support these species. Studies completed in 2012 documented evidence of coyote and habitat capable of supporting kit fox (Ecosphere 2012c).

Transmission Lines

Habitat supporting carnivores occurs within the cover identified within Table 4.6-5 (99.7 percent of the transmission line ROI), excluding open water (0.3 percent) within the APS and PNM transmission line ROI. Biological surveys conducted in 2012 within the PNM ROW documented coyote, gray fox, bobcat, and raccoon (Marron and Associates 2012a, 2012b, 2013). Habitat modeling within the APS transmission corridor identified the following species as likely occurring within the APS ROW: badger, black bear, bobcat, raccoon, Canada lynx, coyote, red fox, gray fox, kit fox, long-tailed weasel, mountain lion, ringtail, and striped skunk (AECOM 2013f).

Big Game

Big-game species, such as elk, deer, and antelope, commonly occur in upland habitats, which include grassland, shrubland communities, and agricultural areas. These big-game species are less likely to occur in disturbed and industrially developed areas but may occur within reclaimed areas where food resources are available. Big game documented, or expected to occur, in the ROI include mule deer, elk , and pronghorn antelope. Deer and elk generally occur in higher elevation Forest & Woodland cover classes identified in Table 4.6-1 (18.7 percent of the ROI), and are expected to occupy lower elevation habitats in winter months during winter migration: Agricultural Vegetation (1.6 percent), Introduced & Semi-Natural Vegetation (0.3 percent), Semi-Desert (64.9 percent), and Shrubland & Grassland (5.8 percent). Pronghorn generally occur in lower elevation Semi-Desert (64.9 percent of the ROI) or Shrubland & Grassland (5.8 percent) cover classes within the ROI. Big game species are less likely to occur within the Developed & Other Human Use and Nonvascular & Sparse Vascular Rock Vegetation cover classes.

Navajo Mine

Habitat supporting big-game species occurs throughout cover classes identified in Table 4.6-2 including Agricultural Vegetation (2.5 percent of the Navajo Mine ROI), Forest & Woodland (2.6 percent), Introduced & Semi-Natural Vegetation (0.3 percent), Semi-Desert (77.2 percent), and Shrubland & Grassland (5.1 percent), or 87.7 percent of the total habitat within the Navajo Mine Permit Area, Pinabete Permit Area, and Burnham Road realignment ROI. Surveys for big game completed for the last 2 decades and more recent studies around the Pinabete Permit Area and Burnham Road realignment have identified mule deer as the only big-game species documented to occur. Furthermore, sightings of mule deer within these areas were identified as occasional. Elk and pronghorn are not known to occur within the Navajo Mine (BNCC 2012f); however, pronghorn have been identified as possibly occurring based upon the presence of Semi-Desert (77.2 percent) and Shrubland & Grassland (5.1 percent) habitats identified in Table 4.6-2 (Ecosphere 2008).

FCPP

Habitat capable of supporting big game occurs within the FCPP lease area including the proposed DFADAs. This includes cover classes identified in Table 4.6-4: Agricultural Vegetation (11.4 percent of the FCPP ROI), Forest & Woodland (4.2 percent), Introduced & Semi-Natural Vegetation (2.2 percent), Semi-Desert (65.4 percent) and Shrubland & Grassland (2.4 percent), or 85.6 percent of the FCPP ROI. Mule deer is the only big game species documented to occur around the FCPP Lease Area (OSMRE 2012a). Pronghorn and elk have not been documented within the immediate area; however, both of these species could occur within the FCPP Lease Area vicinity (AECOM 2013f). No big-game species or evidence of their presence was identified within the proposed DFADAs (Ecosphere 2012c).

Transmission Lines

Habitat supporting big game within the transmission lines occurs within the cover classes identified in Table 4.6-5 including: Agricultural Vegetation (1.2 percent of the transmission line ROI), Forest & Woodland (22.9 percent), Introduced & Semi Natural Vegetation (0.3 percent), Semi-Desert (62.2 percent), and Shrubland & Grassland (6.1 percent), or 92.7 percent of habitats within the APS and PNM transmission line ROI. Biological surveys conducted in 2012 of the PNM ROW documented evidence of mule deer within the PNM ROW and identified habitat capable of supporting pronghorn. Although no pronghorn were documented, they have been identified as likely to occur within the PNM transmission line ROW (Marron and Associates 2012a, 2012b, 2013). Habitat studies completed for the APS transmission lines identified elk, mule deer, and pronghorn as possibly occurring within the APS ROW (AECOM 2013f).

Amphibians and Reptiles

Amphibians and reptile species (herpetofauna or herptiles) distribution and abundance are generally related to the distribution and abundance of aquatic habitat; however, many reptile species occur in arid upland environments similar to those occurring in the ROI. Vegetation cover and habitat supporting herpetofauna occur across all cover classes in the entire ROI, but are less likely to occur in developed areas (Developed & Other Human Use cover classes, 2.3 percent of the ROI) associated with the Navajo Mine and FCPP. The species that have been documented or are expected to occur within the ROI include those listed in Table 4.7-6 (Ecosphere 2012c; Marron and Associates 2012a, b, 2013; BNCC 2012f; AECOM 2013f).

Table 4.7-6 Amphibian and Reptile Species Expected to Occur in the ROI

Species	Expected to Occur
black-necked garter snake (*Thamnophis cyrtopsis*)	Year-round
bull snake (*Pituophis catinifer*)	Year-round
bullfrog (*Rana catesbeiana*)	Year-round
California kingsnake *(Lampropeltis getula)*	Year-round
canyon tree frog (*Hyla arenicolor*)	Year-round
collard lizard (*Crotaphytus collaris*)	Year-round
common lesser earless lizard (*Holybrookia maculata*)	Year-round
desert striped whipsnake *(Masticophis taeniatus)*	Year-round
eastern fence lizard (*Sceloporus undulates*)	Year-round
glossy snake (*Arizona elegans*)	Year-round
gopher snake (*Pituophis melanoeucus*)	Year-round
greater short-horned lizard (*Phrynosoma hernandesi*)	Year-round
hognose snake (*Heterodon nasicus*)	Year-round
little striped whiptail (*Cnemidophorus inoratus*)	Year-round
longnose leopard lizard (*Gambelia wislizenii*)	Year-round
milk snake (Lampropeltis triangulum)	Year-round
New Mexico spadefoot (Spea multiplicata)	Year-round
New Mexico whiptail lizard (*Aspidoscelis neomexicano)*	Year-round
night snake (*Hypsiglena torquata*)	Year-round
northern leopard frog (*Rana pipiens*)	Year-round

Species	Expected to Occur
northern tree lizard (*Urosaurus ornatus*)	Year-round
orange headed Spiny Lizard (*Sceloporus magister cephaloflavus*)	Year-round
plains spadefoot (*Spea bombifrons*)	Year-round
plateau striped whiptail (*Aspidoscelis velox*)	Year-round
plateau striped whiptail (*Cnemidophorus velox*)	Year-round
red-spotted toad (*Bufo punctatus*)	Year-round
sagebrush lizard (*Sceloporus graciosus*)	Year-round
short-horned lizard (*Phrynosoma douglasii*)	Year-round
side-blotched lizard (*Uta stansburiana*)	Year-round
southern many-lined skink (*Eumeces multivirgatus epipleurotus*)	Year-round
southwestern lizard (*Scleoporus cowlesi*)	Year-round
spiny desert lizard (*Sceloporus magister*)	Year-round
striped whipsnake (*Masticophis taeniatus*)	Year-round
tiger salamander (*Ambystoma tigrinum*)	Year-round
wandering garter snake (*Thamnophis elegans*)	Year-round
western chorus frog (*Pseudacris triseriata*)	Year-round
western painted turtle (*Chrysemys picta bellii*)	Year-round
western rattlesnake (*Crotalus viridis*)	Year-round
plateau tiger or western whiptail (*Aspidoscelis tigris septentrionalis*)	Year-round
western whiptail (*Cnemidophorus tigris*)	Year-round
western yellow-bellied racer *(Coluber constrictor* sub. *mormon*)	Year-round
Woodhouse's toad (*Bufo woodhousii*)	Year-round

Navajo Mine

Habitat supporting herpetofauna occurs throughout all cover classes identified in Table 4.6-2 (90.2 percent of the Navajo Mine ROI), excluding Developed & Other Human Use (9.8 percent) within the Navajo Mine Permit Area, Pinabete Permit Area, and proposed Burnham Road realignment ROI. Surveys for herptiles have occurred within the Navajo Mine over the past two decades around the Navajo Mine Permit Area, Pinabete Permit Area, and Burnham Road realignment. Herptile species observed include plateau striped whiptail, western whiptail, gopher snake, bull snake, short-horned lizard, western yellow-bellied racer, side-blotched lizard, lesser earless lizard, prairie rattlesnake, and collared lizard. These species occur across all habitat types identified within the Navajo Mine Permit Area (BNCC 2012a,f; OSMRE 2012a; Ecosphere 2008).

FCPP

Habitat supporting herpetofauna occurs within the FCPP Lease Area, including Morgan Lake and the proposed DFADAs. These habitats include all cover classes identified in Table 4.6-4 (96.3 percent of the FCPP ROI), excluding Developed & Other Human Use (3.7 percent) t within the FCPP ROI. Species documented to occur within the FCPP Lease Area include leopard frog, lesser earless lizard, northern side-blotched lizard, plateau whiptail, prairie rattlesnake, and Great Basin gopher snake. Herpetofauna expected to occur within and near the FCPP Lease Area include black-necked garter snake, canyon tree frog,

collared lizard, desert short-horned lizard, desert side-blotched lizard, garter snake, little striped whiptail, long-nosed leopard lizard, mountain short-horned lizard, New Mexico milk snake, night snake, northern plateau lizard, northern sagebrush lizard, northern whiptail, orange headed spiny lizard, red-spotted toad, Woodhouse's toad, southern many-lined skink, striped whipsnake, tree lizard, tiger salamander, western painted turtle, western rattlesnake, and western spade foot toad (BOR 1975, AECOM 2013f). Surveys conducted within the proposed DFADAs identified habitat capable of supporting herptiles and documented the occurrence of whiptail and sagebrush lizard (Ecosphere 2012c).

Transmission Lines

Habitat supporting herpetofauna occurs within all cover classes identified in Table 4.6-5 (99.6 percent of the transmission line ROI), excluding Developed & Other Human Use (0.4 percent) of the APS and PNM transmission line ROI. Biological surveys conducted in 2012 within the PNM ROW documented bull snake, collared lizard, common lesser earless lizard, greater short-horned lizard, New Mexico whiptail lizard, plateau striped whiptail, sagebrush lizard, side-blotched lizard, and southwestern lizard (Marron and Associates 2012a, 2012b, 2013). Habitat analysis of the APS ROW identified the following species as likely to occur: bullfrog, California kingsnake, collard lizard, desert striped whipsnake, eastern fence lizard, glossy Arizona snake, hognose snake, lesser earless lizard, long-nose leopard lizard, milk snake, New Mexico spadefoot, night snake, northern sagebrush lizard, northern garter snake, northern leopard frog, northern tree lizard, plains spadefoot, plateau striped whiptail, red-spotted toad, short-horned lizard, side-blotched lizard, spiny desert lizard, tiger salamander, wandering garter snake, western chorus frog, western painted turtle, western rattlesnake, western whiptail, Woodhouse's toad, and yellowbelly racer (AECOM 2013f).

Fisheries and Aquatic Habitats

Potential habitat for fish species within the ROI is limited to permanent or perennial water resources. The areas of permanent surface water in the Project area and vicinity include the San Juan River, Morgan Lake, and the lower portions of the Chaco River below Morgan Lake. Other waterbodies in the ROI are intermittent, only containing water during portions of the year. These include Pinabete Arroyo and Cottonwood Arroyo, as well as numerous other washes that carry water only during and very shortly after precipitation events. Other major water bodies in the vicinity include the Animas, La Plata, and Mancos Rivers. None of the latter three watersheds are within or adjacent to the Project Area, and all fall outside of the FCPP deposition area as predicted by the atmospheric deposition models (AECOM 2013c).The species that have been documented or are expected to occur within the ROI and vicinity include those listed in Table 4.7-7.

Table 4.7-7 Fish Species Occurring in Permanent Water Bodies in the ROI and Vicinity

Species	Origin**	Family	San Juan River (LBF[a]/SBF[b])	Morgan Lake[c,d]	Chaco River[e]	Lake Powell[f]
bluehead sucker (*Catostomus discobolus*)	N	Catostomidae	C/C			
flannelmouth sucker (*Catostomus latipinnis*)	N	Catostomidae	C/U			P
razorback sucker (*Xyrauchen texanus*)	N	Catostomidae	U/-			P
mottled sculpin (*Cottus bairdi*)	N	Cottidae	R/-			
Colorado pikeminnow (*Ptychocheilus Lucius*)	N	Cyprinidae	U/U			P
roundtail chub (*Gila robusta*)	N	Cyprinidae	-/R			
speckled dace (*Rhinichthys osculus*)	N	Cyprinidae	C/C			P
white sucker (*Catostomus commersoni*)	I	Catostomidae	U/-			
black crappie (*Pomoxis nigromaculatus*)	I	Centrarchidae				P
bluegill (*Lepomis macrochirus*)	I	Centrarchidae		P		P
green sunfish (*Lepomis cyanellus*)	I	Centrarchidae	R/R			P
largemouth bass (*Micropterus salmoides*)	I	Centrarchidae	R/R	P		P
smallmouth bass (*Micropterus dolomieui*)	I	Centrarchidae	R/-			P
white crappie (*Pomoxis annularis*)	I	Centrarchidae		P		
gizzard shad (*Dorosoma cepedianum)*	I	Clupeidae		P		P
common carp (*Cyprinus carpio*)	I	Cyprinidae	U/U	P		
fathead minnow (*Pimephales promelas*)	I	Cyprinidae	R/U			P
red shiner (*Cyprinella lutrensis*)	I	Cyprinidae	U/C			P
plains killifish (*Fundulus zebrinus*)	I	Cyprinodontidae	R/R			
Nothern pike (*Esox Lucius*)	I	Esocidae				P
black bullhead (*Ameiurus melas*)	I	Ictaluridae	R/R			P
channel catfish (*Ictalurus punctatus*)	I	Ictaluridae	C/C	P		P
yellow bullhead (*Ameiurus natali*)s	I	Ictaluridae	R/R			
armored catfish (*Plecostomus* sp.)	I	Loricariidae		P		

Species	Origin**	Family	San Juan River (LBF[a]/SBF[b])	Morgan Lake[c,d]	Chaco River[e]	Lake Powell[f]
walleye (*Stizostedion vitreum*)	I	Percidae				P
Western mosquitofish (*Gambusia affinis*)	I	Poeciliidae	-/C			
brown trout (*Salmo trutta*)	I	Salmonidae	U/-			
kokanee (*Oncorhychus nerka*)	I	Salmonidae				
rainbow trout (*Oncorhychus mykiss*)	I	Salmonidae	U/-			P
striped bass (*Morone saxitilis*)	I	Percichthyidae				P

** N = Native, I = Introduced. C=common, U=uncommon, R=Rare, - =not reported, P=present

[a]LBF=Large-bodied Fish, Source: Ryden 2012. 2010 SJR Large-bodied Fish Monitoring - based on proportion of catch C>5%,U>1%,R<1%

[b]SMF= Small-bodied Fish, Source: Gilbert, et al. 2012. 2011 SJR Small-bodied Fish Monitoring, based on 2011 proportion of catch in three habitats as above

[c] DOE and BIA 2007

[d]personal communication to M. Calle of OSMRE

[e]Does not support fish

[f]Utah - Lake Powell (accessed at www.waterquality.utah.gov/watersheds/lakes/lakepowl.pdf on 7/9/13)

Navajo Mine

Ponds and impoundments that occur within the ROI and surrounding areas function as either livestock watering impoundments or sediment control ponds to control runoff from mining activities. These small ponds are dry most of the year, only containing water following precipitation events. No perennial waters capable of supporting fish occur within the ROI (BNCC 2012a, 2012f).

FCPP

Morgan Lake is a permanent, artificial water body located within the FCPP Lease Area. Morgan Lake receives cooling water from the adjacent FCCP, and also serves as a recreational fishery operated by the Navajo Nation. Water temperatures in the lake exceed 75 degrees Fahrenheit year-round. Water from Morgan Lake supports bass stocked by the New Mexico Department of Game and Fish (BNCC 2012a). The lake does not support any native fish species; however, at least six species of non-native fish occur in the lake, including channel catfish, bluegill, largemouth bass (all game fish), gizzard shad and common carp. One concern regarding Morgan Lake is the potential for non-native fish to escape the lake and become established in the San Juan River (New Mexico State Parks 2013a).

The San Juan River runs east to west approximately 2.3 miles north of the project area and is the source of FCPP cooling water. The fisheries of the San Juan River have been the focus of numerous studies over the last two decades. These studies have been coordinated through the San Juan River Restoration Implementation Plan, the focus of which is to recover populations of Colorado pikeminnow and razorback sucker. The studies being conducted and most recent reports provide an abundance of information about the fish species present throughout the San Juan River (e.g., Ryden 2010, 2012; Gilbert et al. 2011, 2012; SJRIP n.d.). Seven species of native fish have been observed in the San Juan River (Table 4.7-7). Of these, bluehead sucker, flannelmouth sucker, and speckled dace are common, comprising more than 5 percent of the total catch (denoted as “C” in Table 4.7-7). Razorback sucker and Colorado pikeminnow are uncommon, representing 1 to 5 percent of the total catch (denoted as “U” in Table 4.7-7). Mottled sculpin and roundtail chub are rare, representing less than 5 percent of the total catch in either survey (denoted as “R” in Table 4.7-7). Colorado pikeminnow and razorback sucker are listed as endangered

under the federal ESA. Roundtail chub in the San Juan River are not listed, but the Lower Colorado Basin Distinct Population Segment is a candidate species under the federal ESA. These species are described in more detail in Section 4.8.2.3.

Surveys conducted within the proposed DFADAs identified no permanent water sources capable of supporting fish (Ecosphere 2012c). The Chaco River runs to the west of the project area. This river is ephemeral until it passes downstream of Morgan Lake, where leakage from the lake and backwater from the San Juan River creates permanent water. This permanent water has not been sampled, but likely contains many of the same species observed in the San Juan River.

In the San Juan River, native fish tend to outnumber non-native fish (Ryden 2012, Gilbert et al. 2012). Native fish in the river tend to be more dominant in upstream reaches, such as are found near the project area, whereas non-native fish tend to increase in abundance in the lower reaches of the river and Lake Powell. The number of native fish, particularly Colorado pikeminnow and razorback sucker are increasing over time because of extensive stocking by the Recovery Program. As recently as 2001, the number of native fish in the large bodied fish monitoring program was very low. In 2010, native fish made up over 80 percent of the total catch in the Large Bodied Fish Monitoring Program (Ryden 2012). The numbers of channel catfish are also down in the upstream areas, but remain strong in the middle and downstream portions of the river. This species is subject to a non-native fish removal program, which appears to be having some success. This same program has also greatly reduced the number of common carp throughout the river. Other common non-native species on the San Juan River include red shiner, and western mosquitofish (Table 4.7-7).

The San Juan River flows from the Project Area westward to Lake Powell. Because contaminants from FCPP emissions flow downstream with the river and enter Lake Powell, the San Juan River arm of Lake Powel is included in the project vicinity. No quantitative estimates of relative abundance of fish in the San Juan Arm of Lake Powell have been found; however, it is a reasonable presumption that many, if not all of the fish species found in the San Juan River are likely to be found in this arm of the lake. A 30-foot waterfall currently separates the San Juan River from Lake Powell so while fish can easily move from the river into the San Juan River arm of Lake Powell, they cannot move from the lake into the river. While native fish tend to outnumber non-native fish in the river, non-native fish tend to outnumber native fish in the San Juan River arm of Lake Powell and in the lake at large (Ryden 2012, Gilbert et al. 2012). Other non-native species found in Lake Powell include largemouth and smallmouth bass, several species of sunfish, gizzard shad, fathead minnow, northern pike, and black bullhead (Table 4.7-7).

Transmission Lines

Transmission lines in the ROI cross numerous perennial and ephemeral water bodies (see Section 4.5, Water Resources), which support numerous fish and other aquatic species typical of the region. No specific surveys of these species were conducted because the Proposed Action does not include a proposal to construct or modify the existing transmission line structures, which could affect aquatic species.

APS transmission lines extend from FCPP to the west and southwest, extending from San Juan County, New Mexico across Apache, Navajo and into Cococino counties, Arizona. The 500 KV line crosses the Little Colorado River, as well as Chinle Wash and several ephemeral waterways. The 345 KV line crosses only ephemeral waterways. Habitat modeling and field studies found that these lines do not intersect suitable habitat for listed or sensitive fish species (AECOM 2013c).

PNM transmission lines extend from FCPP to the north (FCPP to San Juan Generating Station) and southeast (FCPP to West Mesa line). The FCPP to San Juan Generating Station line lies entirely within San Juan County extending from the FCPP to the San Juan Generating Station. The FCPP to West Mesa line crosses portions of San Juan, McKinley and Sandoval counties, NM. Both lines cross lands of the Navajo Nation, as well as BLM and State Trust lands. The FCPP to San Juan Generating Station line wraps around the perimeter of Morgan Lake and crosses the San Juan River between towers FC28 and

FC29. The fish community of Morgan Lake and the San Juan River is described above. Both towers are located outside of the active channel and riparian zone. This line does not cross any other permanent waterbodies (Marron and Associates 2012a). The FCPP to West Mesa line crosses a number of ephemeral drainages, including West Fork Gallegos Canyon, Moncisco Wasy, Kimbeto Wash Escavada Wash, Torreon Wash, San Isidro Wash, Betonnie Tsosie Wash, Canada Alemita, Canada Alamos, Canada Correles, Arroyo Pueblo Alto, Chaco Wash, Daniel Wash, Arroyo Piedra Lumbre, Benard Arroyo and Truijilio Canyon. Of these, only the West Fork Gallegos Canyon and Moncicso Wash supported wetland development. The line also crosses the Rio Puerco, which was dry at the time wildlife surveys were conducted in 2012, but may have perennial water in wetter years (Marron and Associates 2012b). This area is unlikely to support any fish. The transmission line spans the river and the towers are above the high water line. Any maintenance activities would occur outside of the riparian zone.

4.7.3 Changes to Wildlife and Habitat Affected Environment Post-2014

Two completed Federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions, and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed Federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Action are compared in the following section. Therefore, neither of these completed Federal actions would change the affected environment for wildlife and habitats.

4.7.4 Environmental Consequences

Impacts to wildlife may include direct impacts from habitat loss, alteration, and fragmentation, and incidental mortality from vehicle collisions, vegetation clearing with heavy equipment, or construction activities. Impacts may also include indirect impacts from noise and human presence. Direct impacts to wildlife and their habitat were determined using best available data for the wildlife species known or expected to occur within the ROI. Indirect effects to wildlife and habitat resulting from FCPP air emissions were evaluated through an ERA (AECOM 2013c), described in detail in Section 4.6.

The criteria used to determine impacts to wildlife are defined as follows:

- Major – Impacts that could affect a species at the population level
- Moderate – Effects that are outside of the random fluctuations of natural processes but do not cause a significant loss of the resource; e.g., significant mortality, habitat loss, or stress
- Minor – Changes that would affect the quality of wildlife/habitat but are similar to those caused by random fluctuations in natural processes; e.g., habitat loss in relatively small proportion
- None – Impacts that are not measurable or would not impact wildlife

4.7.4.1 Alternative A – Proposed Action

The Proposed Action impacts analysis includes potential impacts to wildlife that are common to the Proposed Action and the alternatives. These common potential impacts are discussed below, prior to discussion of the specific potential impacts for each alternative.

Wildlife Impacts Common to All Project Components

Combined impacts associated with activities common to all project components and those impacts specific to the Navajo Mine, FCPP, and transmission lines would not substantially impact existing wildlife resources on a population or rage-wide level, but would range from moderate to minor on an individual basis depending upon the species size and mobility. Specifically, wildlife populations occurring in the ROI are not expected to be irreversibly impacted due to the availability of thousands of acres of similar habitats adjacent to the ROI, and that large portions of the Project are would be reclaimed to meet reclamation criteria equal

to or greater in vegetative cover and production that pre-mining conditions. Finally, the projected future contaminant emissions are not expected to contribute substantially to these impacts.

As proposed, the various project components would be constructed and/or designed in such a way so as to minimize overall impacts to wildlife species. This would be accomplished by timing of construction activities resulting in ground or habitat disturbance outside critical breeding or nesting periods. Similarly, where a potential for injury or death of wildlife species exists as a direct result of operations or maintenance, wildlife protection measures, such as reduced speed limits to minimize wildlife vehicle collisions or APLIC-approved design standards to minimize or eliminate electrocution risk, would be implemented (as described in Section 3.2.6.7).

Fugitive Dust

Fugitive dust created during construction, mining, development of borrow pits, and transportation on unpaved access roads could impair wildlife respiratory functions and eyesight. The impact of dust pollution on wildlife is expected to be of localized importance near construction areas and would be minimized by standard construction practices, such dust control methods as dust suppression (watered with water trucks), stock pile stabilization, and use of haul roads to minimize airborne dust.

Impacts to wildlife occurring in the ROI from fugitive dust emissions would be minor due to dust control BMPs already in place.

Noise

Noise is expected to be generated during operational activities and active mining, operation of the FCPP, construction associated with the Burnham Road realignment, development of borrow pits, and construction of the DFADAs. Impacts to wildlife from noise depend on multiple variables, such as the magnitude and duration of the noise, proximity to the source, life history of the species affected, time of year, time of day, and the influence of other environmental stressors such as heat or drought. Construction activities would result in a short-term increase in the ambient noise level. Noise levels associated with this construction would be restricted to the areas surrounding active construction areas, including borrow areas. Noises associated with construction can cause wildlife to avoid or temporarily abandon active construction sites and can affect physiology, behavior, or reproductive success until construction is complete and noises are no longer being generated. Section 4.14 provides detailed information on the maximum noise levels generated by typical construction equipment. Operation of existing facilities within the Navajo Mine and FCPP that produce noise and unanticipated noises generated could have a moderate impact on individual animals in the area, causing flight or stress behaviors that could negatively affect wildlife; however, these are not expected to be different from what is currently experienced by wildlife under existing conditions.

Impacts to wildlife associated with noise generated during operation of existing facilities within the Navajo Mine and FCPP would be minor, as wildlife are expected to be acclimated to noises associated with existing Project components. Noise impacts from construction activities would be minor due to the short-term nature of the noise and general acclimation of ROI wildlife to noise from existing operations.

Human Activity

Wildlife occurring in the ROI may temporarily avoid areas where human disturbances are occurring or may permanently abandon areas where human presence is more permanent. Alterations of nesting, foraging, hunting, and breeding behavior in some wildlife species could result. Wildlife may be especially sensitive to human presence during periods of their annual cycles, such as migration or breeding seasons. These responses could include annoyance and cause wildlife to flee or panic, resulting in serious injury or death.

Impacts to wildlife resulting from human activity associated with operation of the Navajo Mine and FCPP would range from minor to moderate depending upon the activity occurring, the proximity of the activity, and the species encountered.

Impacts are expected to be moderate for smaller terrestrial burrowing species such as small mammals and reptiles occurring in the immediate vicinity of the project components. These species, by nature, occupy smaller home-ranges and would be less capable of fleeing areas of active operations, maintenance, or other ground disturbing activities and could be subject to injury, death, or displacement due to ground disturbance or habitat fragmentation. Minor impacts to larger, more mobile, species such as raptors, non-raptor avian species, bats, rabbits and hares, carnivores, big games, lagomorphs, carnivores, big-game, and raptors are expected as these species would likely temporarily flee the immediate terrestrial impact areas and access adjacent habitats or would be remain unaffected by the Proposed Action. Loss or avoidance of foraging, breeding, or nesting habitats associated with these species would be small as many of these species occupy larger home-ranges and would make use of adjacent undisturbed habitats.

Habitat Loss and Fragmentation

Direct impacts from habitat loss and fragmentation would occur in active mining, road construction, development of borrow pits, and construction of roads and the DFADA components. These impacts could affect the wildlife community at differing levels of the food chain, for example, causing such small mammals as rodents and rabbits and their respective predators to abandon an area. Removal of habitat within the ROI is likely to result in displacement of wildlife to adjacent, undisturbed suitable habitat. In areas where vegetation is permanently removed, it is likely that wildlife species would migrate to suitable habitat and not return to the permanently altered area. Generalist species, such as jackrabbits and coyotes, may be more successful than habitat specialists at colonizing disturbed or fragmented habitat types.

Impacts to wildlife from habitat loss during the active mining and reclamation activities in the ROI would be considered short-term and moderate; habitat would be reestablished as a result of on-going reclamation. Construction of ancillary facilities and roads would result in moderate impacts to wildlife as a result of long-term habitat loss (all roads and facilities would be removed at the end of the permit period, with the exception of Burnham Road). It is unlikely that wildlife populations in these areas would be irreversibly impacted due to the availability of thousands of acres of similar habitats adjacent to the ROI, and that large portions of the Project would be reclaimed to meet reclamation criteria equal to or greater in vegetative cover and production that pre-mining conditions.

Ground Disturbance

Direct impacts from ground disturbance would occur from active mining, road construction, development of borrow pits, and construction of the DFADA components where direct ground disturbance is proposed. Permanent losses of soil horizon habitats would reduce the abundance of ground-dwelling wildlife, particularly small mammals. Small mammals that occur within the ROI may experience mortality as topsoil is stripped; however, disturbance would not be expected to affect a species' regional population. Multiple wildlife studies completed for Project components within the Navajo Mine since the 1960s and more recent studies completed for the DFADAs indicate that overall densities of small mammals in shrubland habitats within the ROI are generally low. As an indicator of food chain impacts, their removal from an area would consequently have only minor to moderate impacts to their predators' survival in the ROI. Direct Impacts to breeding and nesting avian species could occur as a direct result of ground disturbing activities, particularly to migratory birds, ground nesting avian species, or species nesting directly adjacent to ground disturbing activities. To avoid violation of the MBTA and BGEPA, impacts to breeding and nesting avian species would be reduced or eliminated by clearing vegetation for ground disturbing activities outside critical breeding and nesting periods.

Impacts to wildlife from ground disturbance would be considered moderate due to temporary and potentially permanent ground loss during the life of the mining and construction activities. It is unlikely that

wildlife populations in these areas would be irreversibly impacted, as these species could occupy extensive adjacent acres of similar undisturbed habitats.

Vehicles

Vehicular traffic could have a negative effect on wildlife, resulting in injury or mortality from wildlife/vehicle collisions with construction equipment and employee vehicles. A variety of wildlife would inevitably be injured or killed by vehicle traffic accessing existing and proposed facilities. These impacts are expected to be greater during Project construction when vehicle traffic would be the highest. Reptiles are more prone to being run over along the paved power plant access road due to their attraction to the warm road surface and their inability to avoid oncoming traffic.

Impacts to wildlife would be considered moderate due to some animals' inability to avoid vehicles. Impacts would not be considered to affect any species at the population level.

Wildlife Impacts Specific to Alternative A

Navajo Mine

The existing Navajo Mine support facilities would be used to process and transport coal mined from the Navajo Mine and Pinabete Permit Areas. No additional removal of wildlife habitat is expected to occur within these areas. Mining activities for the Proposed Action would not create an increase above the current baseline conditions in the number and type of vehicles using the Navajo Mine buildings, support facilities, and coal-handling areas. Infrequent animal vehicle collisions with truck and train travel would be expected to occur at levels consistent with current truck and rail activity. These infrequent, ongoing impacts would persist until coal-hauling activities began to decline as the Pinabete Permit Area was mined out. Impacts to wildlife from transportation of coal would be considered moderate due to potential for animal mortality, and would be considered long-term as infrequent mortalities would be expected to occur over the life of the Navajo Mine. Fugitive dust associated with the continued operations of the support facilities would be minimized by the implementation of standard construction and operational fugitive dust control measures. Impacts to wildlife from existing support facilities, coal-handling areas, and buildings would be considered negligible compared to baseline conditions, as no existing facilities would be altered.

The types of wildlife habitat expected to experience the greatest amount of loss and disturbance are those areas in and around the Pinabete Permit Area and Burnham Road realignment where direct vegetation removal is proposed. Direct impacts to wildlife from mining operations include the loss and fragmentation of upland habitats in Badlands, Alkali Wash, Sands, Thinbreaks, Dune, and Arroyo Shrub habitats in the Pinabete Permit Area (see Section 4.6). 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 ROI. Sands and Alkali Wash would be the next most impacted areas. Minimal disturbance to riparian habitats are expected as riparian habitats within these areas are mostly occupied by saltcedar and are considered marginal riparian habitat. Generalist species such as coyote, black-tailed jackrabbit, desert cottontail, lizards, and small mammals use these habitats and are commonly documented in the Navajo Mine and Pinabete Permit Areas (BNCC 2012f). Small mammal densities are low in the ROI (BNCC 2012f) and concentrated in Arroyo Shrub habitat due to greater availability of food and shelter relative to other area habitats. No permanent waters occur within the Navajo Mine Lease Area and BMPs are used to prevent runoff of sediments and chemicals into natural waterways, therefore there would be no impacts to fish or other aquatic resources.

Direct impacts from habitat loss and fragmentation would be confined to the proposed Pinabete Permit Area. These impacts would have moderate effects on wildlife in the short term due to the availability of thousands of acres of similar habitats adjacent to the Pinabete Permit Area. Impacts would be minor in the long term after reclamation of the mined area was complete. 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. Direct impacts to ground- and shrub-nesting species

that may be present in the ROI are expected to occur as a direct result of vegetation removal and ground-disturbing activities. These direct impacts would be short-term and limited to the mined area during vegetation removal at the onset of mining activities and, therefore, would be considered moderate.

All areas mined under the Proposed Action would be reclaimed according to the SMCRA permit, which commences once an area is mined out (BNCC 2012f). Reclamation under Alternative A would restore vegetative cover, resulting in a species composition and density of vegetation necessarily different from but compatible with that which was disturbed, as specified in the permit. Upon completion of mining, post-mining reclamation will restore the vegetative cover to a diverse, stable, and self-sustaining vegetation community composed of native species capable of meeting the post-mining land use to support wildlife use and grazing. As part of post mining reclamation, reclaimed would meet or exceed pre-mining vegetative cover and vegetative production values which may provide greater vegetative diversity and cover that pre-mining conditions, particularly in those habitats with naturally low cover and production values and in areas which have experienced historically high grazing activities. Wildlife would return to mined areas following reclamation, although the species that use the reclaimed areas may be different in variety and abundance than historically documented.

Realigning Burnham Road would result in surface disturbance associated with the permanently removed and replaced driving surfaces (see Table 3-10). Direct impacts from habitat loss would be moderate due to the long-term nature of the disturbance. The primary habitat affected by the Burnham Road realignment would include upland habitats of Alkali Wash, Arroyo Shrub, Badlands, Sands, and Thinbreaks. Wildlife occurring in the path of the realignment would be impacted by habitat loss, alteration, and fragmentation, but the availability and quantity of identical habitat near the realignment would reduce the overall impacts to these wildlife. Low densities of small mammals have been documented using Alkali Wash habitats, as well as Sands and Arroyo Shrub habitats. 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 by the loss of prey and associated habitat supporting them. Big-game and small mammal species could be directly impacted as a result of vehicle collisions but would generally remain unaffected by the alignment. Impacts to wildlife would be considered moderate due to the permanent loss of habit and potential wildlife mortality from long-term traffic on the road.

Infrequent animal vehicle collisions with truck and train travel would be expected to occur at levels consistent with current truck and rail activity. These low, ongoing impacts would persist until coal-hauling activities began to decline as the Pinabete Permit Area was mined out. Impacts to wildlife from transportation of coal would be considered moderate due to potential animal mortality; however, impacts would be short-term.

FCPP

Wildlife are affected by air pollutants through direct inhalation, consumption, and absorption of gases through the skin. In general, only soft-bodied invertebrates or amphibians are affected by the absorption of air pollutants through their skin; however, chemicals can bioaccumulate as wildlife ingests species exposed to pollutants (AECOM 2013a). Compounds including O_3, SO_2, and NO_2 have particularly negative impacts on the respiratory systems of animals. In addition to causing respiratory problems, chemical pollutants may accumulate in the tissues of both plants and wildlife, which can lead to tissue damage and genetic mutations. The accumulation of chemical pollutants in the tissues of wildlife can also have additive impacts among higher trophic levels. Wildlife at higher food chain (trophic) levels, such as carnivores, may accumulate much greater concentrations of chemicals, simply through regular diet, than organisms lower in the food chain. Concentrations of compounds in wildlife at higher trophic levels can reach levels to cause adverse effects on behavior, reproduction, longevity, or disease resistance, and even cause death. The concentrations of chemical air pollutants to which wildlife in the ROI would be exposed are expected to be variable and dependent upon location and local environmental factors.

Ecological risks associated with FCPP emissions were evaluated to address the impacts of direct contributions from the FCPP stacks under the Proposed Action that are deposited on nearby terrestrial and aquatic habitats. Total future risks were calculated by considering risks from constituents currently present in the environment, as well as constituents associated with future emissions from the FCPP for an additional 25 years, from 2016 to 2041. Based on this evaluation, no major additional risks to terrestrial plants (habitat), invertebrates, birds, mammals, or fish are expected within the deposition area as a result of proposed future operations of the FCPP and impacts from the Proposed Action are not expected to increase current risks to a level of concern (AECOM 2013c). Therefore, impacts to wildlife from air pollution are considered minor.

FCPP's continued operation would result in the ongoing generation of noise. No increase in noises associated with FCPP operations are expected, as FCPP operations for the Proposed Action would not increase above current conditions. Infrequent animal collisions with employee vehicles and noise and avian collisions or electrocution associated with the power infrastructure would be expected to occur at levels commensurate with current operations. These low, ongoing impacts would persist for the FCPP's life. Impacts to wildlife from noise generated at the FCPP would be considered minor as noise levels do not change under the Proposed Action compared to the baseline conditions.

Construction of the expanded DFADAs is expected to permanently remove acreage as shown in Table 3-7, primarily upland habitat (92 percent) and riparian dominated by saltcedar (8 percent). Loss of these habitat types would affect a variety of wildlife species as this area provides suitable habitat for nesting/burrowing, foraging, and breeding for terrestrial wildlife, birds, and raptors. Wildlife occurring in the location of the expanded DFADAs would be permanently impacted by habitat loss, alteration, and fragmentation, but the availability and quantity of identical habitat near the proposed facility would reduce the overall impacts to these wildlife. Small mammals and herptiles have been documented in habitat within the proposed facility. Carnivore and raptor species dependent on small mammals and herptiles for prey could also be indirectly impacted by loss of prey and associated habitat supporting prey species. Potential impacts from fugitive dust would be localized and decreased through the implementation of fugitive dust control measures. Impacts to wildlife from the proposed DFADAs would be considered moderate, for while there is permanent loss of habitat, similar habitats are available in the vicinity of the ROI.

Transmission Lines

The existing power poles provide perching, nesting, and roosting opportunities for many avian species. Continued use of power structures could negatively affect some avian species by collisions with the structures or by electrocution. Raptors and large birds are electrocuted through energized line to ground contacts, while small birds can be electrocuted from transformers and other power pole components. Both the APS and PNM high voltage transmission lines are constructed in compliance with National Electric Safety Code and internal engineering standards. The transmission lines also meet the USWFS recommended APLIC minimum 60 inches horizontal and 48 inches vertical recommended conductor spacing to reduce risks of raptor electrocutions. As a general rule, APLIC design recommendations were developed to reduce avian electrocution risk along distribution lines, which are generally much smaller than the APS or PNM transmission lines. By design the conductor separation for the APS and PNM line voltages (500 and 345 kV) is in excess of 12 feet, well over the APLIC recommended conductor spacing. The California condor is the largest avian species that could occur or potentially utilize the power lines structures for perching and has an approximate wing span of 9 feet, 3 feet narrower than the smallest APS or PNM transmission line conductor separation. Both utilities have developed implemented a corporate level and system wide program designed to minimize the risks of electrocution or collision to protected birds and a variety of mammals. APS has a Wildlife Protection Program and PNM has an Avian Protection Plan that they comply with and these programs cover the transmission lines within the ROI.

Nesting raptors are monitored on a biannual basis near the Navajo Mine to identify and manage risk to avian species by electrocution. APS implements a Wildlife Protection Program designed to minimize the

danger of energized lines for birds of prey and a variety of mammals. PNM documents collisions and electrocutions on a yearly basis to identify wildlife hazards across their service area. Both APS and PNM wildlife programs collect data system wide that document collisions and electrocutions on a yearly basis to identify wildlife hazards across their service area. Avian mortality reports submitted to USFWS by PNM and avian mortality reports tracked by APS have documented avian mortalities associated with their respective transmission and distribution line systems. Although the records do not specify the specific lines where the mortality incidents occurred, they do provide a general sense of the potential risk associated with their distribution and transmission lines. Of the 90 documented PNM records between 2003 and 2011 and 1,143 documented APS records between 2002 and 2012, there was only one occurrence that could not be excluded from the ROI. This event occurred in 2005 and involved an American kestrel near Star Lake, McKinley County. Based on the mortality reports and transmission lines conductor configuration and spacing it was concluded that this incident was likely associated with a smaller distribution line and not the Project transmission lines. Therefore, impacts to raptors and migratory birds are considered moderate, for while a potential for electrocution would exist, the Wildlife Protection Program would decrease this potential. The continued operation of electrical transmission towers and lines would increase the long-term potential for large bird or raptor collisions and electrocution from perching on or near tower conductors. With continued implementation of the existing APS and PNM Avian Protection Plans, this potential impact would be minor. Continued use of the APS and PNM transmission corridors would have relatively little human activity associated with them outside of regular maintenance activities. During maintenance, wildlife may flee the immediate area and would return following the departure of maintenance crews.

Renewal of the ROW leases would not remove or alter wildlife habitats within the APS or PNM ROWs. Renewal of the ROW leases would allow both APS and PMN to continue routine inspections, maintenance activities, and repairs along the entire length of the ROW leases. Vegetation management within the ROWs is expected to result in the minor loss of woody debris and woody vegetation along the ROWs during tree trimming efforts that could result in direct impacts to nesting avian species within the ROWs.

4.7.4.2 Alternative B – Navajo Mine Extension Project Mine Plan

Navajo Mine

Under Alternative B, the affected footprint would be larger than that of the Proposed Action (see Table 3-7). The types of direct and indirect effects on wildlife occurring within these areas would be identical to those described in the Proposed Action, but would result in greater loss of wildlife and their associated upland habitats.

The Burnham Road realignment would result in the removal of approximately 165 acres of upland vegetation during construction. Approximately 50 acres of vegetation associated with the driving surface and drainage structures would be permanently removed, resulting in long-term impacts to wildlife habitat. Short-term impacts would occur on the extended acreage, which would be reclaimed following construction. The types of direct and indirect effects on wildlife occurring in these areas would be identical to those described in the Proposed Action, but could increase the wildlife-vehicle collision risks to wildlife species as a direct result of additional roadway construction and usage.

Under Alternative B, additional primary and ancillary roads would be required to support mining activities (see Table 3-7). The types of direct and indirect effects on wildlife occurring within these areas would be identical to those described in the Proposed Action, but could increase the wildlife-vehicle collision risks to wildlife species as a direct result of additional roadway usage.

Use of the existing Navajo Mine buildings, support facilities, and coal-handling areas would operate as described under the Proposed Action. Under Alternative B, eight more miles of transmission lines would be constructed over what is described for the Proposed Action. The types of direct and indirect effects on wildlife occurring within these areas would be identical to those described in the Proposed Action, but

could increase the collision or electrocution risks to avian species as a direct result of additional power line operation.

Mine operations, mine reclamation, and wildlife management measures associated with mining operations, road construction and use, and existing facility operations would be the same as described under the Proposed Action.

FCPP

Under Alternative B, the FCPP would operate as described under the Proposed Action. No changes are proposed, and impacts would be as described for the Proposed Action.

Transmission Lines

Under Alternative B, the transmission line ROWs would continue to be operated and maintained as described under the Proposed Action. No changes are proposed, and impacts would be as described for the Proposed Action.

4.7.4.3 Alternative C – Alternative Pinabete Mine Plan

Navajo Mine

Alternative C would result in a larger conceptual footprint than the Proposed Action (see Table 3-8). The types of direct and indirect effects on wildlife occurring in these areas would be identical to those described in the Proposed Action, but would result in greater loss to existing wildlife and their associated upland habitats.

Under Alternative C, additional primary and ancillary roads would be required to support mining activities (see Table 3-8). The types of direct and indirect effects on wildlife occurring within these areas would be identical to those described in the Proposed Action, but could increase the wildlife-vehicle collision risks to wildlife species as a direct result of additional roadway usage.

The Burnham Road realignment would be extended, resulting in removal of approximately 165 acres of upland vegetation during construction. Approximately 50 acres of vegetation associated with the driving surface and drainage structures would be permanently removed, resulting in long-term impacts to wildlife habitat. Short-term impacts would occur on the remaining acres, which would be reclaimed following construction. The types of direct and indirect effects on wildlife occurring within these areas would be identical to those described in the Proposed Action, but could increase the wildlife-vehicle collision risks to wildlife species as a direct result of additional roadway construction and use.

Use of the existing Navajo Mine buildings, support facilities, and coal-handling areas would occur as described under the Proposed Action. Under Alternative C, eight more miles of transmission lines would be constructed over what is described for the Proposed Action. The types of direct and indirect effects on wildlife occurring within these areas would be identical to those described in the Proposed Action, but could increase the collision or electrocution risks to avian species as a direct result of additional power line operation. Impacts to wildlife due to existing support facilities would be similar to those established under Alternative A, with a slightly larger footprint.

Mine operations, mine reclamation, and wildlife management measures associated with mining operations, road construction and use, and existing facility operations would be the same as described under the Proposed Action.

FCPP

Under Alternative C, the FCPP would operate as described under the Proposed Action. No changes are proposed, and impacts would be as described for the Proposed Action.

Transmission Lines

Under Alternative C, the transmission line ROWs would continue to be operated and maintained as described under the Proposed Action. No changes are proposed, and impacts would be as described for the Proposed Action.

4.7.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action. Impacts would be the same as described for the Proposed Action.

Four Corners Power Plant

Under this alternative, the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The types of direct and indirect effects on wildlife occurring as a result of the DFADAs would be of the same nature as those described for the Proposed Action but would result less loss to the local biological community. The 10% reduction in surface area of the DFADAs would result in less permanent loss, alteration, or fragmentation of suitable habitat and therefore less potential for impacts to the local wildlife community. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

Under this alternative, the transmission line ROWs would be approved and they would continue to be operated and maintained as described for the Proposed Action. No changes are proposed, and impacts would be as described for the Proposed Action.

4.7.4.5 Alternative E – No Action Alternative

Navajo Mine

Under the No Action Alternative, the Navajo Mine would close; therefore, no additional loss or modification of wildlife habitat, direct impacts, or indirect impacts to wildlife would occur. Upon permit expiration, NTEC would begin reclamation activities within the Navajo Mine until all requirements of the existing SMCRA permit are met.

FCPP

Under the No Action Alternative, Units 4 and 5 would be shut down and the FCPP would be decommissioned and demolished. Wildlife would be disturbed as a result of increased noise and dust during demolition; however, these effects would be short term. Upon completion of demolition activities, wildlife could return to the area depending on site conditions after either the decommissioning or the demolition.

Transmission Lines

Under the No Action Alternative, wildlife or their habitats could be disturbed by activities associated with decommissioning and dismantling of APS and PNM transmission lines. It is anticipated that such activities would be coordinated with the Navajo Nation and the BLM to maintain compliance with all environmental laws and regulations throughout the demolition process; therefore, impacts to wildlife are anticipated to be short term and minor.

4.7.5 Wildlife and Habitats Mitigation Measures

The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific mitigating

measures for certain environmental impacts, standard operating procedures that reduce or avoid environmental impacts, and best management practices for specific activities. These are described in Section 3.2.6.7. These measures are part of their application materials and are enforceable through permit or lease conditions. In addition, the Project Applicants must comply with additional protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section for each resource category. Where the environmental analysis in this EIS recommends additional protective measures, over and above the applicant proposed measures and regulatory compliance, they are listed below as specific mitigation measures.

The Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects to Wildlife and Habitats. Therefore, no additional mitigation is recommended.

4.8 Special-Status Species

This section addresses the potential effects of the alternatives to special-status plant and wildlife species. Special-status species are those that are protected or proposed to be protected (i.e., candidate) by the Federal ESA. In addition, agencies and organizations such as BLM, and New Mexico Game and Fish (NMGF), and tribal governments maintain lists of special concern or sensitive species that are also appropriate to consider in this NEPA analysis. For purposes of this environmental analysis, special-status plants and animals include species that are proposed for Federal listing as threatened or endangered or considered candidates for listing, and species noted as sensitive or of special concern by other Federal agencies and state or tribal governments. The special-status species identified may also be protected by other Federal legislation including the MBTA, BGEPA, and Neotropical Migratory Bird Conservation Act.

The ROI for this section is the lease boundary for the Navajo Mine and FCPP, with an additional 1-mile buffer. For the transmission lines, the ROI is a one-half mile buffer outside each side of the ROW boundary. For the FCPP, the ROI also includes the deposition area around the plant within which 99 percent of all COPECs emitted from the plant are projected to the ground or water. For this component of the analysis, the area of interest is extended down the San Juan River to Lake Powell, because these COPECs have the potential to be transported that distance by water and biota. Surveys that support this analysis were conducted in 2012 and 2013. For consideration of Alternative B, survey data from 2008 were used.

4.8.1 Regulatory Compliance Framework

4.8.1.1 Federal Regulations

Endangered Species Act of 1973

Congress passed the ESA (16 USC 1531-1544) in 1973 in recognition that many of our nation's native plants and animals were in danger of becoming extinct. The purposes of the Act are to protect these endangered and threatened species and to provide a means to conserve their ecosystems. To this end, Federal agencies are directed to use their authorities to conserve listed species and make sure that their actions do not jeopardize the continued existence of these species. For the Proposed Action, the law is administered by the USFWS. The USFWS works with other agencies to plan or modify Federal authorized projects so that they will have minimal impact on listed species and their habitats.

Federal agencies are required by ESA Section 7 (19 USC Part 1536[c], as amended) to ensure that any actions authorized, funded, or carried out by the agency do not jeopardize the continued existence of a Federally listed threatened or endangered species, or result in the destruction or adverse modification of the designated critical habitat of a Federally listed species. The lead Federal agency (e.g., OSMRE) is required to consult with USFWS and/or US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) to determine whether Federally listed threatened or endangered species or designated critical habitat are found in the vicinity of the proposed Project, and to determine the Proposed Action's potential effects on those species or critical habitats. For actions involving major ground-disturbing activities with the potential to affect listed species or designated critical habitat, the lead Federal agency must prepare a Biological Assessment (BA) for those species that may be affected. The BA is submitted to USFWS and/or NMFS and, if it is determined that the action may adversely affect a listed species, the Federal agencies must submit a request for formal consultation to comply with ESA Section 7. In response, USFWS or NMFS would issue a Biological Opinion (BO) as to whether or not the Federal action would likely jeopardize the continued existence of a listed species, or result in the destruction or adverse modification of designated critical habitat. In compliance with ESA Section 7, OSMRE is submitting a BA to the USFWS under separate cover from this EIS. No species under the jurisdiction of NMFS would be affected by the Proposed Action.

The NEPA and ESA processes interact, but the EIS is a public document, wherein the public is encouraged to participate in scoping a project, provide suggestions for alternatives, and provide comments on the evaluation of the effects of the Proposed Action and its alternatives. The ESA process is an agency-to-agency process and does not include public participation. The ESA process generally considers only the Proposed Action, while the alternatives analysis is the heart of the EIS. The potential effects of a project on listed species and their critical habitats are evaluated during both processes. Generally speaking, the two processes will use the same information in making their assessments. The NEPA assessment focuses on the potential effects on the species in a project area and immediate vicinity. The ESA BA focuses on effects to individuals and then projects how those effects might affect the species regionally, and places those effects within the context of the entire population of that species. The BA will include an effects determination as to whether a project is likely or not likely to adversely affect these species or may adversely modify designated critical habitat.

The submittal of the BA to the USFWS initiates formal consultation on a project and starts the time period for the consultation, as described in the ESA. USFWS will use the BA as the basis for preparing a BO that determines whether a project is likely to jeopardize the continued existence of the species or result in destruction or adverse modification of designated critical habitat. The BO will include reasonable and prudent alternatives that the USFWS believes the agency or applicant may take to avoid jeopardy to the species or adverse modification of designated critical habitat, and terms and conditions that specify the methods by which these alternatives are to be accomplished and provide reporting and monitoring requirements to ensure adequate oversight of any incidental take. Finally, the BO will include an incidental take statement that provides for a specific level of take or habitat modification that is allowed for a project, if a project is implemented in accordance with these alternatives and terms and conditions.

Because of the differing timeframes of the NEPA and Section 7 processes and the need to identify the Proposed Action prior to initiating Section 7 consultation, the EIS process runs ahead of the Section 7 process. OSMRE will initiate informal consultation after the Draft EIS has been made available and formal consultation will begin after OSMRE has had an opportunity to review and evaluate comments on the PDEIS. The USFWS BO is scheduled to be released in December 2014, just prior to publication of the final EIS in January 2015.

Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act

During vegetation clearing activities, the Project will be subject to compliance with the MBTA. In accordance with the MBTA active nests (presence of egg or young) would be protected from ground or vegetation clearing activities requiring nest searches and avoidance measures be implemented to protect breeding migratory birds. Another potentially relevant regulatory compliance framework is the BGEPA (16 USC 668-668d), which affords additional legal protection to bald and golden eagles are.

4.8.1.2 Tribal Regulations

The Navajo Natural Heritage Program (NNHP) is the Navajo Nation's rare, threatened and endangered species office. NNHP's purpose is to collect, manage and disseminate biological and ecological information for land-use planning to promote the conservation of biological diversity on the Navajo Nation. The NNHP maintains a comprehensive database of information on rare and protected plant and animal species and biological communities on the Navajo Nation. Special-status species listed on the Navajo Nation Endangered Species List (NESL) only include Groups 2 and 3, because species in NESL Group 1 no longer exist on the Navajo Nation and NESL Group 4 species are not afforded protection under Navajo law. Group 2 (G2) species are those whose prospects of survival or recruitment are in jeopardy. Group 3 (G3) species are those whose prospects of survival or recruitment are likely to be in jeopardy in the foreseeable future. Group 4 (G4) are those species for which the NNDFW does not currently have sufficient information to support their being listed in G2 or G3, but has reason to consider them as a species of interest. The Proposed Action is subject to compliance with the NESL, pursuant to the Navajo

Tribal Code. This code (17 NNC Part 507) makes it "unlawful for any person to take, possess, transport, export, process, sell or offer for sale or ship" any species in Groups 2 and 3 on the NESL.

Due to a covenant in the FCPP lease between APS and the Navajo Nation (Covenant 17: Operation of Power Plant; 1960 *et. seq*.), the Navajo Nation cannot impose tribal regulation on the operations of FCPP; therefore, NNDFW cannot regulate tribally listed species occurring within the FCPP lease area. This provision is not present in the Navajo Mine lease agreement, so potential effects to tribally listed species occurring within the Navajo Mine lease area are assessed in a Biological Evaluation (BE) that has been prepared and submitted to NNDFW for review/concurrence. Although the preparation of a BA per the Navajo Nation Endangered Species Act (Title 17 Part 507 of the Navajo Tribal Code) is not required for tribally listed species occurring within the FCPP lease area, potential effects to those species are considered in this EIS to provide a comprehensive assessment of sensitive species per the requirements of NEPA for projects occurring on tribal trust lands (Secretarial Order 3206).

4.8.1.3 State Regulations

The State of New Mexico designates species as either endangered, threatened, or as species of concern. Endangered species are those in danger of extinction throughout all or a significant portion of its range. Threatened species are those likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Species of concern are those for which further biological research and field study are needed to resolve their conservation status, or those considered sensitive, rare or declining on lists maintained by Natural Heritage Programs, state wildlife agencies, Federal agencies, or professional scientific societies. The State of New Mexico has responsibility for management of these species and state trust and private lands, but does not manage species on Navajo lands.

The State of Arizona designates state status to wildlife and plant species through the Arizona Game and Fish Department and the Arizona Department of Agriculture. The Arizona Game and Fish Department designates Wildlife of Special Concern in Arizona to wildlife that is or may be in jeopardy, or with known or perceived threats or population declines. Arizona Department of Agriculture designates special listing to those plant species in the follow categories: Highly Safeguarded where no collection is allowed; Salvage Restricted where collection is allowed only by permit; Export Restricted where transport out of state is prohibited; Salvage Assessed where permits are required to remove live trees; and Harvest Restricted where permits are required to remove plant by-products. All Project lands within Arizona are on Navajo and Hopi traditional lands and during agency consultation the Arizona state wildlife agency deferred the management or protection responsibility of any special-status wildlife and plant species on tribal lands to the Navajo Nation or Hopi Tribe so only those NESL Group 2-3 and Hopi Cultural Sensitive species are listed.

4.8.2 Affected Environment Pre-2014

A multistep process was developed to describe the potential occurrence of special-status species in the ROI. First, lists of species within the six counties included in the ROI were requested from the following:

1. Federally listed species were obtained from the USFWS website (USFWS 2012, 2013c);
2. The NNHP within the NNDFW provided information on the NESL Groups 2, 3, and 4 species known to occur in the vicinity of the ROI (NNHP 2011, 2012a, b). NESL Group 4 species were not included in the detailed habitat model evaluation or evaluated for potential Project-related impacts because these species are not afforded protection under Navajo or Federal law.
3. The Hopi Tribe provided a list of Hopi culturally sensitive species, as designated through the tribe's Wildlife and Ecosystem Management Program (Hopi Tribe 2012).
4. Sensitive species lists were obtained from the BLM for portions of the PNM transmission line that crosses BLM lands.

5. Natural Heritage New Mexico and the Arizona Game and Fish Department also were contacted for species information, but deferred any management or assessment on potential occurrence response to the NNHP for species on Navajo Nation lands. A list of species present on nontribal lands was obtained for San Juan, McKinley and Sandoval counties, New Mexico, as portions of the PNM FCPP to West Mesa transmission line crosses nontribal lands.

These lists substantially overlap. The results of this first step are described in Section 4.8.2.1, "Regional Setting." Next, recent survey data for the Navajo Mine, FCPP, and Transmission Lines are used to determine whether any of these species has a potential to occur within the ROI. The results of this evaluation are described in component-specific subsections after "Regional Setting".

4.8.2.1 Regional Setting

The combined lists from the NNHP, the Hopi Tribe, USFWS, BLM and NMGF included a total of 64 different special-status species that could occur within the six counties crossed by the Project or Project-related ROI (NNHP 2011, 2012a, 2012b; USFWS 2012, 2013c). Thirty-two species occur on the on the USFWS threatened and endangered, candidate, or proposed (TECP) list, 29 species occur on the NESL and Hopi list and 30 species occur on BLM and NMGF lists. Fifteen species on the NNHP and Hopi list are also on the USFWS TECP list and twelve species on the BLM or NMGF lists occur on either the USFWS or NNHP or Hopi lists. Potential to occur within the ROI was evaluated for each of the 64 species based on their habitat requirements and/or known distribution. As a result, 22 special-status species were eliminated from the USFWS TECP and 11 from the NNHP and Hopi detailed analysis because their known ranges are outside of the ROI or the ROI does not include suitable habitat. The identified NNHP, Hopi Tribe, USFWS, BLM, and NMGF special status species with potential to occur in the Project Area include 11 bird species, 9 mammal species, 3 fish species, and 9 plant species.

Federally Listed Species

Lists of TECP species under the ESA that could occur in the counties within which the Project occurs were obtained from the USFWS and included Apache, Coconino and Navajo counties in Arizona and McKinley, Sandoval and San Juan counties in New Mexico (USFWS 2012, 2013c). The USFWS lists include a total of 32 TECP species that could occur within the 6 counties crossed by the Project or ROI area. These include 4 bird species, 4 mammal species, 2 reptile and amphibian species, 8 fish species, 2 invertebrate species, and 12 plant species. These species, their scientific names, status, associated habitats, and their potential for occurrence within the ROI are summarized in Table 4.8-1.

Occurrence potential within the ROI was evaluated for each of the 32 species based on the habitat requirements and/or known distribution. As a result, 23 special-status plant and wildlife species were eliminated from further detailed analysis because their known ranges are outside of the ROI or the ROI does not include suitable habitat.

Navajo Nation and Hopi Tribe Species of Special Importance

The NNHP within the NNDFW provided information on the NESL species known to occur or with likelihood to occur in the vicinity of the ROI. The Hopi Tribe provided a list of Hopi culturally sensitive species, as designated through the tribe's Wildlife and Ecosystem Management Program. The list includes a total of 29 species that could occur within the 6 counties crossed by the Project or ROI, and includes 9 bird species, 2 mammal species, 2 amphibian species, 3 fish species, 1 invertebrate species, and 12 plant species. Fifteen of these species are also on the USFWS TECP list. These species, their scientific names, status, associated habitats, and their potential for occurrence within the ROI, are summarized Table 4.8-2.

Occurrence potential within the ROI was evaluated for each of the 29 species based on the habitat requirements and/or known distribution. As a result, 11 special-status plant and wildlife species were eliminated from further detailed analysis because their known ranges are outside of the ROI or the ROI does not include suitable habitat for them.

New Mexico Species of Concern and BLM Sensitive Species

PNM owns and operates two major electric transmission lines that cross approximately 70 miles of the Navajo Nation properties within San Juan, McKinley and Sandoval counties, New Mexico, that require reauthorization of the existing ROWs. The remaining portion of the line (approximately 85 miles) is outside of the Navajo Nation and cross a mixture BLM, State of New Mexico, and private lands. The segment of line from Rio Puerco to West Mesa Switching Station has been reauthorized and no pending or future ROW issues exist on this 19.7-mile segment of line. However, assessment of special-status species occurrences or potential Project-related impacts has been included for this segment of line since it is part of the Proposed Action.

The list of USFWS TECP New Mexico Species of Concern and BLM Sensitive Species with the potential to occur within or adjacent to the portion of the PNM transmission corridor in McKinley and Sandoval counties consists of 30 species shown in Table 4.8-3. Twelve of these species also occur on the TECP or Navajo and Hopi species list. These species were evaluated based on the habitat requirements and/or known distribution. As a result, 1 plant, 1 mammal, 3 birds and 5 fish special-status wildlife species were identified as not likely to occur and eliminated from further analysis (8 of which occurred on the USFWS or Navajo and Hopi lists).

The 20 special-status species on the potential to occur list includes 7 species of birds, 7 species of mammals, and 6 species of plants, four of which occur on either the USFWS or the Navajo/Hopi list. These species, their scientific names, status, associated habitats, and their potential for occurrence within the ROI are summarized in the following table.

The preceding paragraphs refer to the species with the potential to occur in the ROI as a whole. While many of these species will occur in association with some of project elements, few of the species will occur in all of those areas. Only a subset of these species will be associated with each element, as described in the following sections. The species counts for those elements will not match those provided above.

Table 4.8-1 Federally Listed Threatened, Endangered, Candidate, and Proposed Species within the Project Region of Influence

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Mammals					
Canis lupus baileyi	Mexican gray wolf	Federally Endangered	Apache, Navajo	Chaparral, woodland, and forested areas.	**Yes.** Mexican gray wolf may occur as migrant through the Project Area. Any limited potential habitat is too isolated to support this species.
Lynx canadensis	Canada lynx	Federal Candidate	San Juan	Subalpine/coniferous forests. Mature forests with downed logs and windfalls provide cover for denning, escape and protection from severe weather.	**Yes.** Lynx may occur as migrant through the Project Area. Limited potential habitat in the Chuska mountains is too isolated to support this species.
Mustela nigripes	Black-footed ferret	Federally Endangered	Apache, Coconino, Navajo, San Juan	Grassland plains/prairie. Prairie Dog town complexes of 200 acres or more for the Gunnison's prairie dog (*Cynomys gunnisoni*) and/or 80 acres or more for any subspecies of Black-tailed prairie dog (*Cynomys ludovicianus*). No known wild ferrets on the Navajo Nation except for those associated with the Arizona Game and Fish Dept. reintroduction on Tribal Ranch lands of Big Boquillas in Aubrey Valley, Coconino Co., approximately 100 miles to the west of the Project Area	**No.**
Zapus hudsonius luteus	New Mexico jumping mouse	Federal Candidate	Apache	Nests in dry soils but also uses moist, streamside, dense riparian/wetland vegetation. The jumping mouse appears to only utilize two riparian community types: (1) persistent emergent herbaceous wetlands; and (2) scrub-shrub wetlands. The New Mexican jumping mouse is diminished to 6 populations in the White Mountains, Arizona.	**Yes**. Suitable habitat was not found.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Birds					
Coccyzus americanus	Yellow-billed cuckoo	Federal Candidate	Apache, Coconino, Navajo, San Juan	Nesting cuckoos are associated with relatively dense, wooded, streamside riparian habitat, with varying combinations of Fremont cottonwood, willow, velvet ash, Arizona walnut, mesquite, and tamarisk. Some cuckoos also have been detected nesting in velvet mesquite, netleaf hackberry, Arizona sycamore, Arizona alder, and some exotic neighborhood shade trees.	**No**. Suitable habitat is not found along the Project's transmission line portion, but potential habitat could occur in riparian areas with higher canopies or salt cedar along the San Juan River.
Empidonax traillii extimus	Southwestern willow flycatcher	Federally Endangered	Apache, Coconino, Navajo, San Juan	Riparian-obligate bird found in cottonwood/willow and tamarisk vegetation communities along rivers and streams.	**No**. Suitable nesting habitat is not found along the Project's transmission line portion, but marginal habitat was identified within 30 km of the FCPP.
Gymnogyps californicus	California Condor	Federally Endangered	Apache, Coconino, Navajo,	High desert canyons and plateaus. Ill-defined nest, if any, composed of existing debris within overhung cliff ledges, crevices, potholes, or caves; in northern Arizona, nesting will likely be within walls of major river canyons or tall, steep cliffs within desert scrub and grasslands that allow easy approach from the air, and are inaccessible for terrestrial predators.	**Yes**. Suitable nesting habitat is not found within the Project Area but California condors could occur as occasional visitors within the Project Area or use the area for foraging.
Strix occidentalis lucida	Mexican spotted owl	Federally Threatened	Apache, Coconino, Navajo, San Juan	Nests in canyons and dense forests with multilayered foliage structure. Generally nest in older forests of mixed conifer or ponderosa pine/gambel oak type. Restricted habitat includes mixed-conifer forest, pine-oak forest, and riparian areas.	**Yes**. Suitable habitat is not found within the transmission line ROWs or within the Project Area.
Anthus spragueii	Sprague's pipet	Federal Candidate	San Juan	Breeds in northern Great Plains. Non breeding range extends from south-central and south-eastern AZ, occasionally in southern NM. Habitat during migration and in winter consists of pastures and weedy fields, including grasslands with dense herbaceous vegetation or grassy agricultural fields.	**Yes.** The current range of this species is outside the Action Area.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Amphibians					
Lithobates chiricahuensis	Chiricahua leopard frog	Federally Threatened	Apache, Navajo, Coconino	Streams, rivers, backwaters, ponds, and stock tanks that are mostly free from introduced fish, crayfish, and bullfrogs.	**Yes**. The current range of this species is outside the Project Area.
Reptiles					
Thamnophis eques megalops	Northern Mexican Garter-snake	Federal Candidate	Apache, Navajo, Coconino	Cienegas, stock tanks, large-river riparian woodlands and forests, streamside gallery forests. Core population areas in the US include mid/upper Verde River drainage, mid/lower Tonto Creek, and the San Rafael Valley and surrounding area. Status on tribal lands unknown. Strongly associated with the presence of a native prey base including leopard frogs and native fish.	**Yes.** Suitable habitat is not found within the Project Area.
Thamnophis rufipunctatus	Narrow-headed Garter-snake	Federal Proposed	Apache, Navajo, Coconino	The narrow-headed gartersnake is one of the most aquatic of the gartersnakes. This species is strongly associated with clear, rocky streams using predominantly pool and riffle habitat that includes cobbles and boulders, but it has also been observed using lake shoreline habitat in New Mexico. The species occurs at elevations from 2,300 – 8,200-feet in four types of biotic communities: Petran Montane Conifer Forest, Great Basin Conifer Woodland, Interior Chaparral, and the Arizona Upland subdivision of Sonoran Desert scrub.	**Yes.** Suitable habitat is not found within the Action Area.
Fish					
Catostomus discorbolus yarrow	Zuni bluehead sucker	Federal Candidate	Apache	Small streams in low velocity, moderate deep pools, and pool runs with seasonal dense algae. Young prefer quieter shallow areas near shoreline. Limited to possibly one creek in Arizona and to the headwaters of Zuni River drainage in New Mexico.	**Yes.** The current range of this species is outside the Project Area.
Gila cypha	Humpback chub	Federally Endangered	Coconino	Large, warm turbid rivers especially canyon areas with deep fast water. Species found in the Upper Colorado River basin in Utah and Colorado, and in the Little Colorado and Colorado rivers in Marble and Grand canyons, Arizona.	**Yes.** Suitable habitat is not found within the Project Area.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Gila robusta	Roundtail chub	Federal Candidate	Apache, Coconino, Navajo, San Juan	This species is found within the San Juan and Mancos rivers. Rarely encountered in recent surveys; they have been found from Shiprock to near Lake Powell with most between Shiprock and Aneth (RM 107-140). Adults inhabit the most permanent water in cool to warm water mid-elevation streams, typically using pools and eddies, adjacent to rapids and boulders. They are often found near cover (e.g., rocks, plant roots) and in pools behind irrigation diversions. Juveniles prefer the margins of flowing water and backwater areas. Spawning occurs over gravel bottoms in runs and pools with ≥25-cm water depth.	**No.**
Lepidomeda vittata	Little Colorado spinedace	Federally Threatened	Apache, Coconino, Navajo	Moderate to small streams; found in pools and riffles with water flowing over fine gravel and silt substrate.	**Yes.** The current range of this species is outside the Project Area.
Oncorhynchus gilae apache	Apache trout	Federally Threatened	Apache, Coconino, Navajo	This species is presently restricted to drainages in the White Mountains. Habitat includes streams and rivers generally above 6,000-foot elevation with adequate stream flow and shading; temperatures below 77°F; and substrate composed of boulders, rocks, gravel and some sand and silt.	**Yes.** The current range of this species is outside the Project Area.
Ptychocheilus lucius	Colorado pike-minnow	Federally Endangered; Experimental Population, Non-Essential	San Juan	On the Navajo Nation, it has been documented throughout the San Juan River (SJR), from Shiprock to Lake Powell; the mouth of the Mancos River is used during the spring runoff period. The majority of adults use the stretch from about 11 km downstream of Shiprock (RM 142) to just downstream of Four Corners (RM 117), and spawn in 'The Mixer Area' (RM 131-132); young-of-year have primarily been found within the lower 26 km of the SJR just upstream of Lake Powell. Adults use backwaters and flooded riparian areas during spring runoff, and migrate large distances (15 to 64 km in the SJR) to spawn in riffle run areas with cobble/gravel substrates. Post-spawning adults primarily use run habitats, with eddies and slackwater also being important. Young-of-year (<120-mm length) use warm backwaters along shorelines. Deeper backwater areas (>1 m deep at confluence with main channel) are the preferred habitat of young fish into the subadult stage (>3 yrs. age and 200- to 400-mm length). Irrigation canals and ponds connected to SJR may be potential habitat.	**No.**

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Tiaroga cobitis	Loach minnow	Federally Endangered	Apache, Navajo	Presently found in small to large perennial streams with swift shallow water over cobble and gravel. Recurrent flooding and natural hydrograph important.	**Yes.** The current range of this species is outside the Project Area.
Xyrauchen texanus	Razorback sucker	Federally Endangered	Coconino; San Juan	This species is restricted to the Colorado River and a few of its warm-water tributaries; rare along the mainstem Colorado River in Marble Canyon and the mouth of the Little Colorado River, San Juan arm of Lake Powell, and upstream within the SJR. In mainstream portions of rivers, pre- and post-spawning suckers mostly use low-flow areas (backwaters over sand and silt substrate, deep eddies, and impoundments), but shallow to deep runs over sandbars and seasonally flooded shorelines also are important. Spawning occurs in areas with shallow, swift riffles over gravel or cobble substrate, and they also may use backwater habitats. Young-of-year use warm, flooded bottomlands and backwaters. Irrigation canals and ponds connected to the SJR may be potential habitat.	**No.**
Invertebrates					
Oxyloma haydeni kanabensis	Kanab ambersnail	Federally Endangered	Coconino	Extremely geographically isolated. Three historical populations; two remaining; one on private property in Utah and one in Grand Canyon National Park. Associated with travertine seeps and springs, watercress, monkey flower, and other wetland vegetation.	**Yes.** The known range is outside Project Area.
Pyrgulopsis trivialis	Three Forks springsnail	Proposed Endangered	Apache	Rheocrene springs, seeps, marshes, spring pools, outflows and diverse lotic waters commonly referred to as cienegas. Distribution limited to Three Forks and Boneyard Spring complexes in the North Fork of the East Fork Black River watershed.	**Yes.** The known range is outside of the Project Area.
Plants					
Asclepias welshii	Welsh's milkweed	Federally Threatened	Coconino	Open, sparsely vegetated semistabilized sand dunes and on lee slopes of actively drifting sand dunes.	**Yes.** Known range outside the Project Area.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Astragalus cremnophylax var. *cremnophylax*	Sentry milk-vetch	Federally Endangered	Coconino	Grows on a white layer of Kaibab limestone, with little or no soil, in an unshaded opening within a pinyon-juniper-cliffrose plant community.	**Yes.** Known range outside Project Area.
Astragalus humillimus	Mancos milk-vetch	Federally Endangered	San Juan	Forms highly localized populations from 4 to 20 acres in size. It is typically found on large, nearly flat sheets of exfoliating whitish-tan colored sandstone, in small depressions and sand-filled cracks on or near ledges and mesa tops in slickrock communities of Point Lookout & Cliffhouse Sandstone. Known only from the Four Corners area of New Mexico, San Juan County, and adjacent Montezuma County, Colorado. Navajo Nation Distribution: San Juan County, New Mexico, Palmer Mesa east to the Hogback area and south of the SJR, to a hogback east of Little Water. Potential Navajo Nation Distribution: Four Corners area, all slickrock formations of Point Lookout & Cliffhouse Sandstone, and possibly other related members.	**No.**
Carex specuicola	Navajo sedge	Federally Threatened	Apache, Coconino, Navajo	Silty soils at shady seeps and springs. Typically found in seeps and hanging gardens, on vertical sandstone cliffs and alcoves. General Distribution: Northern Arizona, San Juan Co, Utah. Navajo Nation Distribution: From the Navajo Creek drainage in Coconino Co, east to the Tsegi Canyon Watershed in Navajo Co, south to the Rock Point/Mexican Water & Canyon de Chelly National Monument, Apache Co, Arizona area. Potential Navajo Nation Distribution: Northern Arizona and southeastern Utah, especially in hanging gardens of the SJR drainage and Lake Powell.	**Yes.** Suitable habitat is not found within the Project Area.
Erigeron rhizomatus	Zuni fleabane	Federally Threatened	Apache; San Juan	Typically, only found on fine textured clay hillsides. It is known from clays derived from the Chinle Formation in the Zuni and Chuska Mountains, and to similar clays of the Baca Formation in the Datil and Sawtooth ranges in New Mexico. Only one known Arizona location in the Chuska Mountain on the Navajo Nation. Potential Navajo Nation Distribution: Chuska Mountains and in suitable habitat in the pinion-juniper associations between Lupton, Apache Co., Arizona, and Prewitt, McKinley Co., New Mexico.	**Yes.** Suitable habitat is not found within the Project Area.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Packera franciscana	San Francisco Peaks groundsel	Federally Threatened	Coconino	Alpine tundra Found above spruce-fir and pine forests.	**Yes.** Known range outside Project Area.
Pediocactus bradyi	Brady pincushion cactus	Federally Endangered	Coconino	Benches and terraces in Navajo desert near Marble Gorge. Plant community dominated by shadescale (*Atriplex confertifolia*), snakeweed (*Gutierrezia sarothrae*), mormon tea (*Ephedra viridis*), and desert trumpet (*Eriogonum inflatum*).	**Yes.** This species was not included on NNHP data response as potentially occurring within the Project Area.
Pediocactus knowltonii	Knowlton's cactus	Federally Endangered	San Juan	Rolling, gravelly hills covered with pinyon pine, Rocky Mountain juniper, and sagebrush. Knowlton cactus is found on the very eastern edge of the Colorado Plateau Province, adjacent to the San Juan Mountains. Grows on tertiary alluvial deposits overlying the San Jose Formation. Known populations range from 2,075- to 2,300-meter elevation. The only viable populations exist in San Juan County, New Mexico.	**Yes.** The known range is outside the Project Area.
Pediocactus peeblesianus var. *fickeiseniae*	Fickeisen plains cactus	Federal Proposed	Coconino	Soils overlain by Kaibab Limestone in Navajoan desert or Great Plains Grassland, along canyon rims and flat terraces along washes, typically with limestone chips scattered across the surface. General Distribution: Arizona: Coconino Co., from House Rock Valley and Gray Mt., to the Little Colorado and Colorado rivers. Navajo Nation Distribution: Gray Mountain to southwest of Bitter Springs, Coconino Co., Arizona Potential Navajo Nation Distribution: Marble Canyon to Gray Mountain.	**No.**
Pediocactus peeblesianus var. *peeblesianus*	Peebles Navajo cactus	Federally Endangered	Navajo	Gravely soils of the Shinarump conglomerate of the Chinle Formation.	**Yes.** Known range outside the Project Area.
Pediocactus sileriI	Siler pincushion cactus	Federally Threatened	Coconino	Desert-scrub transitional areas of Navajo, sagebrush and Mohave Deserts.	**Yes.** Known range outside the Project Area.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Sclerocactus mesae-verdae	Mesa Verde cactus	Federally Threatened	San Juan	Salt-desert scrub communities, typically in the Fruitland and Mancos shale formations, but also in the Menefee Formation overlaying Mancos shale. It is most frequently found on the tops of hills or benches and along slopes. General Distribution: San Juan Co, New Mexico, and adjacent Montezuma Co, Colorado. Navajo Nation Distribution: Colorado border south to near Naschitti, New Mexico. Potential Navajo Nation Distribution: Within the known distribution to the north, south, and west. The eastern limits are still unclear.	**No.**

Table 4.8-2 Hopi and NNHP Special-Status Species within the Project Region of Influence

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Mammals					
Antilocapra americana	Pronghorn	NESL G3	Apache, Coconino, Navajo, San Juan	Found in grasslands or desert scrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees (typically juniper and sagebrush). Range includes most western US states from southcentral Canada west to Nevada and south to Arizona, New Mexico, and western Texas. Occupied range on Navajo Nation is the southwestern portion north of Flagstaff, and checkerboard lands in New Mexico. Results of data request from NNHP indicate Coconino as the only county with potential for occurrence.	**No.**
Mustela nigripes	Black-footed ferret	NESL G2	Apache, Coconino, Navajo, San Juan	Grassland plains/prairie. Prairie Dog town complexes of 200 acres or more for the Gunnison's prairie dog (*Cynomys gunnisoni*) and/or 80 acres or more for any subspecies of Black-tailed prairie dog (*Cynomys ludovicianus*). No known wild ferrets on the Navajo Nation except for those associated with the Arizona Game and Fish Dept. reintroduction on Tribal Ranch lands of Big Boquillas in Aubrey Valley, Coconino Co., approximately 100 miles to the west of the Project Area	**No.**
Birds					
Aquila chrysaetos canadensis	Golden Eagle	NESL G3; Hopi Cultural Sensitive Species	Apache, Coconino, Navajo, San Juan	Nest on steep cliffs in middle to upper parts of cliffs in sheltered ledges, potholes, or small caves, typically ≥30 m in height, although shorter cliffs (≥10 m) occasionally used. Nesting cliffs are normally directly adjacent to foraging habitat of desert grasslands or desert scrub, with only sparse shrubs if present, that provides primary prey of cottontail and jackrabbits.	**No.**
Buteo jamaicensis	Red-tailed Hawk	Hopi Cultural Sensitive Species	Coconino, Navajo	This species is common within the Project Area and is found in almost all habitats from mountains to deserts, in forested areas and open country. Prefers trees for nesting sites, but will utilize shrubs and cliffs in open country.	**No.**

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Buteo regalis	Ferruginous hawk	NESL G3	Apache, Coconino, Navajo, San Juan	Ferruginous Hawks nest in badlands, flat or rolling desert grasslands, and desert scrub. Most nests on Navajo Nation are on clay or rock pinnacles, small buttes, or short cliffs (<30-meter height); fewer are placed in top of juniper trees or on the ground, and one record exists of a nest on the crossarm of a transmission-line tower. Habitat surrounding nest site must support populations of prey items like cottontail and jackrabbits, prairie dogs, ground squirrels and gophers.	**No.**
Cinclus mexicanus	American dipper	NESL G3	Apache, Coconino, Navajo, San Juan	Nests are near clear, unpolluted streams usually ≤15 m in width and ≤2 m in depth, with a variety of riffles, pools, and waterfalls with instream and streamside substrate of rocks, sand, and rubble; boulders are necessary for perches.	**Yes.** Suitable habitat is not found within the Project Area.
Coccyzus americanus	Yellow-billed cuckoo	NESL G2	Apache, Coconino, Navajo, San Juan	Nesting cuckoos are associated with relatively dense, wooded, streamside riparian habitat, with varying combinations of Fremont cottonwood, willow, velvet ash, Arizona walnut, mesquite, and tamarisk. Some cuckoos also have been detected nesting in velvet mesquite, netleaf hackberry, Arizona sycamore, Arizona alder, and some exotic neighborhood shade trees.	**No**. Suitable habitat is not found along the Project's transmission line portion, but potential habitat could occur in riparian areas with higher canopies or salt cedar along the San Juan River.
Empidonax traillii extimus	Southwestern willow flycatcher	NESL G2	Apache, Coconino, Navajo, San Juan	Riparian-obligate bird found in cottonwood/willow and tamarisk vegetation communities along rivers and streams.	**No**. Suitable nesting habitat is not found along the Project's transmission line portion, but was identified within 30 km of the FCPP.
Gymnogyps californicus	California Condor	NESL G4	Apache, Coconino, Navajo,	High desert canyons and plateaus. Ill-defined nest, if any, composed of existing debris within overhung cliff ledges, crevices, potholes, or caves; in northern Arizona, nesting will likely be within walls of major river canyons or tall, steep cliffs within desert scrub and grasslands that allow easy approach from the air, and are inaccessible for terrestrial predators.	**Yes**. Suitable nesting habitat is not found within the Project Area but California condors could occur as occasional visitors within the Project Area or use the area for foraging.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Haliaeetus leucocephalus alascanus	Bald eagle	NESL G2; Hopi Cultural Sensitive Species	Apache, Coconino, San Juan	Typically nest within trees in forested areas, especially mature and old-growth stands, adjacent (usually <2 km) to large bodies of water with suitable forage of waterfowl and fish; rarely uses cliff face adjacent to large body of water. Winter roost in large trees in forests, river bottoms, or near canyon rims, usually within a few miles of ponds, lakes and rivers with adequate prey. Ponds and lakes are used until completely iced-over and prey availability is reduced.	No.
Strix occidentalis lucida	Mexican spotted owl	NESL G3	Apache, Coconino, Navajo, San Juan	Nests in canyons and dense forests with multilayered foliage structure. Generally nest in older forests of mixed conifer or ponderosa pine/gambel oak type. Restricted habitat includes mixed-conifer forest, pine-oak forest, and riparian areas.	**Yes** Suitable habitat is not found within the transmission line ROWs or within the Project Area.
Amphibians					
Lithobates chiricahuensis	Chiricahua leopard frog	NESL G2	Apache, Navajo, Coconino	Streams, rivers, backwaters, ponds, and stock tanks that are mostly free from introduced fish, crayfish, and bullfrogs.	**Yes**. The current range of this species is outside the Project Area.
Rana pipiens	Northern leopard frog	NESL G2	Apache. Coconino, Navajo, San Juan	Breeds in wetlands usually with permanent water and aquatic vegetation (especially cattails), ranging from irrigation ditches and small streams to rivers, and small ponds and marshes to lakes or reservoirs. Distribution: On Navajo Nation, historic records include Chuska Mountains, Little Colorado, Colorado, and San Juan rivers; most of these populations are now extirpated. Potential exists throughout the Navajo Nation where appropriate habitat is present.	**Yes.** Suitable habitat is not found within the Project Area.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Fish					
Gila robusta	Roundtail chub	NESL G2	Apache, Coconino, Navajo, San Juan	This species is found within the San Juan and Mancos rivers. Rarely encountered in recent surveys; they have been found from Shiprock to near Lake Powell with most between Shiprock and Aneth (RM 107-140). Adults inhabit the most permanent water in cool to warm water mid-elevation streams, typically using pools and eddies, adjacent to rapids and boulders. They are often found near cover (e.g., rocks, plant roots) and in pools behind irrigation diversions. Juveniles prefer the margins of flowing water and backwater areas. Spawning occurs over gravel bottoms in runs and pools with ≥25-cm water depth.	**No.**
Ptychocheilus lucius	Colorado pike-minnow	NESL G2	San Juan	On the Navajo Nation, it has been documented throughout the San Juan River (SJR), from Shiprock to Lake Powell; the mouth of the Mancos River is used during the spring runoff period. The majority of adults use the stretch from about 11 km downstream of Shiprock (RM 142) to just downstream of Four Corners (RM 117), and spawn in 'The Mixer Area' (RM 131-132); young-of-year have primarily been found within the lower 26 km of the SJR just upstream of Lake Powell. Adults use backwaters and flooded riparian areas during spring runoff, and migrate large distances (15 to 64 km in the SJR) to spawn in riffle run areas with cobble/gravel substrates. Post-spawning adults primarily use run habitats, with eddies and slackwater also being important. Young-of-year (<120-mm length) use warm backwaters along shorelines. Deeper backwater areas (>1 m deep at confluence with main channel) are the preferred habitat of young fish into the subadult stage (>3 yrs. age and 200- to 400-mm length). Irrigation canals and ponds connected to SJR may be potential habitat.	**No.**

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Xyrauchen texanus	Razorback sucker	NESL G2	Coconino; San Juan	This species is restricted to the Colorado River and a few of its warm-water tributaries; rare along the mainstem Colorado River in Marble Canyon and the mouth of the Little Colorado River, San Juan arm of Lake Powell, and upstream within the SJR. In mainstream portions of rivers, pre- and post-spawning suckers mostly use low-flow areas (backwaters over sand and silt substrate, deep eddies, and impoundments), but shallow to deep runs over sandbars and seasonally flooded shorelines also are important. Spawning occurs in areas with shallow, swift riffles over gravel or cobble substrate, and they also may use backwater habitats. Young-of-year use warm, flooded bottomlands and backwaters. Irrigation canals and ponds connected to the SJR may be potential habitat.	**No.**
Invertebrates					
Speyeria nokomis	Nokomis fritillary	NESL G3	Apache, Coconino, Navajo and San Juan	Perennially wet meadows associated with seeps, springs, and streams variable in size (0.1 ha to >1.2 ha), relatively open, and dominated by grasses and with few shrubs. Violets (*Viola nephrophylla*), found in wet soils in shady areas beneath shrubs or within stream banks, are a necessary component of habitat as the host plant for larvae. Distribution: Range extends across eastern Utah, western CO, and northern Arizona and New Mexico. On Navajo Nation, known from <10 populations in Chuska Mountains and Defiance Plateau where appropriate habitat is present.	**Yes.** Suitable habitat is not found within the Project Area.
Plants					
Allium gooddingii	Gooding's onion	NESL G3	Apache; San Juan	Generally in spruce-fir forests and mixed conifer forests; in the Chuska Mountains also under Gambel oak thickets interspersed with aspen, dogwood, and Douglas fir; in moist, shady canyon bottoms and north-facing slopes, often along streams. General Distribution: Apache Co., Arizona, and New Mexico. Navajo Nation Distribution: Chuska Mountains, Apache Co., Arizona, & San Juan Co., New Mexico. Potential Navajo Nation Distribution: Throughout the Chuska Mountains and the Defiance Plateau.	**Yes.** Suitable habitat is not found within the Project Area.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Astragalus humillimus	Mancos milk-vetch	NESL G2	San Juan	Forms highly localized populations from 4 to 20 acres in size. It is typically found on large, nearly flat sheets of exfoliating whitish-tan colored sandstone, in small depressions and sand-filled cracks on or near ledges and mesa tops in slickrock communities of Point Lookout & Cliffhouse Sandstone. Known only from the Four Corners area of New Mexico, San Juan County, and adjacent Montezuma County, Colorado. Navajo Nation Distribution: San Juan County, New Mexico, Palmer Mesa east to the Hogback area and south of the SJR, to a hogback east of Little Water. Potential Navajo Nation Distribution: Four Corners area, all slickrock formations of Point Lookout & Cliffhouse Sandstone, and possibly other related members.	**No.**
Astragalus naturitensis	Naturita milk-vetch	NESL G3	San Juan	Habitat: Sand-filled pockets of sandstone slickrock and rimrock pavement along canyons in the pinion juniper zone. General Distribution: McKinley and San Juan counties, New Mexico, southwestern Colorado and southeastern Utah. Known Distribution on the Navajo Nation: Hogback, San Juan Co., to the Pinetree Canyon area, McKinley Co., New Mexico. Potential Distribution on the Navajo Nation: In suitable habitat of the Hogback, San Juan Co., New Mexico.	**No.**
Carex specuicola	Navajo sedge	NELS G3	Apache, Coconino, Navajo	Silty soils at shady seeps and springs. Typically found in seeps and hanging gardens, on vertical sandstone cliffs and alcoves. General Distribution: Northern Arizona, San Juan Co, Utah. Navajo Nation Distribution: From the Navajo Creek drainage in Coconino Co, east to the Tsegi Canyon Watershed in Navajo Co, south to the Rock Point/Mexican Water & Canyon de Chelly National Monument, Apache Co, Arizona area. Potential Navajo Nation Distribution: Northern Arizona, especially in hanging gardens of the SJR drainage and Lake Powell.	**Yes.** Suitable habitat is not found within the Project Area.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Erigeron rhizomatus	Zuni fleabane	NESL G2	Apache; San Juan	Typically, only found on fine textured clay hillsides. It is known from clays derived from the Chinle Formation in the Zuni and Chuska Mountains, and to similar clays of the Baca Formation in the Datil and Sawtooth ranges in New Mexico. Only one known Arizona location in the Chuska Mountain on the Navajo Nation. Potential Navajo Nation Distribution: Chuska Mountains and in suitable habitat in the pinion-juniper associations between Lupton, Apache Co., Arizona, and Prewitt, McKinley Co., New Mexico.	**Yes.** Suitable habitat is not found within the Project Area.
Errazurizia rotundata	Round dunebroom	NESL G3	Apache, Coconino, Navajo	Generally, in exposed habitats in the semiarid environment of the Great Basin Desert scrub. Known Distribution on the Navajo Nation: Between Moenave and Willow Springs, Coconino Co., Arizona. Potential Navajo Nation Distribution: In suitable habitats between Gap, Coconino County, and Petrified Forest National Park, Apache Co., Arizona.	**No**
Lesquerella navajoensis	Navajo bladderpod	NESL G3	Apache; San Juan	Windswept mesa rims and nearby habitat with little vegetative cover and high insolation. Also found at the base and slopes of small hills of the Chinle Formation. Typically only found in a combination of Todilto Limestone overlaying Entrada Sandstone or Chinle outcrops in pinion-juniper communities. Known Distribution on the Navajo Nation: In New Mexico on mesa rims NW of Thoreau and Continental Divide, and Chuska Mountains, at Todilto Park, McKinley Co. In Arizona, from the Red Valley area (N of Navajo, New Mexico) to Wheatfields Lake, Apache Co. Potential Navajo Nation Distribution: Todilto limestone and Chinle outcroppings NE and NW of Thoreau, and the Chuska Mountains, San Juan Co., New Mexico. Possibly in the Chuska & Carrizo Mountains, Apache County, Arizona.	**Yes.** Suitable habitat is not found within the Project Area.
Pediocactus bradyi	Brady pincushion cactus	NESL G2	Coconino	Benches and terraces in Navajo desert near Marble Gorge. Plant community dominated by shadescale (*Atriplex confertifolia*), snakeweed (*Gutierrezia sarothrae*), mormon tea (*Ephedra viridis*), and desert trumpet (*Eriogonum inflatum*).	**Yes.** This species was not included on NNHP data response as potentially occurring within the Project Area.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Type	Eliminate from Further Analysis (Yes, No)
Pediocactus peeblesianus var. *fickeiseniae*	Fickeisen plains cactus	NESL G3	Coconino	Soils overlain by Kaibab Limestone in Navajoan desert or Great Plains Grassland, along canyon rims and flat terraces along washes, typically with limestone chips scattered across the surface. General Distribution: Arizona: Coconino Co., from House Rock Valley and Gray Mt., to the Little Colorado and Colorado rivers. Navajo Nation Distribution: Gray Mountain to southwest of Bitter Springs, Coconino Co., Arizona Potential Navajo Nation Distribution: Marble Canyon to Gray Mountain.	**No**
Platanthera zothecina	Alcove bog-orchid	NESL G3	Apache, Coconino, Navajo	Seeps, hanging gardens, and moist stream areas from the desert shrub to pinion-juniper & Ponderosa pine/mixed conifer communities. Known Distribution on the Navajo Nation: Headwaters of Oljeto Wash, Tsegi Canyon Watershed, hanging gardens surrounding Navajo Mountain, Chinle Wash drainages.	**Yes.** Suitable habitat is not found within the Project Area.
Sclerocactus mesae-verdae	Mesa Verde cactus	NESL G2	San Juan	Salt-desert scrub communities, typically in the Fruitland and Mancos shale formations, but also in the Menefee Formation overlaying Mancos shale. It is most frequently found on the tops of hills or benches and along slopes. General Distribution: San Juan Co, New Mexico, and adjacent Montezuma Co, Colorado. Navajo Nation Distribution: Colorado border south to near Naschitti, New Mexico. Potential Navajo Nation Distribution: Within the known distribution to the north, south, and west. The eastern limits are still unclear.	**No**
Zigadenus vaginatus	Alcove death camass	NESL G3	Apache; Coconino	Hanging gardens in seeps and alcoves. Endemic to the Colorado Plateau in southern Utah and northern Arizona. Navajo Nation Distribution: Hanging gardens in sandstone canyon surrounding Navajo Mountain, Coconino Co, Arizona, and San Juan Co., Utah. Potential Navajo Nation Distribution: Hanging gardens surrounding the drainages into Lake Powell and the drainages of Chinle Wash south to Canyon de Chelly New Mexico, Apache and Coconino counties, Arizona, San Juan Co., Utah.	**Yes.** Suitable habitat is not found within the Project Area.

Table 4.8-3 Federally Listed TECP, BLM Sensitive, and State of New Mexico Species of Concern

Species Scientific Name	Species Common Name	Status; Federal/BLM/NM	Counties (NM)	Habitat Requirements	Eliminated from Further Analysis (No, Yes)
Mammals					
Mustela nigripes	Black-footed ferret	Federally Endangered	McKinley, San Juan, Sandoval	Grassland plains/prairie. Prairie Dog town complexes of 200 acres or more for the Gunnison's prairie dog (*Cynomys gunnisoni*). No known wild ferrets in these three counties.	**Yes**. No prairie dog (*Cynomys gunnisoni*) towns of sufficient size exist to support black-footed ferret in the ROW area.
Euderma maculatum	Spotted bat	NM Threatened	McKinley, San Juan, Sandoval	The habitat likely to be utilized by bats as rooting areas is primarily the small sandstone outcrops that are scatted throughout the central and southern portions of the ROW corridor.	**No.** Potential foraging habitat for this species occurs within the ROW area.
Nyctinomops macrotis	Big-freetail bat	BLM Sensitive	McKinley, San Juan, Sandoval	The habitat likely to be utilized by bats as rooting areas is primarily the small sandstone outcrops that are scatted throughout the central and southern portions of the ROW corridor.	**No.** Potential foraging habitat for this species occurs within the ROW area.
Myotis leibii	Small-footed bat	BLM Sensitive	McKinley, San Juan, Sandoval	The habitat likely to be utilized by bats as rooting areas is primarily the small sandstone outcrops that are scatted throughout the central and southern portions of the ROW corridor.	**No.** Potential foraging habitat for this species occurs within the ROW area.
Myotis volans	Long-legged myotis	BLM Sensitive	McKinley, San Juan, Sandoval	The habitat likely to be utilized by bats as rooting areas is primarily the small sandstone outcrops that are scatted throughout the central and southern portions of the ROW corridor.	**No.** Potential foraging habitat for this species occurs within the ROW area.
Myotis yumanensis	Yuma myotis	BLM Sensitive	McKinley, San Juan, Sandoval	The habitat likely to be utilized by bats as rooting areas is primarily the small sandstone outcrops that are scatted throughout the central and southern portions of the ROW corridor. This species would be limited to the area near the Rio Puerco drainage.	**No.** Potential foraging habitat for this species occurs within the ROW area.
Myotis occultus	Occult little brown bat	BLM Sensitive	McKinley, San Juan, Sandoval	The habitat likely to be utilized by bats as rooting areas is primarily the small sandstone outcrops that are scatted throughout the central and southern portions of the ROW corridor. This species would be limited to the area near the Rio Puerco drainage.	**No.** Potential foraging habitat for this species occurs within the ROW area.

Species Scientific Name	Species Common Name	Status; Federal/BLM/NM	Counties (NM)	Habitat Requirements	Eliminated from Further Analysis (No, Yes)
Myotis thysanodes	Fringed myotis	BLM Sensitive	McKinley, San Juan, Sandoval	The habitat likely to be utilized by bats as rooting areas is primarily the small sandstone outcrops that are scatted throughout the central and southern portions of the ROW corridor.	No. Potential foraging habitat for this species occurs within the ROW area.
Birds					
Ammodramus bairdii	Baird's sparrow	NM Threatened	McKinley, San Juan, Sandoval	This sparrow is normally found in shrubby short-grass and prairie habitats in New Mexico where it occurs as a migrant.	No. Potential habitat for this species occurs within the ROW area.
Flaco peregrinus anatum	American peregrine falcon	NM Threatened	McKinley, San Juan, Sandoval	Cliffs that generally exceed 200 feet in height near permanent surface water.	No. Potential foraging habitat for this species occurs within the ROW area.
Buteo regalis	Ferruginous hawk	BLM Sensitive	McKinley, San Juan, Sandoval	Nests in badlands, flat or rolling desert grasslands, and desert scrub. Most nests are on clay or rock pinnacles, small buttes, or short cliffs (<30 m height).	No. Potential foraging and known nesting habitat for this species occurs within the ROW area and on structures.
Lanius ludovicianus	Loggerhead shrike	BLM Sensitive	McKinley, San Juan, Sandoval	This species is found in open grasslands, deserts, riparian area and woodlands and nests in shrubs, hedgerows and trees often using the same nest year after year.	No. Potential habitat for this species occurs within the ROW area.
Coccyzus americanus	Yellow-billed cuckoo	Federal Candidate	McKinley, San Juan, Sandoval	Breeds in riparian woodlands with dense understory vegetation.	**Yes.** Suitable habitat is not found within the ROW area due to lack of riparian woodland habitats and perennial water resources.
Empidonax traillii extimus	Southwestern willow flycatcher	Federally Endangered; NM Endangered	McKinley, San Juan, Sandoval	Riparian-obligate bird found in cottonwood/willow and tamarisk vegetation communities along rivers and streams.	No. Poor migratory stopover habitat found in scattered patches of decadent tamarisk (*Tamarix* sp.*)*.No suitable nesting habitat in the ROW area.

Species Scientific Name	Species Common Name	Status; Federal/BLM/NM	Counties (NM)	Habitat Requirements	Eliminated from Further Analysis (No, Yes)
Athene cunicularia hypogea	Western burrowing owl	BLM Sensitive	McKinley, San Juan, Sandoval	Nests in ground burrows often using deserted prairie dog burrows in dry open grasslands or desert scrub.	No. Potential habitat for this species and burrows found within the ROW area.
Strix occidentalis lucida	Mexican spotted owl	Federally Threatened	San Juan	Nests in canyons and dense forests with multilayered foliage structure. Generally nest in older forests of mixed conifer or ponderosa pine/gambel oak type.	**Yes.** Suitable habitat is not found within the area due to lack of mixed conifer forests.
(Haliaeetus leucocephalus)	Bald eagle	NM Endangered	McKinley, San Juan, Sandoval	Typically nest within trees in forested areas, especially mature and old-growth stands, adjacent (usually <2 km) to large bodies of water with suitable forage of waterfowl and fish; rarely uses cliff face adjacent to large body of water. Winter roost in large trees in forests, river bottoms, or near canyon rims, usually within a few miles of ponds, lakes and rivers with adequate prey.	**Yes**. Absent in the FW ROW area and no large rivers or suitable habitat occurs off of Navajo Nation lands.
Vireo vicinior	Gray vireo	NM Threatened	McKinley, San Juan, Sandoval	The Gray vireo is found through much of the western US and northern Mexico and utilizes juniper savanna and pinyon-juniper woodland habitats.	**No.** Potential habitat for this species found within limited portions of the ROW area.
Fish					
Gila robusta	Roundtail chub	Federal Candidate; BLM Sensitive, NM Endangered	San Juan	Uses large rivers and present in low numbers in the San Juan, Mancos, La Plata and Animas rivers in New Mexico and Colorado.	**Yes.** Suitable habitat is not within the area due to lack of perennial waters.
Ptychocheilus lucius	Colorado pike-minnow	Federally Endangered with critical habitat, NM Endangered	San Juan	Large rivers with strong currents, deep pools and quite backwaters. On the Navajo Nation it has been documented throughout the San Juan River (SJR), from Shiprock to Lake Powell; the mouth of the Mancos River is used during the spring runoff period.	**Yes.** Suitable habitat is not within the area due to lack of perennial waters.
Xyrauchen texanus	Razorback sucker	Federally Endangered with critical habitat, NM Endangered	San Juan	Medium to large rivers with silty to rocky substrates. Species prefers strong currents and deep pools. This species is restricted to the Colorado River and a few of its warm-water tributaries.	**Yes.** Suitable habitat is not within the area due to lack of perennial waters.

Species Scientific Name	Species Common Name	Status; Federal/BLM/NM	Counties (NM)	Habitat Requirements	Eliminated from Further Analysis (No, Yes)
Hybognathus amarus	Rio Grande Silvery Minnow	Federally Endangered with critical habitat, NM Endangered	McKinley, Sandoval	The silvery minnow is a pelagic spawning species; i.e., its eggs flow within the water column (Piatania and Altenbach 1998). The silvery minnow is the only surviving small, native pelagic spawning minnow in the Middle Rio Grande, and its range has been reduced to only 5 percent of its historic extent.	**Yes.** The ROW corridor does not occur within or near the Rio Grande or designated critical habitat.
Cataostomus plebeisu	Rio Grande sucker	NM Endangered			**Yes.** Suitable habitat is not within the area due to lack of perennial waters.
Plants					
Astragalus humillimus	Mancos milk-vetch	Federally Endangered; NM Endangered	San Juan	Cracks of Point Lookout sandstone of the Mesa Verde series at 5,000- to 6,000-foot elevations.	**Yes.** This type of sandstone formation does not occur within the ROW area.
Asclepias sanjuanensis	San Juan milkweed	BLM Sensitive/NM Species of Concern	San Juan	Sandy loam soils in juniper savanna and Great Basin desert scrub at 5,000- to 5,500-foot elevations.	**No**. Suitable habitat occurs within ROW area
Sclerocactus mesae-verdae	Mesa Verde cactus	Federally Threatened; NM Endangered	San Juan	Highly alkaline soils in sparse shale or adobe clay badlands of the Mancos and Fruitland formations at 4,000- 5,550-foot elevations.	**No.** Potential habitat occurs within ROW area.
Sclerocactus cloveriae ssp. *Brackii*	Brack's fishhook cactus	BLM Sensitive, NM Endangered	McKinley, San Juan	This species occurs principally on clay soils from near Angel's Peak south of the San Juan River. Potential habitat occurs along the same segments of line as Aztec gila.	**No.** Suitable habitat occurs in scattered areas along much of the northern half of the ROW.
Astragalus naturitensis	Naturita milk-vetch	NM Species of Concern	San Juan	Sand-filled pockets of sandstone slickrock and rimrock pavement along canyons in the pinyon juniper zone.	**No.** Suitable habitat is within the ROW area.
Aliciella formosa	Aztec gilia	BLM Sensitive, NM Endangered	McKinley, San Juan	The Aztec gilia is a perennial herb approximately 2.75-12.00 inches tall. It is known to occur on Navajo lands in Kutz Canyon, south of Bloomfield. It often occurs within dry salt desert scrub communities.	**No.** Suitable habitat occurs in scattered areas along much of the northern half of the ROW.
Puccinellia parishii	Parish's alkali grass	BLM Sensitive	San Juan	Parish's alkali grass occurs within a very specific type of wetland soils in areas that have shallow groundwater that moves to the surface and evaporates, leaving behind an alkali crust.	**No.** Potential habitat occurs within a small area of ROW.

4.8.2.2 Navajo Mine

In this section, recent survey data (2012 and 2013) are used to determine whether the special-status species provided in the entire 6-county ROI have the potential to occur on the Navajo Mine and Pinabete permit areas. According to the USFWS, 12 Federally listed TECP species have the potential to occur in San Juan County where the mine is located. The NESL identifies 15 species of concern with the potential to occur within the Navajo Mine and Pinabete Permit Areas in San Juan County, New Mexico. The 22 special-status species (5 of the NESL species are also on the Federal list) with the potential to occur included three mammals (pronghorn, black-footed ferret, Canada lynx), 7 birds (golden eagle, ferruginous hawk, American dipper, yellow-billed cuckoo, southwestern willow flycatcher, bald eagle and Mexican spotted owl), 3 fish (roundtail chub, Colorado pike-minnow and razorback sucker), 1 amphibian (northern leopard frog), 1 invertebrate (Nokomis fritillary), and 7 plants (Mancos milk-vetch, Zuni fleabane, Knowlton's cactus, Mesa Verde cactus, Gooding's onion, Naturita milk-vetch and Navajo bladderpod).

A review of the special-status species list and their potential to occur within the Navajo Mine and Pinabete Permit Areas indicated no suitable habitat or potential for occurrence for any of the plant, amphibian, invertebrate or fish species listed above (Ecosphere 2012b), eliminating them from further analysis in this area (see Table 4.8-4). Based on the known historic range or known suitable habitat, further analysis through the biological survey results were warranted for one mammal and three avian species: black-footed ferret, southwestern willow flycatcher, golden eagle and ferruginous hawk as shown in Table 4.8-4. These species are described below.

Wildlife

Black-footed ferret

The black-footed ferret is Federally listed as endangered and is a NESL G2 species

Distribution and habitat: Black-footed ferrets are closely associated with prairie dog towns because prairie dogs are their primary prey. Open grasslands with year-round prairie dog (*Cynomys gunnisoni*) colonies greater than 198 acres in size and greater than 20 burrows per 2.5 acres are considered suitable habitat.

Potential to occur: Prairie dog colonies of sufficient size exist to support black-footed ferret in the permit areas. BNCC documented 7 prairie dog towns totaling 1,064 acres (ranging in size from 53 to 422 acres) all within a 6.5-mile range from Area IV North to Area V. Two prairie dog towns had a few prairie dogs present and sign of fresh activity (digging and scat) and other prairie dog towns had functional burrows present, but were unoccupied (i.e., no signs of recent activity was observed). No black-footed ferrets have ever been documented on leased property.

Golden Eagle

The golden eagle is a NESL G3 species. It is also protected under two Federal statutes: MBTA and BGEPA.

Distribution and habitat: Golden eagles are found year round throughout northwestern New Mexico. They typically inhabit mountainous or hilly terrain, hunting over open country. On the Navajo Nation, golden eagle nests most often occur on steep cliff ledges, usually ≥ 100 feet in height; although shorter cliffs may also be used (Ecosphere 2013). In other parts of their range, golden eagles may nest in large trees, man-made structures, and rarely on the ground. Nest sites are adjacent to open habitats that support preferred prey populations such as black-tailed jackrabbits, desert cottontails, reptiles, and prairie dogs. Golden eagle territories in the west typically range from 12 to 20 square miles (Ecosphere 2013).

Table 4.8-4 Federally Listed TECP and NESL Species Groups 2 and 3 – Navajo Mine and Pinabete Permit Areas

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Mammals					
Antilocapra americana	Pronghorn	NESL G3	Apache, Coconino, Navajo, San Juan	Found in grasslands or desert scrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees (typically juniper and sagebrush). Occupied range on Navajo Nation is the southwestern portion north of Flagstaff, and checkerboard lands in New Mexico.	**No.** Results of the data request from NNHP indicate Coconino as the only county with potential for occurrence.
Mustela nigripes	Black-footed ferret	Federally Endangered; NESL G2	San Juan	Grassland plains/prairie. Prairie Dog town complexes of 200 acres or more for the Gunnison's prairie dog (*Cynomys gunnisoni*). No known wild ferrets on the Navajo Nation in San Juan County.	**Yes.** Prairie dog (*Cynomys gunnisoni*) towns of marginally sufficient size exist to support black-footed ferret in the permit areas.
Lynx canadensis	Canada lynx	Federal Candidate	San Juan	Generally occurs in boreal and montane forests dominated by coniferous or mixed forest with thick undergrowth.	**No.** No boreal or montane forests occur within the permit area.
Birds					
Aquila chrysaetos canadensis	Golden Eagle	NESL G3	San Juan	Nest on steep cliffs in middle to upper parts of cliffs in sheltered ledges, potholes, or small caves, typically ≥30 m in height, although shorter cliffs (≥10 m) occasionally used. Nesting cliffs are normally directly adjacent to foraging habitat of desert grasslands or desert scrub, with only sparse shrubs if present, that provides primary prey of cottontail and jackrabbits.	**Yes.** Potential habitat for this species occurs within the permit areas. Most recent successful nesting occurred about 1 mile west of the 1-mile buffer in area 4 South in 2012.
Buteo regalis	Ferruginous hawk	NESL G3	San Juan	Nest in badlands, flat or rolling desert grasslands, and desert scrub. Most nests on Navajo Nation are on clay or rock pinnacles, small buttes, or short cliffs (<30 m height).	**Yes.** Potential habitat for this species occurs within the permit areas; the most recent successful nesting occurred east of the 1-mile buffer in 2011. Successful nesting was documented in Area I in 2012.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Cinclus mexicanus	American dipper	NESL G3	Apache, Coconino, Navajo, San Juan	Nests are near clear, unpolluted streams usually ≤ 15 m in width and ≤ 2 m in depth, with a variety of riffles, pools, and waterfalls with in-stream and streamside substrate of rocks, sand, and rubble. Boulders are necessary for perches	**No.** Suitable habitat is not found within the Project Area.
Coccyzus americanus	Yellow-billed cuckoo	Federal Candidate NESL G2	San Juan	Nesting cuckoos are associated with relatively dense, wooded, streamside riparian habitat, with varying combinations of Fremont cottonwood, willow, velvet ash, Arizona walnut, mesquite, and tamarisk.	**No.** Suitable habitat is not found within the permit areas due to lack of riparian woodland habitats and perennial water resources.
Empidonax traillii extimus	South-western willow flycatcher	Federally Endangered; NESL G2	San Juan	Riparian-obligate bird found in cottonwood/willow and tamarisk vegetation communities along rivers and streams.	**Yes.** Sparse suitable migratory stopover habitat found in widely scattered patches of tamarisk (*Tamarix* sp.) in Pinabete and Cottonwood arroyos and at a small stock pond in the southern portion of the permit areas.
Haliaeetus leucocephalus alascanus	Bald eagle	NESL G2	Apaches, Coconino, San Juan	Typically nest within trees in forested areas, especially mature and old-growth stands, adjacent to large bodies of water with suitable forage of waterfowl and fish. Winter roost in large trees in forests, river bottoms, or near canyon rims. Ponds and lakes are used until completely iced-over and prey availability is reduced.	**No.** Suitable habitat is not found within the permit areas due to lack of riparian woodland habitats.
Strix occidentalis lucida	Mexican spotted owl	Federally Threatened	San Juan	Nests in canyons and dense forests with multilayered foliage structure. Generally nest in older forests of mixed conifer or ponderosa pine/gambel oak type.	**No.** Suitable habitat is not found within the permit areas due to lack of mixed conifer forests.
Fish					
Gila robusta	Roundtail chub	Federal Candidate	San Juan	Uses large rivers and present in low numbers in the San Juan, Mancos, La Plata and Animas rivers in New Mexico and Colorado.	**No.** Suitable habitat is not within the permit areas due to lack of perennial waters.
Ptychocheilus lucius	Colorado pike-minnow	Federally Endangered with critical	San Juan	Large rivers with strong currents, deep pools and quite backwaters. On the Navajo Nation it has been documented throughout the San Juan River (SJR), from Shiprock to Lake Powell; the mouth of the Mancos River is used during the spring runoff period.	**No.** Suitable habitat is not within the permit areas due to lack of perennial waters.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Xyrauchen texanus	Razorback sucker	Federally Endangered with critical habitat	San Juan	Medium to large rivers with silty to rocky substrates. Species prefers strong currents and deep pools. This species is restricted to the Colorado River and a few of its warm-water tributaries.	**No.** Suitable habitat is not within the permit areas due to lack of perennial waters.
Amphibian					
Rana pipiens	Northern leopard frog	NESL G2	Apache, Navajo, Coconino	Breeds in wetlands usually with permanent water and aquatic vegetation (especially cattails), ranging from irrigation ditches and small streams to rivers, and small ponds and marshes to lakes and reservoirs.	**No.** Suitable habitat is not within the permit areas.
Invertebrate					
Speyeria Nokomis	Nokomis fritillary	NESL G3	Apache, Coconino, Navajo, and San Juan	Perennially wet meadows associated with seeps, springs, and streams variable in size, relatively open, and dominated by grasses and with few shrubs. Violets (*Viola nephrophylla*), found in wet soils in shady areas beneath shrubs or within stream banks, are a necessary component of habitat as the host plant for larvae.	**No.** Suitable habitat is not within the permit areas.
Plants					
Astragalus humillimus	Mancos milk-vetch	Federally Endangered; NESL G2	San Juan	Cracks of Point Lookout sandstone of the Mesa Verde series at 5,000- to 6,000-foot elevations.	**No.** This type of sandstone formation does not occur within the permit areas and the closest formation is 6-7 miles to the west.
Erigeron rhizomatus	Zuni fleabane	Federally Threatened	Apache, San Juan	Typically, only found on fine textured clay hillsides. It is known from clays derived from the Chinle Formation in the Zuni and Chuska Mountains, and to similar clays of the Baca Formation in the Datil and Sawtooth ranges in New Mexico.	**No.** Suitable habitat is not within the permits areas.
Pediocactus knowltonii	Knowlton's cactus	Federally Endangered	San Juan	Rolling, gravelly hills covered with pinyon pine, Rocky Mountain juniper, and sagebrush at 6,200-to 6,400–foot elevations.	**No.** Suitable habitat is not within the permit areas. The only known population is outside the permit areas.
Sclerocactus mesae-verdae	Mesa Verde cactus	Federally Threatened; NESL G2	San Juan	Highly alkaline soils in sparse shale or adobe clay badlands of the Mancos and Fruitland formations at 4,000- to 5,550 foot elevations.	**No.** Potential habitat does occur within the permit areas but the Badlands areas do not provide suitable habitat.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Allium gooddingii	Gooding's onion	NESL G3	Apache, San Juan	Generally in spruce-fir forests and mixed conifer forests; in the Chuska Mountains also under Gambel oak thickets interspersed with aspen, dogwood, and Douglas fir. In moist, shady canyon bottoms and north-facing slopes.	**No.** Suitable habitat is not within the permit areas.
Astagalus naturitensis	Naturita milk-vetch	NESL G3	San Juan	Sand-filled pockets of sandstone slickrock and rimrock pavement along canyons in the pinion juniper zone.	**No.** Suitable habitat is not within the permit areas.
Lesquerella navajoensis	Navajo bladderpod	NESL G3	Apache, San Juan	Windswept mesa rims and nearby habitat with little vegetative cover and high insolation. Also found at the base and slopes of small hills of the Chinle Formation. Typically only found in a combination of Todilto Limestone overlaying Entrada Sandstone or Chinle outcrops in pinion-juniper communities.	**No.** Suitable habitat is not within the permit areas.

Potential to occur: The relatively open shrublands and mild terrain of the permit areas provide potential foraging habitat for golden eagles. The prairie dog colonies and numerous other rodents located within the analysis area provide a prey base for golden eagles. Power line poles, numerous rock escarpments, bluffs, and formations in and adjacent to the permit areas serve as potential perches. In 2012, an active golden eagle nest with one nestling was documented outside the analysis area, west of the boundary between Area IV South and Area V. Before only two records existed of nesting golden eagles within 5 miles of the Navajo Mine since raptor monitoring within the Navajo Mine Lease Area was initiated in the early 1990s. One nest was found within the analysis area near Area V in the mid-1990s. The other nest was found atop the Hogback monocline, several miles west of the Navajo Mine lease. Because eagle home ranges are so large and numerous records exist of golden eagles nesting in San Juan County, it is likely that eagles occupying territories within 20 miles could utilize the permit areas for foraging. Also, potential for the species to nest within the permit areas is limited

Ferruginous hawk

The ferruginous hawk is a NESL G3 species and also protected under the Federal MBTA statute.

Distribution and habitat: Ferruginous hawks occur year round throughout the Navajo Nation, inhabiting dry, flat, or rolling grasslands and desert scrub (Ecosphere 2013). This species prefers elevated nest sites; nests on the Navajo Nation are most often on rock pinnacles, buttes, or short cliffs. Nests have also been documented in juniper (Juniperus spp.) trees, transmission-line towers, and on the ground (Ecosphere 2013). Nest sites are adjacent to habitats supporting populations of preferred prey species such as cottontails, jackrabbits, prairie dogs, and ground squirrels.

Potential to occur: The relatively flat terrain and open vegetation in the permit areas provide potential foraging habitat for ferruginous hawks. Prairie dog colonies provide a prey base for ferruginous hawks within and adjacent to the analysis area. Badlands in the analysis area offer potential nesting habitat for ferruginous hawks. Ferruginous hawk populations within and in proximity to the Navajo Mine Permit Area have been monitored annually since 1993. Since then, 2 to 12 nests have been documented as active in and adjacent to the Navajo Mine Permit Area annually. One ferruginous hawk nest, located just beyond the Navajo Mine Permit Area southeast of Area IV North, was active in 2009, 2010, and 2011, but not in 2012. Two historical nests southwest of Area IV North are within the Navajo Mine Permit Area. One of the nests has never been recorded as active; the second nest was last active in 1998 and in 1999. Finally, a third historical territory occurs east-northeast of Area IV North within the Navajo Mint Permit Area, but none of the nests in that territory has been active since 1993. Recorded home ranges of ferruginous hawks range from 3.7 square miles to 4.7 square miles (Ecosphere 2013). Ferruginous hawks may forage and nest within and beyond the analysis area.

Southwestern Willow Flycatcher

Distribution and habitat: The occurrence of southwestern willow flycatcher is a riparian obligate bird found in cottonwood/willow and tamarisk vegetation communities along rivers and streams in the desert southwest.

Potential to occur: Only marginally suitable migratory stopover habitat is present and confined to Cottonwood Arroyo, Chinde Wash, and other ephemeral waterways.in widely scattered patches of tamarisk (*Tamarix* sp.) in Pinabete arroyo and at a small stock pond in the southern portion of the permit area. These areas lack the vegetative structure and density to support breeding flycatchers and the habitat lies more than 100 meters from water, which does not meet the hydrologic parameter for suitable habitat. Flycatcher territories and nests typically are adjacent to open water, cienegas, marshy seeps, or saturated soil, and within riparian areas rooted in standing water (Ecosphere 2013). Because of the marginal quality and decadent tamarisk stands found in the survey area, no species-specific or protocol surveys for southwestern willow flycatcher were conducted by BNCC for this baseline evaluation.

4.8.2.3 FCPP

In this section, recent survey data (2012 and 2013) are used to determine whether the species provided in the entire 6-county ROI have the potential to occur on the FCPP Lease Area. According to the USFWS, 11 Federally listed TECP species have the potential to occur in San Juan County where the FCPP is located. Sixteen NESL species of concern have the potential to occur within the FCPP Lease Area in San Juan County, New Mexico. The 22 special-status species (10 of the NESL species are also on the Federal list) with the potential to occur included three mammals (pronghorn, Black-footed ferret, Canada lynx), seven birds (golden eagle, ferruginous hawk, American dipper, yellow-billed cuckoo, southwestern willow flycatcher, bald eagle and Mexican spotted owl), three fish (roundtail chub, Colorado pike-minnow and razorback sucker) one amphibian (northern leopard frog), one invertebrate (Nokomis fritillary) and seven plants (Mancos milk-vetch, Zuni fleabane, Knowlton's cactus, Mesa Verde cactus, Gooding's onion, Naturita milk-vetch and Navajo bladderpod).

A review of the special-status species list and their potential to occur within the FCPP Lease Area indicated no suitable habitat or potential for occurrence for any of the amphibian, invertebrate or fish species listed above (Ecosphere 2012c), eliminating them from further analysis in this area. Based on the known historic range or known suitable habitat, further analysis through the biological survey results were warranted for one plant and three avian species: Mesa Verde cactus, southwestern willow flycatcher, golden eagle and ferruginous hawk as shown in Table 4.8-5. In addition, while no sensitive status fish species occur on the FCPP Lease Area, deposition of pollutants from FCPP may move into the San Juan River, where they may affect Colorado pikeminnow, razorback sucker, and roundtail chub. Also known to occur within the deposition area of the FCPP is the yellow-billed cuckoo. These species are described below.

Wildlife

<u>Southwestern willow flycatcher</u>

The southwestern willow flycatcher is Federally listed as endangered and also a NESL G2 species.

Distribution and habitat: The occurrence of southwestern willow flycatcher is a riparian obligate bird found in cottonwood/willow and tamarisk vegetation communities along rivers and streams in the desert southwest.

Potential to occur: Because of the marginal quality and decadent tamarisk stands found in the majority of the suitable habitat in the survey area and the extended time period anticipated between the baseline evaluation and proposed construction in the survey area, no species-specific or protocol surveys for southwestern willow flycatcher were conducted by APS for this baseline evaluation.

<u>Golden Eagle</u>

The golden eagle is protected under two Federal statutes MBTA and BGEPA as well as a NESL G3 species.

Distribution and habitat: Golden eagles are found year round throughout northwestern New Mexico. They typically inhabit mountainous or hilly terrain, hunting over open country. On the Navajo Nation, golden eagle nests most often occur on steep cliff ledges, usually ≥ 100 feet in height; although shorter cliffs may also be used (Ecosphere 2013). In other parts of their range, golden eagles may nest in large trees, man-made structures, and rarely on the ground. Nest sites are adjacent to open habitats that support preferred prey populations such as black-tailed jackrabbits, desert cottontails, reptiles, and prairie dogs. Golden eagle territories in the west typically range from 12 to 20 square miles (Ecosphere 2013).

Table 4.8-5 Federally Listed TECP and NESL Species Groups 2 and 3 – FCPP

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Mammals					
Antilocapra americana	Pronghorn	NESL G3	Apache, Coconino, Navajo, San Juan	Found in grasslands or desert scrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees (typically juniper and sagebrush). Occupied range on Navajo Nation is the southwestern portion north of Flagstaff, and checkerboard lands in New Mexico.	**No.** The FCPP Lease Boundary is outside of the occupied range for this species.
Mustela nigripes	Black-footed ferret	Federally Endangered; NESL G2	San Juan	Grassland plains/prairie. Prairie Dog town complexes of 200 acres or more for the Gunnison's prairie dog (*Cynomys gunnisoni*). No known wild ferrets on the Navajo Nation in San Juan County.	**No.** No prairie dog (*Cynomys gunnisoni*) towns of sufficient size exist to support black-footed ferret in the area.
Lynx canadensis	Canada lynx	Federal Candidate	San Juan	Generally occurs in boreal and montane forests dominated by coniferous or mixed forest with thick undergrowth.	**No.** No boreal or montane forests occur within the FCPP Lease Boundary.
Birds					
Aquila chrysaetos canadensis	Golden Eagle	NESL G3	San Juan	Open habitats in mountainous, canyon terrain. Nests primarily on steep cliffs and large trees or structures such as electric transmission towers.	**Yes.** Potential foraging habitat for this species occurs within the FCPP Lease Boundary.
Buteo regalis	Ferruginous hawk	NESL G3	San Juan	Nest in badlands, flat or rolling desert grasslands, and desert scrub. Most nests on Navajo Nation are on clay or rock pinnacles, small buttes, or short cliffs (<30 m height).	**Yes.** Potential foraging habitat for this species occurs within the area; known nesting within 0.25 mile of surveyed FCPP area.
Cinclus mexicanus	American dipper	NESL G3	Apache, Coconino, Navajo, San Juan	Nests are near clear, unpolluted streams usually ≤ 15 m in width and ≤ 2 m in depth, with a variety of riffles, pools, and waterfalls with in-stream and streamside substrate of rocks, sand, and rubble. Boulders are necessary for perches	**No.** Suitable habitat is not found within the Project Area.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Coccyzus americanus	Yellow-billed cuckoo	Federal Candidate NESL G2	San Juan	Breeds in riparian woodlands with dense understory vegetation.	**No**. Suitable habitat is not found along within the FCPP Lease Area but potential habitat could occur in riparian areas with higher canopies or salt cedar along the San Juan River.
Empidonax traillii extimus	Southwestern willow flycatcher	Federally Endangered; NESL G2	San Juan	Riparian-obligate bird found in cottonwood/willow and tamarisk vegetation communities along rivers and streams.	**Yes.** Poor suitable migratory stopover habitat found in scattered patches of decadent tamarisk (*Tamarix* sp.*)*. No suitable nesting habitat in the area.
Haliaeetus leucocephalus alascanus	Bald eagle	NESL G2	Apaches, Coconino, San Juan	Typically nest within trees in forested areas, especially mature and old-growth stands, adjacent to large bodies of water with suitable forage of waterfowl and fish. Winter roost in large trees in forests, river bottoms, or near canyon rims. Ponds and lakes are used until completely iced-over and prey availability is reduced.	**No.** Suitable habitat is not found within the area.
Strix occidentalis lucida	Mexican spotted owl	Federally Threatened	San Juan	Nests in canyons and dense forests with multilayered foliage structure. Generally nest in older forests of mixed conifer or ponderosa pine/gambel oak type.	**No.** Suitable habitat is not found within the area due to lack of mixed conifer forests.
Fish					
Gila robusta	Roundtail chub	Federal Candidate	San Juan	Uses large rivers and present in low numbers in the San Juan, Mancos, La Plata and Animas rivers in New Mexico and Colorado.	**No.** Suitable habitat is not within the area due to lack of perennial waters.
Ptychocheilus lucius	Colorado pike-minnow	Federally Endangered with critical habitat	San Juan	Large rivers with strong currents, deep pools and quite backwaters. On the Navajo Nation it has been documented throughout the San Juan River (SJR), from Shiprock to Lake Powell; the mouth of the Mancos River is used during the spring runoff period.	**No.** Suitable habitat is not within the area due to lack of perennial waters.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Xyrauchen texanus	Razorback sucker	Federally Endangered with critical habitat	San Juan	Medium to large rivers with silty to rocky substrates. Species prefers strong currents and deep pools. This species is restricted to the Colorado River and a few of its warm-water tributaries.	**No.** Suitable habitat is not within the area due to lack of perennial waters.
Amphibians					
Rana pipiens	Northern leopard frog	NESL G2	Apache, Navajo, Coconino	Breeds in wetlands usually with permanent water and aquatic vegetation (especially cattails), ranging from irrigation ditches and small streams to rivers, and small ponds and marshes to lakes and reservoirs.	**No.** Suitable habitat is not within the area due to lack of perennial waters.
Invertebrates					
Speyeria Nokomis	Nokomis fritillary	NESL G3	Apache, Coconino, Navajo, and San Juan	Perennially wet meadows associated with seeps, springs, and streams variable in size, relatively open, and dominated by grasses and with few shrubs. Violets (*Viola nephrophylla*), found in wet soils in shady areas beneath shrubs or within stream banks, are a necessary component of habitat as the host plant for larvae.	**No.** Suitable habitat is not within the area due to lack of perennial waters.
Plants					
Astragalus humillimus	Mancos milk-vetch	Federally Endangered; NESL G2	San Juan	Cracks of Point Lookout sandstone of the Mesa Verde series at 5,000- to 6,000-foot elevations.	**No.** This type of sandstone formation does not occur within the FCPP Lease Boundary and the closest formation is 6-7 miles to the west.
Lesquerella navajoensis	Navajo bladderpod	NESL G3	Apache, San Juan	Windswept mesa rims and nearby habitat with little vegetative cover and high insolation. Also found at the base and slopes of small hills of the Chinle Formation. Typically only found in a combination of Todilto Limestone overlaying Entrada Sandstone or Chinle outcrops in pinion-juniper communities.	**No.** Suitable habitat is not within the area/

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Pediocactus knowltonii	Knowlton's cactus	Federally Endangered	San Juan	Rolling, gravelly hills covered with pinyon pine, Rocky Mountain juniper, and sagebrush at 6,200- to 6,400-foot elevations.	**No.** Suitable habitat is not within the area. The only known population is outside the FCPP Lease Boundary.
Sclerocactus mesae-verdae	Mesa Verde cactus	Federally Threatened; NESL G2	San Juan	Highly alkaline soils in sparse shale or adobe clay badlands of the Mancos and Fruitland formations at 4,000- 5,550-foot elevations.	**Yes.** Potential habitat occurs within area but no populations were found during surveys conducted in 2012.
Allium gooddingii	Gooding's onion	NESL G3	San Juan	Generally found in spruce-fir and mixed conifer forests in the bottom of canyons with moist shady north facing slopes, often along streams at 6,400-9,400-foot elevations.	**No.** Suitable habitat is not within the area.
Astragalus naturitensis	Naturita milk-vetch	NESL G3	San Juan	Sand-filled pockets of sandstone slickrock and rimrock pavement along canyons in the pinyon juniper zone.	**No.** Suitable habitat is not within the area.
Erigeron rhizomatus	Zuni fleabane	NESL G2	San Juan	Selenium rich red or gray detrital clay soils derived from the Chinle and Baca formations.	**No.** Suitable habitat is not within the area.

Potential to occur: The relatively open shrublands and mild terrain of the FCPP area provide potential foraging habitat for golden eagles. The prairie dog colony at the southwestern corner of the area and numerous other rodents located within the survey area provide a prey base for golden eagles. Power line poles, rock escarpments, bluffs, and formations in and adjacent to the Project Area serve as potential perches. Similarly, the surveyed DFADA provides potential foraging habitat for golden eagle. No golden eagles or nests were recorded within the survey area during the field studies by APS.

Ferruginous Hawk

The ferruginous hawk is protected under one Federal statute MBTA and is a NESL G3 species.

Distribution and habitat: Ferruginous hawks occur year round throughout the Navajo Nation, inhabiting dry, flat, or rolling grasslands and desert scrub (Ecosphere 2013). Nest sites are adjacent to habitats supporting populations of preferred prey species such as cottontails, jackrabbits, prairie dogs, and ground squirrels.

Potential to occur: The relatively flat terrain and open vegetation in the FCPP area provide potential foraging habitat for ferruginous hawks. Prairie dog colonies provide a prey base for ferruginous hawks within and adjacent to the survey area. Badlands and ridgeline in the analysis area offer potential nesting habitat for ferruginous hawks. An active ferruginous hawk territory lies within 0.25 mile of the surveyed FCPP area. Another territory is located within 1 mile of the survey area, based on a review of other studies completed by APS in the vicinity. Ferruginous hawks may forage within and beyond the analysis area.

Yellow-billed cuckoo

Distribution and habitat: Based on historic accounts, the species was widespread as well as locally common in California and Arizona and locally common in a few river reaches in New Mexico. The species was fairly common in the mid-1980s along the Rio Grande between Albuquerque and Elephant Butte Reservoir, and along the Pecos River in southeastern New Mexico. The broad-scale clearing of exotic vegetation, such as salt cedar or loss of riparian vegetation, will likely result in additional loss of nesting habitat for the yellow-billed cuckoo. The occurrence of yellow-billed cuckoo is associated with relatively dense, wooded, streamside riparian habitat, with varying combinations of Fremont cottonwood, willow, velvet ash, Arizona walnut, mesquite, and tamarisk. In New Mexico, nonnative salt cedar has provided habitat for approximately 1000 pairs of yellow-billed cuckoos in historically unforested areas.

Potential to occur: The yellow-billed cuckoo has been identified as potentially occurring within riparian habitats within the action area (Lusk pers. comm to L. Wise February 2014). Historically, the yellow-billed cuckoo has been documented as occurring along the San Juan River from Navajo Reservoir to the Arizona state line. The BLM, Farmington Field Office documented this species at five of their San Juan River tract management parcels during 2002 and 2003 surveys between the Hogback and Bloomfield, New Mexico. The closest potential habitat for this species occurs along the San Juan River (Ecosphere 2011); however given this species documented use of salt cedar, this species could occur in the ROI where salt cedar and other riparian vegetation occur.

Plants

Mesa Verde cactus

Mesa Verde cactus is Federally listed as threatened and is a NESL G2 species.

Distribution and habitat: The occurrence of Mesa Verde cactus is documented in San Juan County, New Mexico and Montezuma County, Colorado. It is generally found in salt-desert scrub communities, typically in the Fruitland and Mancos shale formations. It is most frequently found on the tops of hills or benches and along slopes.

Potential to occur: The surveys completed by APS in April 2012 identified approximately 204 acres of potential habitat for this species in the survey area. The habitat identification was determined based on evaluation of soil characteristics and vegetation community types found in the survey area.

Presence/absence pedestrian surveys for this species were completed in suitable habitat during the blooming period by APS biologists and no Mesa Verde cactus was recorded.

Fish

Future emissions from the FCPP could affect fish species in Morgan Lake, the San Juan River, and the Chaco River. Morgan Lake does not support any special-status species. The San Juan River supports three special-status fish species: Colorado pikeminnow, razorback sucker, and roundtail chub. The Chaco River is intermittent or ephemeral along most of its length, but has perennial water below Morgan Lake due to leakage from the lake and backwatering from the San Juan River. The three species listed above could move in the perennial section of the Chaco River from the San Juan River.

Colorado Pikeminnow

The Colorado pikeminnow is Federally listed as endangered and is a NESL G2 species.

Distribution and habitat: The Colorado pikeminnow is a cyprinid, endemic to large and medium sized rivers in the Colorado River Basin. Its current distribution includes portions of the Green, Yampa, Little Snake, White, Price and lower Duchensne, Gunnison, Delores, and upper Colorado rivers, as well as the San Juan River. Within the San Juan, it has been observed from Lake Powell, as far upstream as Farmington. Adults require pools, deep runs and eddy habitats maintained by high spring flows. These flows flush sediments from spawning areas and maintain channel and habitat diversity, including side channel and backwater areas that are the primary rearing habitat of larvae and juveniles. The species can make extended migrations of hundreds of kilometers to spawn. Larval fish are moved downstream by currents and find suitable rearing areas in backwaters and side channels.

Potential to Occur: The San Juan River Recovery Implementation Program has documented Colorado pikeminnow in the San Juan River from upstream of the Animas River confluence downstream to Lake Powell (Ryden 2012, Gilbert et al. 2012).

Razorback sucker

The razorback sucker Federally listed as endangered and is a NESL G2 species.

Distribution and habitat: The razorback sucker is a member of the sucker family, Catostomidae, and is endemic to the Colorado River Basin. Its current distribution includes portions of the Green, Yampa, White, Duchesne, upper Colorado, Gunnison, and San Juan River in the upper Colorado River basin. It is also found in Lake Mohave, Lake Mead and in the lower Colorado River from Lake Havasu to Davis Dam, and has been stocked into the Verde and Salt rivers in the lower Colorado River basin. Within the San Juan, it has been observed from Lake Powell, as far upstream as the PNM weir. Threats to the species include streamflow regulation, habitat modification, competition with and predation by nonnative fish, pesticides and pollutants. Adults use deep runs, eddies, backwaters and flooded off channel area in the spring; runs and pools during the summer, and low-velocity runs, pools and eddies in the winter. This species make long migrations to spawn, and young are dispersed downstream by flow. Young fish require low velocity, warm, shallow habitats, associated with backwaters, tributary mouths, and side channels.

Potential to Occur: The San Juan River Recovery Implementation Program has documented razorback sucker in the San Juan River from upstream of the Animas River confluence downstream to Lake Powell (Ryden 2012, Gilbert el al. 2012).

Roundtail Chub

The roundtail chub is a NESL G2 species. This species in the Project Area is not listed under the Federal ESA,[1] but the lower Colorado River basin district population segment is a candidate species for listing under the Federal ESA since 2009. Critical habitat has not been designated.

Distribution and habitat: The roundtail chub is a cyprinid, endemic to the Colorado River basin. It historically occurred in two subpopulations, one in the upper Colorado River and the other in the Lower Colorado River, with a gap of some 275 miles between the two populations (74 FR 32351). The species typically inhabits riverine habitats, where it is generally found in deep pools and eddies along large streams. They are often associated with over elements. They are tolerant of a wide range of temperatures, with an upper thermal tolerance of over 36°C. Spawning occurs the spring and early summer in areas of slow to moderate water velocity. Individuals may live up to 7 years. The species is omnivorous feeding on aquatic and terrestrial invertebrates, detritus, fish, algae and aquatic plants.

Potential to Occur: The San Juan River Recovery Implementation Program has documented a single roundtail chub in the San Juan River in sampling in 2011, just downstream of McElmo Creek. It is likely that this fish was stocked on McElmo Creek by the Colorado Division of Parks and Wildlife (Gilbert et al. 2012). This collection was the first of a roundtail chub on the San Juan River since 1998.The species may occur in the action area in low numbers.

4.8.2.4 Transmission Lines

APS Lines: FCPP to Moenkopi Substation and FCPP to Cholla Substation

The APS transmission lines from FCPP to Moenkopi and Cholla Substation occur in San Juan County, New Mexico, and in Apache, Navajo, and Coconino counties in Arizona. Terrain elevations along the APS transmission lines range from approximately 4,200 to 9,000 feet above mean sea level. The ROW width for the lines varies between 200 and 500 feet dependent upon voltage and two parallel lines with adjacent ROWs exists.

The FCPP to Moenkopi Substation and the FCPP to Cholla Substation transmission lines begin approximately 5 miles south of Waterflow, New Mexico, and extends 179 miles southwest, crossing the Chuska Mountains at the New Mexico-Arizona border, continuing to the Defiance Plateau, and ending approximately 19 miles north of Holbrook, Arizona. The FCPP to Cholla Substation transmission line splits into 2 lines for just over 40 miles towards the southern end in the ROI.

The FCPP to Moenkopi Substation transmission line extends in a westerly direction, crossing the Chuska Mountains, Chinle Valley, and Black Mesa. It crosses through the Hopi lands, reenters the Navajo Nation at the Little Colorado River, and extends approximately 15 miles west of Cameron, Arizona. The FCPP to Moenkopi Substation transmission line ROI totals approximately 193 miles in length.

According to the USFWS, 32 Federally listed TECP species have the potential to occur in Apache, Coconino and Navajo counties, Arizona, and San Juan County, New Mexico, where the transmission lines are located. The NNHP NESL identifies 28 G2 and G3 species of concern and the Hopi tribe identified 3 cultural sensitive species, all of which were raptors, and 2 of which were also on the NNHP NESL list. The 46 special-status species (15 of the NESL species are also on the Federal list) with the potential to occur included 5 mammals, 9 birds, 3 amphibians and reptiles, 3 invertebrates, 8 fish, and 18 plants.

A review of the special-status species list and APS survey reports on their potential to occur within the APS transmission line ROWs ROI indicated no suitable habitat or potential for occurrence for 36 out of the 46 species. Based on known historic range or known suitable habitat, there is no potential for occurrence for any special status amphibians, reptiles, invertebrates, or fish. This review indicated that

[1] The lower Colorado River basin district population segment has been a candidate for listing under the Federal ESA since 2009 (74 FR 32351)

further analysis through the biological survey results were warranted for five plant species (Mesa Verde Cactus, Fickeisen's Plains Cactus, Mancos Milk-vetch, Naturita Milk-vetch, Round Dunebroom) and five wildlife species (pronghorn antelope, golden eagle, bald eagle, red-tailed hawk, ferruginous hawk) including three Federally listed species) as shown in Table 4.8-6. The species that have a potential of occurrence are discussed below.

Wildlife

Pronghorn

The pronghorn antelope is a NESL G3 species.

Distribution and habitat: Found in grasslands or desert scrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees (typically juniper and sagebrush). Range includes most western US states. Occupied range on Navajo Nation is the southwestern portion north of Flagstaff, and checkerboard lands in New Mexico. Results of data request from NNHP indicate Coconino as the only county with potential for occurrence.

Potential to occur: Much of the transmission line ROW could be considered potential habitat for pronghorn. Although the transmission line ROWs pass through vast stretches of potential habitat, no indications of pronghorn (tracks, droppings, or direct observation) existed within the transmission line corridor during the 2012 surveys. The occupied range of antelope on the Navajo Nation includes only the checkerboard lands in New Mexico.

Golden eagle

The golden eagle is protected under two Federal statutes MBTA and BGEPA as well as a NESL G3 species.

Distribution and habitat: Golden eagles are found year round throughout northwestern New Mexico and northern Arizona. They typically inhabit mountainous or hilly terrain, hunting over open country. On the Navajo Nation, golden eagle nests most often occur on steep cliff ledges, usually ≥ 100 feet in height; although shorter cliffs may also be used (Ecosphere 2012b). In other parts of their range, golden eagles may nest in large trees, man-made structures, and rarely on the ground. Nest sites are adjacent to open habitats that support preferred prey populations such as black-tailed jackrabbits, desert cottontails, reptiles, and prairie dogs. Golden eagle territories in the west typically range from 12 to 20 square miles (Ecosphere 2012b).

Potential to occur: The relatively open shrublands and mild terrain of the transmission ROW provide potential foraging habitat for golden eagles. Power line poles, rock escarpments, bluffs, and formations in and adjacent to the Project Area serve as potential perches. Similarly, the survey area provides potential foraging habitat for golden eagle. No golden eagles or nests were recorded within the survey area during the field studies by APS.

Bald eagle

The bald eagle is protected under two Federal statutes MBTA and BGEPA as well as a NESL G2 and Hopi Cultural Sensitive species.

Distribution and habitat: Typically nest within trees in forested areas, especially mature and old-growth stands, adjacent (usually <2 km) to large bodies of water with suitable forage of waterfowl and fish; rarely uses cliff face adjacent to large body of water.

Potential to occur: Bald eagles are occasionally observed at the northern end of the ROW corridor near the most suitable habitat along the San Juan River or Morgan Lake. Bald eagles are likely to be only migrants through the area.

Table 4.8-6 Federally Listed TECP, Hopi Tribe, and NNHP G2 and G3 Species of Concern – APS Transmission Lines

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Mammals					
Antilocapra americana	Pronghorn	NESL G3	Apache, Coconino, Navajo, San Juan	Found in grasslands or desert scrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees (typically juniper and sagebrush). Range includes most western US states. Occupied range on Navajo Nation is the southwestern portion north of Flagstaff, and checkerboard lands in New Mexico. Results of data request from NNHP indicate Coconino as the only county with potential for occurrence.	**Yes.** Suitable habitat for this species exists along the ROWs.
Canis lupus baileyi	Mexican gray wolf	Federally Endangered	Apache, Navajo	Chaparral, woodland, and forested areas.	**No.** No suitable habitat for this species along the ROW.
Lynx canadensis	Canada lynx	Federal Candidate	San Juan	Subalpine/coniferous forests. Mature forests with downed logs and windfalls provide cover for denning, escape and protection from severe weather.	**No.** Lynx may occur as migrants through the Project Area. Limited potential habitat is too isolated.
Mustela nigripes	Black-footed ferret	Federally Endangered; NESL G2	Apache, Coconino, Navajo, San Juan	Grassland plains/prairie. Prairie Dog town complexes of 200 acres or more for the Gunnison's prairie dog (*Cynomys gunnisoni*) and/or 80 acres or more for any subspecies of Black-tailed prairie dog (*Cynomys ludovicianus*). No known wild ferrets on the Navajo Nation except for those associated with the Arizona Game and Fish Dept. reintroduction on Tribal Ranch lands of Big Boquillas in Aubrey Valley, Coconino Co., approximately 100 miles to the west of the Project Area	**No.** No prairie dog (*Cynomys gunnisoni*) towns of sufficient size exist to support black-footed ferret along the ROWs.
Zapus hudsonius luteus	New Mexico jumping mouse	Federal Candidate	Apache	Nests in dry soils but also uses moist, streamside, dense riparian/wetland vegetation. The jumping mouse appears to only utilize two riparian community types: (1) persistent emergent herbaceous wetlands; and (2) scrub-shrub wetlands. The New Mexican jumping mouse is diminished to 6 populations in the White Mountains, Arizona.	**No.** Suitable habitat was not found.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Birds					
Aquila chrysaetos canadensis	Golden Eagle	NESL G3; Hopi Cultural Sensitive Species	Apache, Coconino, Navajo, San Juan	Nest on steep cliffs in middle to upper parts of cliffs in sheltered ledges, potholes, or small caves, typically ≥30 m in height, although shorter cliffs (≥10 m) occasionally used. Nesting cliffs are normally directly adjacent to foraging habitat of desert grasslands or desert scrub, with only sparse shrubs if present, that provides primary prey of cottontail and jackrabbits.	**Yes.** Potential foraging habitat for this species occurs within and adjacent to the ROWs as well as potential nest site.
Buteo jamaicensis	Red-tailed Hawk	Hopi Cultural Sensitive Species	Coconino, Navajo	This species is common within the Project Area and is found in almost all habitats from mountains to deserts, in forested areas and open country. Prefers trees for nesting sites, but will utilize shrubs and cliffs in open country.	**Yes.** Potential foraging habitat for this species occurs within and adjacent to the ROWs as well as potential nest site.
Buteo regalis	Ferruginous hawk	NESL G3	Apache, Coconino, Navajo, San Juan	Ferruginous Hawks nest in badlands, flat or rolling desert grasslands, and desert scrub. Most nests on Navajo Nation are on clay or rock pinnacles, small buttes, or short cliffs (<30 m height); fewer are placed in top of juniper trees or on the ground, and one record exists of a nest on the crossarm of a transmission-line tower. Habitat surrounding nest site must support populations of prey items like cottontail and jackrabbits, prairie dogs, ground squirrels and gophers.	**Yes.** Potential foraging habitat for this species occurs within and adjacent to the ROWs as well as potential nest site.
Cinclus mexicanus	American dipper	NESL G3	Apache, Coconino, Navajo, San Juan	Nests are near clear, unpolluted streams usually ≤15 m in width and ≤2 m in depth, with a variety of riffles, pools, and waterfalls with in-stream and streamside substrate of rocks, sand, and rubble; boulders are necessary for perches.	**No.** Suitable habitat is not found within or adjacent to the ROWs.
Coccyzus americanus	Yellow-billed cuckoo	Federal Candidate NESL G2	Apache, Coconino, Navajo, San Juan	Nesting cuckoos are associated with relatively dense, wooded, streamside riparian habitat, with varying combinations of Fremont cottonwood, willow, velvet ash, Arizona walnut, mesquite, and tamarisk. Some cuckoos also have been detected nesting in velvet mesquite, netleaf hackberry, Arizona sycamore, Arizona alder, and some exotic neighborhood shade trees.	**No**. Suitable habitat is not found along the Project's transmission line ROWs, but potential habitat could occur in riparian areas with higher canopies or salt cedar along the San Juan River.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Empidonax traillii extimus	Southwestern willow flycatcher	Federally Endangered; NESL G2	Apache, Coconino, Navajo, San Juan	Riparian-obligate bird found in cottonwood/willow and tamarisk vegetation communities along rivers and streams.	No. Suitable nesting habitat is not found within or adjacent to the ROWs. .
Gymnogyps californicus	California Condor	Federally Endangered; NESL G4	Apache, Coconino, Navajo,	High desert canyons and plateaus. Ill-defined nest, if any, composed of existing debris within overhung cliff ledges, crevices, potholes, or caves; in northern Arizona, nesting will likely be within walls of major river canyons or tall, steep cliffs within desert scrub and grasslands that allow easy approach from the air, and are inaccessible for terrestrial predators.	**No.** Suitable habitat is not found within or adjacent to the ROWs
Haliaeetus leucocephalus alascanus	Bald eagle	NESL G2; Hopi Cultural Sensitive Species	Apache, Coconino, San Juan	Typically nest within trees in forested areas, especially mature and old-growth stands, adjacent (usually <2 km) to large bodies of water with suitable forage of waterfowl and fish; rarely uses cliff face adjacent to large body of water. Winter roost in large trees in forests, river bottoms, or near canyon rims, usually within a few miles of ponds, lakes and rivers with adequate prey. Ponds and lakes are used until completely iced-over and prey availability is reduced.	**Yes.** Potential foraging habitat for this species occurs within and adjacent to the ROW area along watercourses.
Strix occidentalis lucida	Mexican spotted owl	Federally Threatened; NESL G3	Apache, Coconino, Navajo, San Juan	Nests in canyons and dense forests with multilayered foliage structure. Generally nest in older forests of mixed conifer or ponderosa pine/gambel oak type. Restricted habitat includes mixed-conifer forest, pine-oak forest, and riparian areas.	**No.** Suitable habitat is not found within or adjacent to transmission line ROWs. Limited suitable habitat exists adjacent to the ROWs.
Amphibians					
Lithobates chiricahuensis	Chiricahua leopard frog	Federally Threatened; NESL G2	Apache, Navajo, Coconino	Streams, rivers, backwaters, ponds, and stock tanks that are mostly free from introduced fish, crayfish, and bullfrogs.	**No.** The current range of this species is outside the transmission line ROWs.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Rana pipiens	Northern leopard frog	NESL G2	Apache. Coconino, Navajo, San Juan	Breeds in wetlands usually with permanent water and aquatic vegetation (especially cattails), ranging from irrigation ditches and small streams to rivers, and small ponds and marshes to lakes or reservoirs. Distribution: On Navajo Nation, historic records include Chuska Mountains, Little Colorado, Colorado, and San Juan rivers; most of these populations are now extirpated. Potential exists throughout the Navajo Nation where appropriate habitat is present.	**No.** Suitable habitat is not found within transmission line ROWs.
Reptiles					
Thamnophis eques megalops	Northern Mexican Garter-snake	Federal Candidate	Apache, Navajo, Coconino	Cienegas, stock tanks, large-river riparian woodlands and forests, streamside gallery forests. Core population areas in the US include mid/upper Verde River drainage, mid/lower Tonto Creek, and the San Rafael Valley and surrounding area. Status on tribal lands unknown. Strongly associated with the presence of a native prey base including leopard frogs and native fish.	**No.** Suitable habitat is not found within the transmission line ROWs.
Fish					
Catostomus discorbolus yarrow	Zuni bluehead sucker	Federal Candidate	Apache	Small streams in low velocity, moderate deep pools, and pool runs with seasonal dense algae. Young prefer quieter shallow areas near shoreline. Limited to possibly one creek in Arizona and to the headwaters of Zuni River drainage in New Mexico.	**No.** The current range of this species is outside the transmission line ROWs.
Gila cypha	Humpback chub	Federally Endangered	Coconino	Large, warm turbid rivers especially canyon areas with deep fast water. Species found in the Upper Colorado River basin in Utah and Colorado, and in the Little Colorado and Colorado rivers in Marble and Grand canyons, Arizona.	**No.** Suitable habitat is not found within the transmission line ROWs.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Gila robusta	Roundtail chub	Federal Candidate; NESL G2	Apache, Coconino, Navajo, San Juan	This species is found within the San Juan and Mancos rivers. Rarely encountered in recent surveys; they have been found from Shiprock to near Lake Powell with most between Shiprock and Aneth (RM 107-140). Adults inhabit the most permanent water in cool to warm water mid-elevation streams, typically using pools and eddies, adjacent to rapids and boulders. They are often found near cover (e.g., rocks, plant roots) and in pools behind irrigation diversions. Juveniles prefer the margins of flowing water and backwater areas. Spawning occurs over gravel bottoms in runs and pools with ≥25-cm water depth.	**No.** Suitable habitat is not found within the transmission line ROWs.
Lepidomeda vittata	Little Colorado spinedace	Federally Threatened	Apache, Coconino, Navajo	Moderate to small streams; found in pools and riffles with water flowing over fine gravel and silt substrate.	**No.** Suitable habitat is not found within the transmission line ROWs.
Oncorhynchus gilae apache	Apache trout	Federally Threatened	Apache, Coconino, Navajo	This species is presently restricted to drainages in the White Mountains. Habitat includes streams and rivers generally above 6,000 feet elevation with adequate stream flow and shading; temperatures below 77°F; and substrate composed of boulders, rocks, gravel and some sand and silt.	**No.** Suitable habitat is not found within the transmission line ROWs.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Ptychocheilus lucius	Colorado pike-minnow	Federally Endangered; Experimental Population, Non-Essential; NESL G2	San Juan	On the Navajo Nation it has been documented throughout the San Juan River (SJR), from Shiprock to Lake Powell; the mouth of the Mancos River is used during the spring runoff period. The majority of adults use the stretch from about 11 km downstream of Shiprock (RM 142) to just downstream of Four Corners (RM 117), and spawn in 'The Mixer Area' (RM 131-132); young-of-year have primarily been found within the lower 26 km of the SJR just upstream of Lake Powell. Adults use backwaters and flooded riparian areas during spring runoff, and migrate large distances (15 to 64 km in the SJR) to spawn in riffle run areas with cobble/gravel substrates. Post-spawning adults primarily use run habitats, with eddies and slackwater also being important. Young-of-year (<120-mm length) use warm backwaters along shorelines. Deeper backwater areas (>1 m deep at confluence with main channel) are the preferred habitat of young fish into the subadult stage (>3 yrs. age and 200- to 400-mm length). Irrigation canals and ponds connected to SJR may be potential habitat.	**No.** Suitable habitat is not found within the transmission line ROWs.
Tiaroga cobitis	Loach minnow	Federally Endangered	Apache, Navajo	Presently found in small to large perennial streams with swift shallow water over cobble and gravel. Recurrent flooding and natural hydrograph important.	**No.** Suitable habitat is not found within the transmission line ROWs.
Xyrauchen texanus	Razorback sucker	Federally Endangered; NESL G2	Coconino; San Juan	This species is restricted to the Colorado River and a few of its warm-water tributaries; rare along the mainstem Colorado River in Marble Canyon and the mouth of the Little Colorado River, San Juan arm of Lake Powell, and upstream within the SJR. In mainstream portions of rivers, pre- and post-spawning suckers mostly use low-flow areas (backwaters over sand and silt substrate, deep eddies, and impoundments), but shallow to deep runs over sandbars and seasonally flooded shorelines also are important. Spawning occurs in areas with shallow, swift riffles over gravel or cobble substrate, and they also may use backwater habitats. Young-of-year use warm, flooded bottomlands and backwaters. Irrigation canals and ponds connected to the SJR may be potential habitat.	**No.** Suitable habitat is not found within the transmission line ROWs.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Invertebrates					
Speyeria nokomis	Nokomis fritillary	NESL G3	Apache, Coconino, Navajo and San Juan	Perennially wet meadows associated with seeps, springs, and streams variable in size (0.1 ha to >1.2 ha), relatively open, and dominated by grasses and with few shrubs. Violets (*Viola nephrophylla*), found in wet soils in shady areas beneath shrubs or within stream banks, are a necessary component of habitat as the host plant for larvae. Distribution: Range extends across eastern Utah, western CO, and northern Arizona and New Mexico. On Navajo Nation, known from <10 populations in Chuska Mountains and Defiance Plateau where appropriate habitat is present.	**No.** Suitable habitat is not found within the transmission line ROWs.
Oxyloma haydeni kanabensis	Kanab ambersnail	Federally Endangered	Coconino	Extremely geographically isolated. Three historical populations; two remaining; one on private property in Utah and one in Grand Canyon National Park. Associated with travertine seeps and springs, watercress, monkey flower, and other wetland vegetation.	**No.** The known range is outside of the transmission line ROWs.
Pyrgulopsis trivialis	Three Forks springsnail	Proposed Endangered	Apache	Rheocrene springs, seeps, marshes, spring pools, outflows and diverse lotic waters commonly referred to as cienegas. Distribution limited to Three Forks and Boneyard Spring complexes in the North Fork of the East Fork Black River watershed.	**No.** The known range is outside of the transmission line ROWs.
Plants					
Allium gooddingii	Gooding's onion	NESL G3	Apache; San Juan	Generally in spruce-fir forests and mixed conifer forests; in the Chuska Mountains also under Gambel oak thickets interspersed with aspen, dogwood, and Douglas fir; in moist, shady canyon bottoms and north-facing slopes, often along streams. General Distribution: Apache Co., Arizona, and New Mexico. Navajo Nation Distribution: Chuska Mountains, Apache Co., Arizona, & San Juan Co., New Mexico. Potential Navajo Nation Distribution: Throughout the Chuska Mountains and the Defiance Plateau.	**No.** Suitable habitat is not found within the transmission line ROWs.
Asclepias welshii	Welsh's milkweed	Federally Threatened	Coconino	Open, sparsely vegetated semistabilized sand dunes and on lee slopes of actively drifting sand dunes.	**No.** Known range outside the transmission line ROWs.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Astragalus cremnophylax var. *cremnophylax*	Sentry milk-vetch	Federally Endangered	Coconino	Grows on a white layer of Kaibab limestone, with little or no soil, in an unshaded opening within a pinyon-juniper-cliffrose plant community.	**No.** Known range outside of the transmission line ROWs.
Astragalus humillimus	Mancos milk-vetch	Federally Endangered; NESL G2	San Juan	Forms highly localized populations from 4 to 20 acres in size. It is typically found on large, nearly flat sheets of exfoliating whitish-tan colored sandstone, in small depressions and sand-filled cracks on or near ledges and mesa tops in slickrock communities of Point Lookout & Cliffhouse Sandstone. Known only from the Four Corners area of New Mexico, San Juan County, and adjacent Montezuma County, Colorado. Navajo Nation Distribution: San Juan County, New Mexico, Palmer Mesa east to the Hogback area and south of the SJR, to a hogback east of Little Water. Potential Navajo Nation Distribution: Four Corners area, all slickrock formations of Point Lookout & Cliffhouse Sandstone, and possibly other related members.	**Yes.** This type of sandstone formation could occur within the transmission line ROWs.
Astragalus naturitensis	Naturita milk-vetch	NESL G3	San Juan	Habitat: Sand-filled pockets of sandstone slickrock and rimrock pavement along canyons in the pinion juniper zone. General Distribution: McKinley and San Juan counties, New Mexico, southwestern Colorado and **s**outheastern Utah. Known Distribution on the Navajo Nation: Hogback, San Juan Co., to the Pinetree Canyon area, McKinley Co., New Mexico. Potential Distribution on the Navajo Nation: In suitable habitat of the Hogback, San Juan Co., New Mexico.	**Yes.** This type of sandstone formation could occur within the transmission line ROWs.
Carex specuicola	Navajo sedge	Federally Threatened; NELS G3	Apache, Coconino, Navajo	Silty soils at shady seeps and springs. Typically found in seeps and hanging gardens, on vertical sandstone cliffs and alcoves. General Distribution: Northern Arizona, San Juan Co, Utah. Navajo Nation Distribution: From the Navajo Creek drainage in Coconino Co, east to the Tsegi Canyon Watershed in Navajo Co, south to the Rock Point/Mexican Water & Canyon de Chelly National Monument, Apache Co, Arizona area. Potential Navajo Nation Distribution: Northern Arizona, especially in hanging gardens of the SJR drainage and Lake Powell.	**No.** Suitable habitat is not found within the transmission line ROWs.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Erigeron rhizomatus	Zuni fleabane	Federally Threatened; NESL G2	Apache; San Juan	Typically only found on fine textured clay hillsides. It is known from clays derived from the Chinle Formation in the Zuni and Chuska Mountains, and to similar clays of the Baca Formation in the Datil and Sawtooth ranges in New Mexico. Only one known Arizona location in the Chuska Mountain on the Navajo Nation. Potential Navajo Nation Distribution: Chuska Mountains and in suitable habitat in the pinion-juniper associations between Lupton, Apache Co., Arizona, and Prewitt, McKinley Co., New Mexico.	**No.** Suitable habitat is not found within the transmission line ROWs.
Errazurizia rotundata	Round dunebroom	NESL G3	Apache, Coconino, Navajo	Generally in exposed habitats in the semiarid environment of the Great Basin Desert scrub. Known Distribution on the Navajo Nation: Between Moenave and Willow Springs, Coconino Co., Arizona. Potential Navajo Nation Distribution: In suitable habitats between Gap, Coconino County, and Petrified Forest National Park, Apache Co., Arizona.	**Yes.** Potential habitat occurs within transmission line ROW but no populations were found during surveys conducted in 2012.
Lesquerella navajoensis	Navajo bladderpod	NESL G3	Apache; San Juan	Windswept mesa rims and nearby habitat with little vegetative cover and high insolation. Also found at the base and slopes of small hills of the Chinle Formation. Typically only found in a combination of Todilto Limestone overlaying Entrada Sandstone or Chinle outcrops in pinion-juniper communities. Known Distribution on the Navajo Nation: In New Mexico on mesa rims NW of Thoreau and Continental Divide, and Chuska Mountains, at Todilto Park, McKinley Co. In Arizona, from the Red Valley area (N of Navajo, New Mexico) to Wheatfields Lake, Apache Co. Potential Navajo Nation Distribution: Todilto limestone and Chinle outcroppings NE and NW of Thoreau, and the Chuska Mountains, San Juan Co., New Mexico. Possibly in the Chuska & Carrizo Mountains, Apache County, Arizona.	**No.** Suitable habitat is not found within the transmission line ROWs.
Packera franciscana	San Francisco Peaks groundsel	Federally Threatened	Coconino	Alpine tundra Found above spruce-fir and pine forests.	**No.** Known range outside of the transmission line ROWs.
Pediocactus bradyi	Brady pincushion cactus	Federally Endangered; NESL G2	Coconino	Benches and terraces in Navajo desert near Marble Gorge.	**No.** Species was not on NNHP data response as potentially occurring within the transmission line ROWs.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Pediocactus knowltonii	Knowlton's cactus	Federally Endangered	San Juan	Rolling, gravelly hills covered with pinyon pine, Rocky Mountain juniper, and sagebrush. Knowlton cactus is found on the very eastern edge of the Colorado Plateau Province, adjacent to the San Juan Mountains. Grows on tertiary alluvial deposits overlying the San Jose Formation. Known populations range from 2,075- to 2,300-meter elevations. The only viable populations exist in San Juan County, New Mexico.	**No.** The known range is outside of the transmission line ROWs.
Pediocactus peeblesianus var. *fickeiseniae*	Fickeisen plains cactus	Federal Proposed; NESL G3	Coconino	Soils overlain by Kaibab Limestone in Navajoan desert or Great Plains Grassland, along canyon rims and flat terraces along washes, typically with limestone chips scattered across the surface. General Distribution: Arizona: Coconino Co., from House Rock Valley and Gray Mt., to the Little Colorado and Colorado rivers. Navajo Nation Distribution: Gray Mountain to southwest of Bitter Springs, Coconino Co., Arizona Potential Navajo Nation Distribution: Marble Canyon to Gray Mountain.	**Yes.** Potential habitat occurs within the transmission line ROWs but no populations were found during surveys conducted in 2012.
Pediocactus peeblesianus var. *peeblesianus*	Peebles Navajo cactus	Federally Endangered	Navajo	Gravely soils of the Shinarump conglomerate of the Chinle Formation.	**No.** Known range outside of the transmission line ROWs.
Pediocactus sileri	Siler pincushion cactus	Federally Threatened	Coconino	Desert-scrub transitional areas of Navajo, sagebrush and Mohave Deserts.	**No.** Known range outside of the transmission line ROWs.
Platanthera zothecina	Alcove bog-orchid	NESL G3	Apache, Coconino, Navajo	Seeps, hanging gardens, and moist stream areas from the desert shrub to pinion-juniper & Ponderosa pine/mixed conifer communities. Known Distribution on the Navajo Nation: Headwaters of Oljeto Wash, Tsegi Canyon Watershed, hanging gardens surrounding Navajo Mountain, Chinle Wash drainages.	**No.** Suitable habitat is not found within the transmission line ROWs.

Species Scientific Name	Species Common Name	Status	Counties (AZ, NM)	Habitat Requirements	Potential to Occur
Sclerocactus mesae-verdae	Mesa Verde cactus	Federally Threatened; NESL G2	San Juan	Salt-desert scrub communities, typically in the Fruitland and Mancos shale formations, but also in the Menefee Formation overlaying Mancos shale. It is most frequently found on the tops of hills or benches and along slopes. General Distribution: San Juan Co, New Mexico, and adjacent Montezuma Co, Colorado. Navajo Nation Distribution: Colorado border south to near Naschitti, New Mexico. Potential Navajo Nation Distribution: Within the known distribution to the north, south, and west. The eastern limits are still unclear.	**Yes.** Potential habitat occurs within the transmission line ROWs but no populations were found during surveys conducted in 2012. The species has never been observed south of the San Juan River.
Zigadenus vaginatus	Alcove death camass	NESL G3	Apache; Coconino	Hanging gardens in seeps and alcoves. Endemic to the Colorado Plateau in southern Utah and northern Arizona. Navajo Nation Distribution: Hanging gardens in sandstone canyon surrounding Navajo Mountain, Coconino Co, Arizona, and San Juan Co., Utah. Potential Navajo Nation Distribution: Hanging gardens surrounding the drainages into Lake Powell and the drainages of Chinle Wash south to Canyon de Chelly New Mexico, Apache and Coconino counties, Arizona, San Juan Co., Utah.	**No.** Suitable habitat is not found within the transmission line ROWs.

Red-tailed hawk

The red-tailed hawk is protected under one Federal statute MBTA and is a Hopi Cultural Sensitive species.

Distribution and habitat: This species is common within the Navajo Nation and along the transmission line ROWs. It will occupy almost all habitats from deserts to mountains and open grasslands to forested foothills. Often utilized trees for nesting but will also use cliffs and man-made structures such as power line structures.

Potential to occur: The relatively flat terrain and open vegetation along the transmission line ROW provide potential foraging habitat for red-tailed hawks. Prairie dog colonies, ground squirrels and small mammals provide a prey base for hawks within and adjacent to the ROW area.

Ferruginous hawk

The ferruginous hawk is protected under one Federal statute MBTA and a NESL G3 species.

Distribution and habitat: Ferruginous hawks occur year round throughout the Navajo Nation, inhabiting dry, flat, or rolling grasslands and desert scrub (Ecosphere 2012b). This species prefers elevated nest sites; nests on the Navajo Nation are most often on rock pinnacles, buttes, or short cliffs. Nests have also been documented in juniper (*Juniperus* spp.) trees, transmission-line towers, and on the ground (Ecosphere 2012b). Nest sites are adjacent to habitats supporting populations of preferred prey species such as cottontails, jackrabbits, prairie dogs, and ground squirrels.

Potential to occur: The relatively flat terrain and open vegetation along the transmission line ROW provide potential foraging habitat for ferruginous hawks. Prairie dog colonies provide a prey base for ferruginous hawks within and adjacent to the ROW area. Badlands and ridgeline near the ROW or transmission structures offer potential nesting habitat for ferruginous hawks. One record exists of a ferruginous hawk nest on a crossarm of a transmission tower.

Plants

Mesa Verde Cactus

The Mesa Verde cactus is Federally listed as a candidate threatened and also a NESL G2 species.

Distribution and habitat: The occurrence of Mesa Verde cactus is documented in San Juan County, New Mexico and Montezuma County, Colorado. It is generally found in salt-desert scrub communities, typically in the Fruitland and Mancos shale formations. It is most frequently found on the tops of hills or benches and along slopes.

Potential to occur: Ten potential habitat locations were identified by the habitat assessment model along the FCPP to Moenkopi transmission line ROW and two along the FCPP to Cholla transmission line ROWs. Field biologists surveyed these locations in April 2013 and they did not find any of the target species within the 12 modeled habitat areas.

Fickeisen's Plains Cactus

The Fickeisen's Plains cactus is Federally listed as a candidate threatened and also a NESL G3 species.

Distribution and habitat: The Fickeisen’s Plains Cactus occupies soils overlain by Kaibab Limestone in Navajoan desert or Great Plains Grassland, along canyon rims and flat terraces along washes, typically with limestone chips scattered across the surface. Its range in Coconino County, Arizona, is from House Rock Valley and Gray Mountain to the Little Colorado and Colorado rivers. Within the Navajo Nation, the species is found from Gray Mountain to southwest of Bitter Springs, Coconino County. It also is potentially found on the Navajo Nation from Marble Canyon to Gray Mountain (AECOM 2013g).

Potential to occur: Five potential habitat locations for the Fickeisen's Plains Cactus were identified by the habitat assessment model and projected to occur, along the FCPP to Moenkopi transmission line ROW. Field biologists surveyed these locations in 2013 and none of the target species were found.

Mancos Milk-vetch

The Mancos milk vetch is Federally listed as a candidate threatened and also a NESL G3 species.

Distribution and habitat: The Mancos milk-vetch forms highly localized populations from 4 to 20 acres in size. It is typically found on large, nearly flat sheets of exfoliating whitish-tan colored sandstone, in small depressions and sand-filled cracks on or near ledges and mesa tops in slickrock communities of Point Lookout and Cliffhouse sandstones. The species only occurs in the Four Corners area including San Juan County, New Mexico, and adjacent Montezuma County, Colorado. Within the Navajo Nation, the species is found within San Juan County, New Mexico, from Palmer Mesa east to the Hogback area and south of the San Juan River to a hogback east of Little Water. It is potentially found within the Navajo Nation in the Four Corners area on all slickrock formations of Point Lookout and Cliffhouse sandstones and possibly other related members. (AECOM 2013g)

Potential to occur: Six potential habitat locations, as identified by the habitat assessment model were projected to occur, two along the FCPP to Moenkopi transmission line ROW and four along the FCPP to Cholla transmission line ROW. Field biologists surveyed these locations in 2013 and 1 population consisting of 8 colonies with 15 individuals total was found around MP 18. Some of the colonies covered a large area but only had approximately 20 percent living plants.

Naturita Milk-vetch

The Naturita milk-vetch is a NESL G3 species.

Distribution and habitat: The Naturita milk-vetch is found in sand-filled pockets of sandstone slickrock and rimrock pavement along canyons in the piñon juniper zone. The species range includes McKinley and San Juan counties, New Mexico, southwestern Colorado and southeastern Utah. Within the Navajo Nation, the species is known from the Hogback, San Juan County, to the Pinetree Canyon area, McKinley County, New Mexico. Within the Navajo Nation, potential habitat is found north of Interstate 40 in McKinley County to the Hogback near the FCPP in San Juan County, New Mexico. (AECOM 2013g)

Potential to occur within the Project Area: Three potential habitat locations, as identified by the habitat assessment model, along the FCPP to Moenkopi transmission line ROW and four along the FCPP to Cholla transmission line ROW were identified. Field biologists surveyed these locations in 2013 and none of the target species were found.

Round Dunebroom

The round dunebroom is a NESL G3 species.

Distribution and habitat: This Arizona-endemic plant is known from only a few small areas along creeks flowing into the Little Colorado River in Coconino and Navajo counties, Arizona (AECOM 2013g). Its habitat consists of dunes, loose sand, sandstone ledges, and rimrock. The round dunebroom generally occurs in exposed habitats in the semiarid environment of the Great Basin Desert. Its known distribution within the Navajo Nation is between Moenave and Willow Springs, Coconino County, Arizona. Potential habitat within the Navajo Nation includes suitable habitats between Gap in Coconino County, Arizona, and Petrified Forest National Park in Apache County, Arizona. (AECOM 2013g)

Potential to occur: Three potential habitat locations, as identified by the habitat assessment model, along the FCPP to Moenkopi transmission line ROW were identified. Field biologists surveyed these locations in 2013 and none of the target species were found.

Fish

No special-status fish occur within the FCPP to Moenkopi Substation or FCPP to Cholla Substation transmission line ROWs.

PNM Lines: FCPP to San Juan Generating Station and FCPP to West Mesa Switchyard

The species evaluation for the PNM transmission lines are separated into two sections based on jurisdiction: Navajo Nation Tribal Trust Lands and non-Navajo lands.

For Navajo Nation Tribal Trust Lands, a total of 16 species that are listed by the Navajo Nation as NESL G2 and G3 species and/or USFWS as TECP were identified within the FCPP to San Juan Generating Station and FCPP to West Mesa transmission line ROW ROI. Of these 16 species, 6 species have the potential to occur, including 1 plant species (Mesa Verde cactus) and 5 wildlife species (pronghorn antelope, golden eagle, bald eagle, ferruginous hawk, and southwestern willow fly catcher), shown in Table 4.8-7 The southwestern flycatcher and Mesa Verde cactus are on both the Federal TECP list and the Navajo Nation NESL list. There is no potential for the occurrence of any special status amphibians or reptiles, or invertebrates on these transmission lines.

For non-Navajo lands, 28 special-status species are identified by the BLM, NMGF, or USFWS as potentially occurring within the PNM transmission line ROW ROI. Of these 28 species, 24 have the potential to occur, including 6 plant species (Aztec gilia, San Juan milkweed, naturita milkvetch, Parish's alkali grass, Brack's fishhook cactus, and Mesa verde cactus), 3 fish species (roundtail chub, Colorado pikeminnow, and razorback sucker) and 8 wildlife species (Baird's sparrow, gray vireo, southwestern willow flycatcher, loggerhead shrike, western burrowing owl, ferruginous hawk, American peregrine falcon and the special-status bat complex, which includes 7 bat species), shown in Table 4.8-8.

A total of three listed species were identified as having the potential to occur both on Navajo Nation Land as well as on non-Navajo lands, including the Mesa Verde cactus, ferruginous hawk, and southwestern willow fly catcher. Therefore, a total of 22 Federally listed TECP species, Navajo Nation NESL G2 or G3 species of BLM/NMGF species of concern have the potential to occur along the FCPP to San Juan Generating Station line or FCPP to West Mesa Switchyard transmission line ROWs, including 6 plant species, 3 fish, and 13 wildlife species. The species that have a potential of occurrence are discussed below.

Wildlife

Pronghorned Antelope

The pronghorn antelope is a NESL G3 species.

Distribution and habitat: Found in grasslands or desert scrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees (typically juniper and sagebrush). Range includes most western US states. Occupied range on Navajo Nation is the southwestern portion north of Flagstaff, and checkerboard lands in New Mexico. Results of data request from NNHP indicate Coconino as the only county with potential for occurrence.

Potential to occur: Much of the FCPP to West Mesa Switchyard transmission line ROW could be considered potential habitat for pronghorn. Although the transmission line ROWs pass through vast stretches of potential habitat, no indications of pronghorn (tracks, droppings, or direct observation) existed within the transmission line corridor during the 2012 surveys. The occupied range of antelope on the Navajo Nation includes only the checkerboard lands in New Mexico south of the Rio Puerco in Sandoval County.

Table 4.8-7 Federally Listed TECP and NESL Species Groups 2 and 3 – PNM FCPP to San Juan Generating Station and FCPP to West Mesa Switchyard Transmission Line ROWs – Navajo Nation

Species Scientific Name	Species Common Name	Status	Counties (NM)	Habitat Requirements	Potential to Occur
Mammals					
Mustela nigripes	Black-footed ferret	Federally Endangered; NESL G2	McKinley, San Juan, Sandoval	Grassland plains/prairie. Prairie Dog town complexes of 200 acres or more for the Gunnison's prairie dog (*Cynomys gunnisoni*). No known wild ferrets on the Navajo Nation in San Juan County.	**No.** No prairie dog (*Cynomys gunnisoni*) towns of sufficient size exist to support black-footed ferret in the area.
Antilocapra americana)	Pronghorn	NESL G3	McKinley, San Juan, Sandoval	Found in grasslands or desert scrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees (typically juniper and sagebrush). Range includes most western US states from southcentral Canada west to Nevada and south to Arizona, New Mexico, and western Texas. Occupied range on Navajo Nation is the southwestern portion north of Flagstaff, and checkerboard lands in New Mexico. Results of data request from NNHP indicate Coconino as the only county with potential for occurrence.	**Yes.** Suitable habitat exists along the ROWs. No sign of pronghorn use during surveys or documented on Navajo Nation.
Amphibians					
(Lithobates pipiens)	Northern leopard frog	NESL G2	San Juan	Breeds in wetlands usually with permanent water and aquatic vegetation (especially cattails), ranging from irrigation ditches and small streams to rivers, and small ponds and marshes to lakes or reservoirs. Distribution: On Navajo Nation, historic records include Chuska Mountains, Little Colorado, Colorado, and San Juan rivers; most of these populations are now extirpated.	**No.** Suitable habitat is not found within most of the ROW area. Only potential habitat is near San Juan River crossing at structures FC 28-29.
Birds					
Aquila chrysaetos canadensis	Golden Eagle	NESL G3	McKinley, San Juan, Sandoval	Open habitats in mountainous, canyon terrain. Nests primarily on steep cliffs and large trees or structures such as electric transmission towers.	**Yes.** Potential foraging habitat for this species occurs within the ROW area.
Buteo regalis	Ferruginous hawk	NESL G3	McKinley, San Juan, Sandoval	Nests in badlands, flat or rolling desert grasslands, and desert scrub. Most nests on Navajo Nation are on clay or rock pinnacles, small buttes, or short cliffs (<30 m height).	**Yes.** Potential foraging and known nesting habitat for this species occurs within the ROW area and on structures.

Species Scientific Name	Species Common Name	Status	Counties (NM)	Habitat Requirements	Potential to Occur
Coccyzus americanus	Yellow-billed cuckoo	Federal Candidate NESL G2	McKinley, San Juan, Sandoval	Breeds in riparian woodlands with dense understory vegetation.	**No**. Suitable habitat is not found along the Project's transmission line ROWs, but potential habitat could occur in riparian areas with higher canopies or salt cedar along the San Juan River.
Empidonax traillii extimus	Southwestern willow flycatcher	Federally Endangered; NESL G2	McKinley, San Juan, Sandoval	Riparian-obligate bird found in cottonwood/willow and tamarisk vegetation communities along rivers and streams.	**Yes.** Poor suitable migratory stopover habitat found in scattered patches of decadent tamarisk (*Tamarix* sp.*)*.No suitable nesting habitat in the area.
Strix occidentalis lucida	Mexican spotted owl	Federally Threatened	San Juan	Nests in canyons and dense forests with multilayered foliage structure. Generally nest in older forests of mixed conifer or ponderosa pine/gambel oak type.	**No.** Suitable habitat is not found within the area due to lack of mixed conifer forests.
Haliaeetus leucocephalus	Bald eagle	NESL G2	McKinley, San Juan, Sandoval	Typically nest within trees in forested areas, especially mature and old-growth stands, adjacent (usually <2 km) to large bodies of water with suitable forage of waterfowl and fish; rarely uses cliff face adjacent to large body of water. Winter roost in large trees in forests, river bottoms, or near canyon rims, usually within a few miles of ponds, lakes and rivers with adequate prey.	**Yes**. Absent in the ROW area to the south but occasionally observed along the San Juan River.
Fish					
Gila robusta	Roundtail chub	Federal Candidate; NESL G2	San Juan	Uses large rivers and present in low numbers in the San Juan, Mancos, La Plata and Animas rivers in New Mexico and Colorado.	**Yes.** Suitable habitat occurs in the San Juan River within the FC ROW.
Ptychocheilus lucius	Colorado pike-minnow	Federally Endangered with critical habitat, NESL G2	San Juan	Large rivers with strong currents, deep pools and quite backwaters. On the Navajo Nation it has been documented throughout the San Juan River (SJR), from Shiprock to Lake Powell; the mouth of the Mancos River is used during the spring runoff period.	**Yes.** Suitable habitat occurs in the San Juan River within the FC ROW.

Species Scientific Name	Species Common Name	Status	Counties (NM)	Habitat Requirements	Potential to Occur
Xyrauchen texanus	Razorback sucker	Federally Endangered with critical habitat, NESL G2	San Juan	Medium to large rivers with silty to rocky substrates. Species prefers strong currents and deep pools. This species is restricted to the Colorado River and a few of its warm-water tributaries.	**Yes.** Suitable habitat occurs in the San Juan River within the FC ROW..
(Hybognathus amarus)	Rio Grande Silvery	Federally Endangered with critical habitat	McKinley, Sandoval	The silvery minnow is a pelagic spawning species; i.e., its eggs flow within the water column (Piatania and Altenbach 1998). The silvery minnow is the only surviving small, native pelagic spawning minnow in the Middle Rio Grande, and its range has been reduced to only 5 percent of its historic extent.	**No.** The ROW corridor does not occur within or near the Rio Grande or designated critical habitat.
Plants					
Astragalus humillimus	Mancos milk-vetch	Federally Endangered; NESL G2	San Juan	Cracks of Point Lookout sandstone of the Mesa Verde series at 5,000- to 6,000-foot elevations.	**No.** This type of sandstone formation does not occur within the transmission line ROWs and the closest formation is 6-7 miles to the west.
Sclerocactus mesae-verdae	Mesa Verde cactus	Federally Threatened; NESL G2	San Juan	Highly alkaline soils in sparse shale or adobe clay badlands of the Mancos and Fruitland formations at 4,000- to 5,550-foot elevations.	**Yes.** Potential habitat occurs within the transmission line ROWs.
Astragalus naturitensis	Naturita milk-vetch	NESL G3	San Juan	Sand-filled pockets of sandstone slickrock and rimrock pavement along canyons in the pinyon juniper zone.	**No.** Suitable habitat is not within the transmission line ROWs.

Table 4.8-8 Federally Listed TECP, BLM Sensitive, and State of New Mexico Species of Concern

Species Scientific Name	Species Common Name	Status; Federal / BLM / NM	Counties (NM)	Habitat Requirements	Potential to Occur
Mammals					
Mustela nigripes	Black-footed ferret	Federally Endangered	McKinley, San Juan, Sandoval	Grassland plains/prairie. Prairie Dog town complexes of 200 acres or more for the Gunnison's prairie dog (*Cynomys gunnisoni*). No known wild ferrets in these three counties.	**No.** No prairie dog (*Cynomys gunnisoni*) towns of sufficient size exist to support black-footed ferret in the area.
Euderma maculatum	Spotted bat	NM Threatened	McKinley, San Juan, Sandoval	The habitat likely to be utilized by bats as rooting areas is primarily the small sandstone outcrops that are scatted throughout the central and southern portions of the ROW corridor.	**Yes.** Potential foraging habitat for this species occurs within the ROW area.
Nyctinomops macrotis	Big-freetail bat	BLM Sensitive	McKinley, San Juan, Sandoval	This species roosts in rocky cliffs and found in wooded or forested areas below 6,000 feet.	**Yes**. Potential foraging habitat for this species occurs within the ROW area.
Myotis leibii	Small-footed bat	BLM Sensitive	McKinley, San Juan, Sandoval	This species is often found in the broken terrain of canyons and foothills.	**Yes**. Potential foraging or roosting habitat for this species occurs near the ROW.
Myotis volans	Long-legged myotis	BLM Sensitive	McKinley, San Juan, Sandoval	Often found in montane habitats but can be found in coniferous woodlands.	**Yes**. Potential foraging or roosting habitat for this species occurs near the ROW.
Myotis yumanensis	Yuma myotis	BLM Sensitive	McKinley, San Juan, Sandoval	This species is usually associated with riparian lands in the western US but may use dryer and shrubby areas.	**Yes**. Potential foraging or roosting habitat for this species occurs near the ROW.
Myotis occultus	Occult little brown bat	BLM Sensitive	McKinley, San Juan, Sandoval	This species is a water bat and found near streams, ditches or permanent water sources.	**Yes**. Potential foraging or roosting habitat for this species occurs near the ROW.
Myotis thysanodes	Fringed myotis	BLM Sensitive	McKinley, San Juan, Sandoval	The habitat likely to be utilized by bats as rooting areas is primarily the small sandstone outcrops that are scatted throughout the central and southern portions of the ROW corridor.	**Yes**. Potential foraging or roosting habitat for this species occurs near the ROW.

Species Scientific Name	Species Common Name	Status; Federal / BLM / NM	Counties (NM)	Habitat Requirements	Potential to Occur
Birds					
Ammodramus bairdii	Baird's sparrow	NM Threatened	McKinley, San Juan, Sandoval	Identified in a variety of shrubby short-grass habitats in northern New Mexico from desert grassland, prairies, and mountain meadows.	**Yes.** Seasonal migrant that could occur in suitable habitat along the ROW.
Flaco peregrinus anatum	American peregrine falcon	NM Threatened	McKinley, San Juan, Sandoval	Cliffs that generally exceed 200 feet in height near permanent surface water.	**Yes**. Potential foraging habitat for this species occurs within the ROW area.
Buteo regalis	Ferruginous hawk	BLM Sensitive	McKinley, San Juan, Sandoval	Nests in badlands, flat or rolling desert grasslands, and desert scrub. Most nests are on clay or rock pinnacles, small buttes, or short cliffs (<30 m height).	**Yes**. Potential foraging and known nesting habitat for this species occurs within the ROW area and on structures.
Lanius ludovicianus	Loggerhead shrike	BLM Sensitive	McKinley, San Juan, Sandoval	Found in open grasslands, deserts, riparian areas and woodlands. Nests in hedgerows, shrubs and trees often using bard wire fences for perching and hunting.	**Yes.** Large portions of the ROW can be considered suitable habitat.
Coccyzus americanus	Yellow-billed cuckoo	Federal Candidate	McKinley, San Juan, Sandoval	Breeds in riparian woodlands with dense understory vegetation.	No. Suitable habitat is not found within the ROW area due to lack of riparian woodland habitats and perennial water resources.
Empidonax traillii extimus	Southwestern willow flycatcher	Federally Endangered; NM Endangered	McKinley, San Juan, Sandoval	Riparian-obligate bird found in cottonwood/willow and tamarisk vegetation communities along rivers and streams.	**Yes**. Poor suitable migratory stopover habitat found in scattered patches of decadent tamarisk (*Tamarix sp.)*.No suitable nesting habitat in the area.
Athene cunicularia hypogea	Western burrowing owl	BLM Sensitive	McKinley, San Juan, Sandoval	Nests in ground burrows often using deserted prairie dog burrows in dry open grasslands or desert scrub.	**Yes**. Potential habitat for this species and burrows found within the ROW area.
Strix occidentalis lucida	Mexican spotted owl	Federally Threatened	San Juan	Nests in canyons and dense forests with multilayered foliage structure. Generally nest in older forests of mixed conifer or ponderosa pine/gambel oak type.	**No**. Suitable habitat is not found within the area due to lack of mixed conifer forests.

Species Scientific Name	Species Common Name	Status; Federal / BLM / NM	Counties (NM)	Habitat Requirements	Potential to Occur
Haliaeetus leucocephalus	Bald eagle	NM Endangered	McKinley, San Juan, Sandoval	Typically nest within trees in forested areas, especially mature and old-growth stands, adjacent (usually <2 km) to large bodies of water with suitable forage of waterfowl and fish; rarely uses cliff face adjacent to large body of water. Winter roost in large trees in forests, river bottoms, or near canyon rims, usually within a few miles of ponds, lakes and rivers with adequate prey.	**Yes**. Absent in the ROW area but found nearby.
Vireo vicinior	Gray vireo	NM Threatened	McKinley, San Juan, Sandoval	The Gray vireo is found through much of the western US and northern Mexico and utilizes juniper savanna and pinyon-juniper woodland habitats.	**Yes**. Potential habitat for this species found within limited portions of the ROW area.
Fish					
Gila robusta	Roundtail chub	Federal Candidate; BLM Sensitive, NM Endangered,	San Juan	Uses large rivers and present in low numbers in the San Juan, Mancos, La Plata and Animas rivers in New Mexico and Colorado.	**Yes.** Suitable habitat occurs in the San Juan River within the FC ROW.
Ptychocheilus lucius	Colorado pike-minnow	Federally Endangered with critical habitat, NM Endangered	San Juan	Large rivers with strong currents, deep pools and quite backwaters. On the Navajo Nation it has been documented throughout the San Juan River (SJR), from Shiprock to Lake Powell; the mouth of the Mancos River is used during the spring runoff period.	**Yes.** Suitable habitat occurs in the San Juan River within the FC ROW.
Xyrauchen texanus	Razorback sucker	Federally Endangered with critical habitat, NM Endangered	San Juan	Medium to large rivers with silty to rocky substrates. Species prefers strong currents and deep pools. This species is restricted to the Colorado River and a few of its warm-water tributaries.	**Yes.** Suitable habitat occurs in the San Juan River within the FC ROW.
Hybognathus amarus	Rio Grande Silvery	Federally Endangered with critical habitat, NM Endangered	McKinley, Sandoval	The silvery minnow is a pelagic spawning species; i.e., its eggs flow within the water column (Piatania and Altenbach 1998). The silvery minnow is the only surviving small, native pelagic spawning minnow in the Middle Rio Grande, and its range has been reduced to only 5 percent of its historic extent.	**No.** The ROW corridor does not occur within or near the Rio Grande or designated critical habitat.
Cataostomus plebeisu	Rio Grande sucker	NM Endangered			**No.** Suitable habitat is not within the area due to lack of perennial waters.

Species Scientific Name	Species Common Name	Status; Federal / BLM / NM	Counties (NM)	Habitat Requirements	Potential to Occur
Plants					
Astragalus humillimus	Mancos milk-vetch	Federally Endangered; NM Endangered	San Juan	Cracks of Point Lookout sandstone of the Mesa Verde series at 5,000- to 6,000-foot elevations.	**No.** This type of sandstone formation does not occur within the ROW area.
Asclepias sanjuanensis	San Juan milkweed	BLM Sensitive/NM Species of Concern	San Juan	Sandy loam soils in juniper savanna and Great Basin desert scrub at 5,000- to 5,500-foot elevations.	**Yes**. Suitable habitat occurs within ROW area
Sclerocactus mesae-verdae	Mesa Verde cactus	Federally Threatened; NM Endangered	San Juan	Highly alkaline soils in sparse shale or adobe clay badlands of the Mancos and Fruitland formations at 4,000- to 5,550-foot elevations.	**Yes**. Potential habitat occurs within ROW area.
Sclerocactus cloveriae ssp. *Brackii*	Brack's fishhook cactus	BLM Sensitive, NM Endangered	McKinley, San Juan	This species occurs principally on clay soils from near Angel's Peak south of the San Juan River. Potential habitat occurs along the same segments of line as Aztec gila.	**Yes**. Suitable habitat occurs in scattered areas along much of the northern half of the ROW.
Astragalus naturitensis	Naturita milk-vetch	NM Species of Concern	San Juan	Sand-filled pockets of sandstone slickrock and rimrock pavement along canyons in the pinyon juniper zone.	**Yes**. Suitable habitat is within the ROW area.
Aliciella Formosa	Aztec gilia	BLM Sensitive, NM Endangered	McKinley, San Juan	The Aztec gilia is a perennial herb approximately 2.75 to 12.00 inches tall. It is known to occur on Navajo lands in Kutz Canyon, south of Bloomfield. It often occurs within dry salt desert scrub communities.	**Yes**. Suitable habitat occurs in scattered areas along much of the northern half of the ROW.
Puccinellia parishii	Parish's alkali grass	BLM Sensitive	San Juan	Parish's alkali grass occurs within a very specific type of wetland soils in areas that have shallow groundwater that moves to the surface and evaporates, leaving behind an alkali crust.	**Yes**. Potential habitat occurs within a small area of ROW.

Golden Eagle

The golden eagle is protected under two Federal statutes MBTA and BGEPA as well as a NESL G3 species.

Distribution and habitat: Golden eagles are found year round throughout northwestern New Mexico. They typically inhabit mountainous or hilly terrain, hunting over open country. On the Navajo Nation, golden eagle nests most often occur on steep cliff ledges, usually ≥ 100 feet in height; although shorter cliffs may also be used (Ecosphere 2012b). In other parts of their range, golden eagles may nest in large trees, man-made structures, and rarely on the ground. Nest sites are adjacent to open habitats that support preferred prey populations such as black-tailed jackrabbits, desert cottontails, reptiles, and prairie dogs. Golden eagle territories in the west typically range from 12 to 20 square miles (Ecosphere 2012b).

Potential to occur: The relatively open shrublands and mild terrain of the FCPP to West Mesa transmission line ROW provide potential foraging habitat for golden eagles. Power line poles, rock escarpments, bluffs, and formations in and adjacent to the Project Area serve as potential perches. Similarly, the survey area provides potential foraging habitat for golden eagle. Five previously known nest sites occur within 0.6 to 1.5 miles from the line. Birds have also been observed flying over the FCPP to San Juan Generating Station transmission line near the FCPP.

Bald eagle

The bald eagle is protected under two Federal statutes MBTA and BGEPA as well as a NESL G2 and Hopi Cultural Sensitive species.

Distribution and habitat: Typically nest within trees in forested areas, especially mature and old-growth stands, adjacent (usually <2 km) to large bodies of water with suitable forage of waterfowl and fish; rarely uses cliff face adjacent to large body of water.

Potential to occur: Bald eagles are occasionally observed at the northern end of the FCPP to San Juan Generating Station transmission line ROW corridor near the most suitable habitat along the San Juan River or Morgan Lake. Bald eagles are likely to be only migrants through the area. The FCPP to West Mesa transmission line ROW corridor does not occur near any large river system that has the required habitat characteristics required by this species.

Ferruginous hawk

The ferruginous hawk is protected under one Federal statute MBTA, is listed as an NESL G3 species and is a BLM sensitive species.

Distribution and habitat: Ferruginous hawks occur year round throughout the FCPP to West Mesa transmission line ROW corridor, inhabiting dry, flat, or rolling grasslands and desert scrub (Ecosphere 2012c). This species prefers elevated nest sites; nests on the Navajo Nation are most often on rock pinnacles, buttes, or short cliffs. Nests have also been documented in juniper (*Juniperus* spp.) trees, transmission-line towers, and on the ground (Ecosphere 2012c). Nest sites are adjacent to habitats supporting populations of preferred prey species such as cottontails, jackrabbits, prairie dogs, and ground squirrels.

Potential to occur: Potential ferruginous hawk hunting and nesting habitat occurs throughout much of the FCPP to West Mesa Switchyard transmission line corridor. The relatively flat terrain and open vegetation along the transmission line ROW provide potential foraging habitat for ferruginous hawks. The transmission structures offer potential nesting habitat for ferruginous hawks. Six nests of ferruginous hawks were reported on transmission towers as well as numerous observations of birds with five occurring on Navajo Nation lands. The only ferruginous hawk nest on this segment of line was near the southern terminus on private lands in Sandoval County.

Southwestern willow flycatcher

The southwestern willow flycatcher is Federally listed as endangered and is also a NESL G2 species as well as a New Mexico endangered species.

Potential to occur: The observation of a flycatcher near Morgan Lake is more than a mile from the FCPP to West Mesa Switchyard transmission line. The only other marginal habitat is located near the West Mesa Switchyard transmission line between poles FW 757-758. These ROW areas lack the vegetative structure and density to support breeding flycatchers. Flycatcher territories and nests typically are adjacent to open water, cienegas, marshy seeps, or saturated soil, and within riparian areas rooted in standing water (Ecosphere 2013). This species is not likely to occur.

Baird's sparrow

The Baird's sparrow is a New Mexico threatened species.

Distribution and habitat: Identified in a variety of shrubby short-grass habitats in northern New Mexico from desert grassland, prairies, and mountain meadows. This species is considered a migrant and may winter in portions of northern New Mexico.

Potential to occur: Wintering habitat is limited in portions of the FCPP to West Mesa Switchyard transmission line ROW near poles FW 609-611 and FW637-639 but overall the corridor lack suitable habitat and the species is not likely to occur.

Loggerhead shrike

The loggerhead shrike is a BLM sensitive species.

Distribution and habitat: Found in open grasslands, deserts, riparian areas and woodlands. Nests in hedgerows, shrubs and trees and often uses bard wire fences for perching and hunting. Its habitat ranges from low elevation agricultural to montane meadows and is considered a permanent resident in New Mexico.

Potential to occur: Large portions of the FCPP to West Mesa Switchyard transmission line ROW can be considered potential habitat for this species. However, multiple surveys over much of the corridor resulted in the observance of only one bird and it was not on BLM lands.

Gray vireo

The gray vireo is a New Mexico threatened species.

Distribution and range: The Gray vireo is found through much of the western US and northern Mexico and utilizes juniper savanna and pinyon-juniper woodland habitats. In New Mexico this species is only found seasonally during the months of April to September.

Potential to occur: Potential gray vireo habitat is scattered along the FCPP to West Mesa Switchyard transmission line ROW with the best habitat occurring between poles FW 257-265, FW 324-337, FW 714-736 and FW 918-924. Five occupied territories were discovered during the field surveys and located on BLM lands at the northern portion of this corridor segment.

Western burrowing owl

The western burrowing owl is a BLM sensitive species.

Distribution and habitat: The western burrowing owl is found throughout the western US. Its preferred habitat in New Mexico includes plains, treeless valleys and mesas. It occupies burrows that were dug by various small mammals including prairie dogs, ground squirrels and badgers. They will occupy rural as well as urban settings like airports and baseball fields.

Potential to occur: Potential habitat for this species occurs throughout the FCPP to West Mesa Switchyard transmission line ROW corridor; however, only one burrowing owl nest site was found in a prairie dog colony on Navajo Nation lands during field surveys. Current population numbers are down for this species in New Mexico so if the population was to increase some of the potential habitat could become occupied.

Peregrine falcon

The American peregrine falcon is a New Mexico threatened species.

Distribution and habitat: In New Mexico this species breeds in mountainous areas and nests on tall, steep, rocky cliffs associated with forested or woodland pockets and in close proximity to water. It preys on song birds and waterfowl taking its prey on the wing. They have been observed near the FCPP.

Potential to occur: This species is known to breed on the Navajo Nation within 1 mile of poles FW 1-12. The species may also occur in other portions of the San Juan basin where suitable cliff habitat is found. No nests of this species were found on any of the FCPP to West Mesa transmission structures. The potential habitat along this segment of the FCPP to West Mesa Switchyard transmission line ROW would be between poles FW 576-731 where sandstone ridges and mesas exist.

Special-Status Bat Complex - Spotted Bat, Big-Freetail Bat, Small-footed bat, Long-Legged Myotis, Yuma Myotis, Occult Little Brown Bat, and Fringed Myotis.

The Spotted Bat is New Mexico threatened and the Long-legged myotis, small-footed myotis, Yuma myotis, Occult little brown bat, fringed myotis and Big-freetail bat are all BLM sensitive species.

Distribution and habitat: Bats are generally found roosting in cracks, crevices and snags or on man-made structures. The habitat likely to be utilized by bats for roosting is primarily the small sandstone outcrops that are scattered throughout the central and southern portions of the FCPP to West Mesa transmission line corridor. Although at least marginal potential habitat for these species of bats existed, none was found within the Project Area, nor was any bat use indicated within the FCPP to West Mesa transmission line corridor based on an extensive survey.

Potential to occur: It is likely that no more than 100 acres of habitat along the entire length of the line that would be considered suitable roosting areas for these bat species. Most of the marginally suitable potential habitat would be found along the central and southern portions of the FCPP to West Mesa Switchyard transmission line ROW.

Plants

Mesa Verde Cactus

The Mesa Verde cactus is Federally threatened, a NESL G2 species, and New Mexico threatened.

Distribution and habitat: The occurrence of Mesa Verde cactus is documented in San Juan County, New Mexico and Montezuma County, Colorado. It is generally found in salt-desert scrub communities, typically in the Fruitland and Mancos shale formations. It is most frequently found on the tops of hills or benches and along slopes

Potential to occur: Potential habitat for Mesa Verde cactus occurred along two portions of the FCPP to San Juan Generating Station transmission line corridor between poles FC38-42 and FC5-18. Four Mesa Verde cactus population sites were found scatted between poles FC13-18.

San Juan Milkweed

The San Juan milkweed is a BLM sensitive species and New Mexico species of concern.

Distribution and habitat: San Juan milkweed usually occurs in sandy loam soils in coniferous woodlands, juniper savannas or Great Basin desert scrub communities at 5,000- to 6,200-foot AMSL elevations in

San Juan County New Mexico. Suitable habitat is likely to occur along the entire FCPP to West Mesa Switchyard transmission line corridor.

Potential to Occur: While suitable habitat has the potential to occur along the FCPP to West Mesa Switchyard transmission line corridor the only two populations found were on the northern end of the line near poles FW260 and FW 269 on state and BLM land within the Navajo Nation and at the southern limits of its known range. Not likely to occur within or adjacent to the ROW for this segment of the FCPP to West Mesa Switchyard transmission line.

Brack's fishhook cactus

The Brack's fishhook cactus is a BLM sensitive and New Mexico endangered species.

Distribution and habitat: This species occurs primarily on clay soils or sandy clay strata in sparse shadscale scrub at 5,000- to 6,000-foot AMSL elevations and often occurs in similar habitat as Aztec gilia.

Potential to Occur: Suitable habitat for Aztec gilia and this species occurred in scatted areas along the northern half of the FCPP to West Mesa Switchyard transmission line corridor but no populations were found during field surveys. This segment of line is south of any known range for this species but potential exists for occurrence in areas of suitable habitat.

Naturita milk-vetch

The Naturita milk-vetch is a New Mexico species of concern.

Distribution and habitat: This species occurs at 5,400- to 6,200-foot AMSL elevations in southern Colorado and San Juan and McKinley counties in New Mexico. It is found in sheet sandstone outcrops.

Potential to Occur: No suitable habitat for this species was found within or adjacent to the FCPP to West Mesa Switchyard transmission line corridor so it is not likely to occur.

Aztec gilia

The Aztec gilia is a BLM sensitive and New Mexico endangered species.

Distribution and habitat: This species is known to occur only in San Juan County, New Mexico and can be found at 5,000- to 6,400-foot AMSL elevations in sandy-clay outcrop soils in salt desert scrub communities.

Potential to Occur: Suitable habitat for Aztec gilia occurred in scatted areas along the northern half of the FCPP to West Mesa Switchyard transmission line corridor but no populations were found during field surveys. This segment of line is south of any known range for this species.

Parish's alkali grass

The Parish's alkali grass is a BLM sensitive species.

Distribution and habitat: Parish's alkali grass occurs within a very specific type of wetland soils in areas that have shallow groundwater that moves to the surface, evaporates and leaves behind an alkali crust. It has been documented in alkaline seeps and seasonally wet areas such as washes.

Potential to occur: Two arroyos on the northern quarter of the FCPP to West Mesa Switchyard transmission line have marginal habitat for this species but they are on Navajo Nation land. No other suitable habitat and no populations of this species were found during surveys so it is unlikely to occur.

Fish

The FCPP to San Juan Generating Station ROW spans the San Juan River and thus, crosses over potential habitat for Colorado pikeminnow, razorback sucker, and roundtail chub. Therefore, each of these species are discussed below.

Colorado Pikeminnow

The Colorado pikeminnow (*Ptychocheilus lucius*) is Federally listed as endangered and is a NESL G2 species.

Distribution and habitat: The Colorado pikeminnow is a cyprinid, endemic to large and medium sized rivers in the Colorado River Basin. Its current distribution includes portions of the Green, Yampa, Little Snake, White, Price and lower Duchensne, Gunnison, Delores, and upper Colorado rivers, as well as the San Juan River. Within the San Juan, it has been observed from Lake Powell, as far upstream as Farmington. Adults require pools, deep runs and eddy habitats maintained by high spring flows. These flows flush sediments from spawning areas and maintain channel and habitat diversity, including side channel and backwater areas that are the primary rearing habitat of larvae and juveniles. The species can make extended migrations of hundreds of kilometers to spawn. Larval fish are moved downstream by currents and find suitable rearing areas in backwaters and side channels.

Potential to Occur: The San Juan River Recovery Implementation Program has documented Colorado pikeminnow in the San Juan River from upstream of the Animas River confluence downstream to Lake Powell (Ryden 2012, Gilbert et al. 2012).

Razorback sucker

The razorback sucker Federally listed as endangered and is a NESL G2 species.

Distribution and habitat: The razorback sucker is a member of the sucker family, Catostomidae, and is endemic to the Colorado River Basin. Its current distribution includes portions of the Green, Yampa, White, Duchesne, upper Colorado, Gunnison, and San Juan River in the upper Colorado River basin. It is also found in Lake Mohave, Lake Mead and in the lower Colorado River from Lake Havasu to Davis Dam, and has been stocked into the Verde and Salt rivers in the lower Colorado River basin. Within the San Juan, it has been observed from Lake Powell, as far upstream as the PNM weir. Adults use deep runs, eddies, backwaters and flooded off channel area in the spring; runs and pools during the summer, and low-velocity runs, pools and eddies in the winter. This species make long migrations to spawn, and young are dispersed downstream by flow. Young fish require low velocity, warm, shallow habitats, associated with backwaters, tributary mouths, and side channels.

Potential to Occur: The San Juan River Recovery Implementation Program has documented razorback sucker in the San Juan River from upstream of the Animas River confluence downstream to Lake Powell (Ryden 2012, Gilbert et al. 2012).

Roundtail Chub

The roundtail chub (Gila robusta) is a NESL G2 species. This species in the Project Area is not listed under the Federal ESA[11], but the lower Colorado River basin district population segment is a candidate species for listing under the Federal ESA since 2009. Critical habitat has not been designated.

Distribution and habitat: The roundtail chub is a cyprinid, endemic to the Colorado River basin. It historically occurred in two subpopulations, one in the upper Colorado River and the other in the Lower Colorado River, with a gap of some 275 miles between the two populations (74 FR 32351). The species typically inhabits riverine habitats, where it is generally found in deep pools and eddies along large streams. They are often associated with over elements. They are tolerant of a wide range of temperatures, with an upper thermal tolerance of over 36°C. Spawning occurs the spring and early summer in areas of slow to moderate water velocity. Individuals may live up to 7 years. The species is omnivorous feeding on aquatic and terrestrial invertebrates, detritus, fish, algae and aquatic plants.

[11] The lower Colorado River basin district population segment has been a candidate for listing under the Federal ESA since 2009 (74 FR 32351)

Potential to Occur: The San Juan River Recovery Implementation Program has documented a single roundtail chub in the San Juan River in sampling in 2011, just downstream of McElmo Creek. It is likely that this fish was stocked on McElmo Creek by the Colorado Division of Parks and Wildlife (Gilbert et al. 2012). This collection was the first of a roundtail chub on the San Juan River since 1998 and, thus, the species is not likely to occur in the Project Area.

4.8.3 Changes to Special-Status Species Affected Environment Post-2014

Two completed federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions; and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared in the following Section. Neither of these completed federal actions would change the affected environment for special-status species.

4.8.4 Environmental Consequences

This section describes impacts to special-status species that have a likelihood of occurrence within the Project Area and resulting from each of the Project components. Impacts were determined through a comparison of the anticipated area of disturbance, available habitat, and potential for species to occur. Potential impacts to aquatic species were evaluated based on a review of the results of deposition modeling for the FCPP and the ERAs prepared for the proposed Project (AECOM 2013c, h), described in detail in Section 4.6. The following criteria are used to determine impacts:

- *Major.* Effects that would limit recovery of a listed species; result in the lethal take of individuals of listed species; or impair the reproductive success of a listed species.
- *Minor.* For federally listed species, any disturbance that causes an individual to move from suitable habitat, as long as the movement occurs outside of breeding season. Minor losses or disturbance of foraging habitat.
- *Negligible.* Impacts of less magnitude, but still predictable under current technology (e.g., computer models) or measurable under commonly employed monitoring technology.
- *None.* No adverse effects are predicted, or effects are below a level that can be measured.

4.8.4.1 Alternative A – Proposed Action

Navajo Mine

A review of the surveys for the biological resources of the Pinabete Permit Area (Ecosphere 2013) indicated no suitable habitat or potential for occurrence for any of the plant, amphibian, invertebrate, or fish species on the list. Based on the information provided in the biological reports, the known historic range, and known suitable habitat, the only species that require analysis are the black-footed ferret, southwestern willow flycatcher, golden eagle and ferruginous hawk. The potential for Project-related impacts to these species are discussed below.

Wildlife

Black-footed ferret

Prairie dog colonies of sufficient size exist to support black-footed ferret in the permit areas. Repeated nocturnal spotlighting surveys and prairie dog town mapping has occurred since 1987. Despite the common occurrence of prairie dogs on leased areas no evidence exists of black-footed ferrets. No black-footed ferrets have ever been documented on leased property. No impacts are likely to this species.

Golden Eagle

Golden eagles typically prefer steeper cliff walls than are present in the permit areas so direct impacts to suitable nesting substrate are unlikely. Approximately 4,104 acres of potential foraging habitat for golden eagles would be altered during the 25-year mining period, but would be reclaimed to approximate premining conditions once mining is completed. Based on the amount of suitable habitat in the surrounding area, impacts resulting from the alteration of foraging habitat would be low and long term. Monitoring of golden eagle nests, as required under the SMCRA and in coordination with NNHP, would continue to occur in the Navajo Mine Lease Area. Golden eagles may avoid the permit areas during mining activities due to noise associated with human activity, blasting, machinery operation, and vehicular traffic. The proposed electric power line would be constructed using the Navajo Nation Raptor Electrocution Prevention Regulations (Ecosphere 2013; NNDFW 2008), and so no impacts associated with these power lines are associated.

Based on the availability of habitat for this species, lack of suitable nesting habitat in the immediate Project Area, and the ability of this species to quickly travel large distances, some disturbance of individuals may occur, but none are expected to be otherwise affected by the Project. No population-level impacts to golden eagles are expected to result from extending mining into the Pinabete Permit Area and continued authorization of the Navajo Mine and no loss of species viability would occur rangewide. Therefore, any affects to Golden eagle would be minor and no mitigation is required.

Ferruginous hawk

Three potential ferruginous hawk nesting areas that include seven historic nests occur along the perimeter of the Project Area. Monitoring of ferruginous hawk nests—as required under the SMCRA and in coordination with NNHP—would continue to occur in the Navajo Mine Lease Area. Direct impacts to ferruginous hawks would include the alteration of approximately 4,104 acres of suitable foraging habitat. Reclamation would mitigate the loss of foraging habitat by restoring habitat for prey species once an area has been mined. Therefore, impacts to foraging habitat would be low and short to long term (more than 25 years). Also, a long-term loss of vegetation would be associated with the realignment of 2.8 miles of Burnham Road. Badland habitats within the Pinabete Permit Area provide potential nesting habitat for ferruginous hawks. Approximately 1,481 acres of badlands would be permanently removed from the Pinabete Permit Area, resulting in an irretrievable loss of potential nesting habitat for ferruginous hawks. Given the abundance of suitable nesting habitat within the Project Area and surrounding multistate region, impacts from this amount of habitat loss would be low. Ferruginous hawks may avoid the permit areas during mining activities due to noise associated with human activity, blasting, machinery operation, and vehicular traffic. Ferruginous hawks are sensitive to human disturbance, especially during the breeding season (Ecosphere 2013). The ferruginous hawk population, monitored by mine personnel and the NNDFW, has been relatively constant and stable since annual raptor monitoring was initiated. Mine operators would follow the Navajo Nation's *Ferruginous Hawk Management Guidelines,* for any ferruginous hawk nests within the analysis area. The electric power line would be constructed using the Navajo Nation Raptor Electrocution Prevention Regulations.

Based on the availability of habitat for this species, lack of suitable nesting habitat in the immediate Project Area, and the ability of this species to quickly travel large distances, some disturbance of individuals may occur, but none are expected to be otherwise affected by the Project. No population level impacts to ferruginous hawks are expected to result from extending mining into the Pinabete Permit Area and continued authorization of the Navajo Mine and no loss of species viability would occur rangewide. Therefore, there would be minor impacts on the species and no mitigation is required.

Southwestern willow flycatcher

Only marginally suitable migratory stopover habitat is present; it is confined to Cottonwood Arroyo, Chinde Wash, and other ephemeral waterways as well as in widely scattered patches of tamarisk

(*Tamarix* sp.) in Pinabete arroyo and at a small stock pond in the southern portion of the permit areas. These areas lack the vegetative structure and density to support breeding flycatchers, and do not meet the hydrologic parameter for suitable habitat and, thus, are not likely to be utilized except as a migratory stopover for short periods.

The marginal habitat quality in the decadent tamarisk stands found in the outer edges leased area may only be utilized by southwestern willow flycatcher for short periods. Continued operation of the Navajo Mine and authorization of the Pinabete Permit Area is not likely to impact this species.

Plants

No special-status plants are known to occur within the Navajo Mine Lease Area.

Fish

No special-status fish are known to occur within the Navajo Mine Lease Area and the mine employs appropriate BMPs to prevent runoff of sediment or toxins from the mine to water bodies supporting sensitive fish species. Therefore, no impacts from this action would occur to special-status fish species.

FCPP

No new ground-disturbing activities area anticipated to be carried out within the FCPP Lease Area, except for the expansion of the DFADAs. Units 1 through 3 were shut down December 31, 2013. Units 4 and 5 would continue to operate with increased emissions treatment. Construction of the new emissions treatment facilities is expected to occur on highly disturbed areas within or adjacent to the FCPP. FCPP would continue to use water from the San Juan River for its processes and would continue to discharge cooling water to Morgan Lake.

FCPP Air Emissions

The FCPP would continue to emit some metals, PAHs and dioxins from its stacks. Two ERAs were conducted to evaluate potential ecological impacts associated with future emissions from the combustion of coal at the FCPP (AECOM 2013c, h). One ERA was conducted for both terrestrial and aquatic environments within the area identified by air dispersion modeling as having a 1 percent future increase in soil metals concentrations above current condition (baseline) metals concentrations (AECOM 2013c). This area was defined as the deposition area, and the ERA is hereafter referred to at the Deposition Area ERA. The other ERA was conducted for mercury, selenium and arsenic in the aquatic environment of the San Juan River basin, both within the deposition area and downstream of the deposition area into the San Juan River arm of Lake Powell (AECOM 2013c). This effort considered the contribution of the FCPP, as well as other regional sources of arsenic, mercury, and selenium, and global sources of mercury. This ERA is hereafter referred to as the San Juan River ERA. For both ERAs, the aquatic environment may include receptors that live in the aquatic environment as well as those that forage within the aquatic environment.

The ecological risks associated with exposure to a series of COPECs were evaluated. The COPECs were selected based on EPRI studies evaluating the emission rates and associated human health risks associated with coal fired power plants (EPRI 2009, 2011, as cited in AECOM 2013c). For each COPEC, a HQ was calculated using EPA guidelines for ecological risk assessments to evaluate the potential risk associated with those COPECs to different groups of plants and animals (receptors) in different environments (AECOM 2013c, h). HQs greater than 1 indicate a potential for ecological risks to occur; HQs less than one indicate that ecological risks are not likely. For both the Deposition Area ERA and the San Juan River ERA all HQs associated with future FCPP emissions were less than 1. Therefore, the ERAs indicate that ecological impacts associated with future FCPP emissions are not likely to occur for any special-status wildlife, vegetation or fish species.

While the ERAs identified a number of COPECs with elevated HQs related to existing conditions, the FCPP did not contribute significantly to this risk. It does contribute, to a minor degree, to the cumulative risk posed by these COPECs, as discussed in Section 4.18, Cumulative Impacts.

Dry Fly Ash Disposal Area

Operation of the FCPP and construction of the proposed DFADAs would entail an increase in human presence and ground disturbance above existing levels. Based on the known historic range or known suitable habitat, further analysis is warranted for one plant and three avian species with some potential to occur in the ROI: Mesa Verde cactus, southwestern willow flycatcher, golden eagle and ferruginous hawk. These species are evaluated below.

Wildlife

Southwestern Willow Flycatcher

Suitable, low-quality southwestern willow flycatcher foraging habitat occurs within the survey area and in habitat patches in the adjacent Chaco River. No suitable nesting habitat exists within this area. Individual southwestern willow flycatchers are only expected to occur in the area as they migrate through and are not expected to spend a substantial amount of time there. Expansion of the DFADA would affect only a limited portion of the species range. Therefore, impacts are expected to be low over the long term.

Given the limited suitable habitat within the DFADA and this species distribution, expansion of the DFADA would result in impacts to limited poor quality habitat, but would not be expected to result in substantive impacts to any individual, the loss of any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide. Moreover, the ERAs indicate that ecological impacts associated with future FCPP emissions are not likely to affect for any special-status wildlife species. Therefore, there would be negligible effects to Southwestern Willow Flycatcher, and no mitigation is required.

Golden Eagle

Golden eagles typically prefer steeper cliff walls than are present near the Project Area so direct impacts to nesting eagles are unlikely. Approximately 1,450 acres of potential foraging habitat for golden eagles would be altered during the development of the five ash disposal sites. Based on the amount of suitable habitat in the surrounding area, impacts resulting from the alteration of foraging habitat would be low and long term. Golden eagles are likely to avoid the FCPP during operational activities due to noise associated with human activity, machinery operation, and vehicular traffic.

Based on the availability of habitat for this species, lack of suitable nesting habitat in the immediate Project Area, and the ability of this species to quickly travel large distances, some disturbance of individuals may occur, but none are expected to be otherwise affected by the Project. No population level impacts to golden eagles are expected to result from expanding the ash disposal sites or continued operation of the FCPP. Impacts are not likely to result in a loss of species viability rangewide. Moreover, the ERAs indicate that ecological impacts associated with future FCPP emissions are not likely to affect for any special-status wildlife species. Therefore, there would be negligible adverse effects to the species and no mitigation is required.

Ferruginous hawk

The potential ferruginous hawk nesting areas and two historic territories occur outside but close to the perimeter of the analysis area. Direct impacts to ferruginous hawks would include the alteration and loss of approximately 1,450 acres of suitable foraging habitat for the expansion of the ash disposal sites. Given the presence of suitable foraging and nesting habitat within the analysis area and surrounding region, impacts from Project-related habitat loss would be low. Ferruginous hawks may avoid the Project Area due to noise

associated with human activity, machinery operation, and vehicular traffic. Ferruginous hawks are sensitive to human disturbance, especially during the breeding season.

Based on the availability of habitat for this species, lack of suitable nesting habitat in the immediate Project Area, and the ability of this species to quickly travel large distances, some disturbance of individuals may occur, but none are expected to be otherwise affected by the Project. No population level impacts to ferruginous hawks are expected to result from expanding the ash disposal sites and continued operation of the FCPP. Impacts are not likely to result in a loss of species viability rangewide. Moreover, the ERAs indicate that ecological impacts associated with future FCPP emissions are not likely to affect for any special-status wildlife species. Therefore, there would be negligible adverse effects to the species and no mitigation is required.

Plants

Mesa Verde cactus

No Mesa Verde cactus has been recorded in the DFADA. Approximately 204 acres of potential habitat for the species would be modified, resulting in long-term impacts. No Mesa Verde cactus was observed during focused surveys of this habitat in 2012. Expansion of the DFADA would affect only a limited portion of the species range. Therefore, impacts to Mesa Verde cactus populations are expected to be low over the long term.

Given the limited suitable habitat within the DFADA and this species distribution, expansion of the DFADA would result in impacts to limited suitable habitat, but would not be expected to result in the loss of any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide. Moreover, the ERAs indicate that ecological impacts associated with future FCPP emissions are not likely to affect for any special-status vegetation species. Therefore, there would be minor adverse effects to the species and no mitigation is required.

Fish

No special-status fish occur within the DFADA and the operation of this area would not affect fisheries in downstream areas. Moreover, ERAs indicate that ecological impacts associated with future FCPP emissions are not likely to affect special-status fish species, so no mitigation is required.

Transmission Lines

Renewal of the ROW leases will have no direct impact on vegetation communities or special-status species habitat within the APS or PNM ROWs. Vegetation management activities will continue to be conducted as a regular part of routine operations to ensure reliability and safety across the length of the transmission lines. Vegetation management within the ROW will include removal of taller growing woody vegetation within or adjacent to the ROWs and would result in minimal changes to the vegetation communities or habitat occurring within the ROW. Ground-disturbing activities would also be minimal and only associated with the required routine maintenance activities.

Both APS and PNM also have internal wildlife special-status species and avian protection programs that identify best management practices (BMPs) and avoidance measures, as discussed in Section 4.7, Wildlife. The BMPs and avoidance measures for transmission line maintenance activities are intended to reduce impacts to special-status species that may utilize habitat within the ROW or protected avian species that nest on the transmission structures.

The following discusses the potential impacts to special-status species with some potential to occur in the ROI. The APS transmission lines are discussed first, followed by the PNM transmission lines.

APS Lines: FCPP to Moenkopi Substation and FCPP to Cholla Substation

Wildlife

Pronghorn Antelope

Much of the transmission line ROW could be considered potential habitat for pronghorn; however, no indications of pronghorn (tracks, droppings, or direct observation) were found within the transmission line corridor during the 2012 surveys. No pronghorn have been documented on Navajo Nation lands and results of data request from NNHP indicate Coconino as the only county with potential for occurrence. Any maintenance associated disturbance impacts would be temporary and of short duration.

Due to the mobility of this species and their broad distribution, continued operation of the transmission lines and performance of required maintenance activities as previously authorized would not result in any new or additional impacts to suitable habitat, or any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be negligible adverse effects to the species and no mitigation is required.

Golden Eagle

The relatively open shrublands and mild terrain of the transmission ROW provide potential foraging habitat for golden eagles. Power line poles, rock escarpments, bluffs, and formations in and adjacent to the Project Area serve as potential perches and nest site. No golden eagles or nests were recorded within the survey area during the field studies by APS.

Impacts to this species would occur only if required maintenance activities and associated disturbances were conducted during nesting periods and nests were located on the transmission structures or in close proximity. However, the restrictions of the MBTA and the BGEPA, which prevent activities that would disturb birds on an active nests or the nest itself during the breeding season would apply. All transmission structures are designed with adequate line clearances to prevent electrocutions and meet Avian Power Line Interaction Committee (APLIC) design guidelines so no risk of electrocution exists. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be negligible adverse effects to the species and no mitigation is required.

Bald Eagle

Bald eagles are occasionally observed at the northern end of the ROW corridor near the most suitable habitat along the San Juan River or Morgan Lake. Bald eagles are likely to be only migrants through the area and not likely to be impacted by maintenance activities.

Impacts to this species would occur only if required maintenance activities and associated disturbances were conducted during nesting periods and nests were located on the transmission structures or in close proximity. Such activities are prohibited under the MTBA and the BGEPA, which prevents activities that have the potential to disturb a bird on an active nest or the nest itself. If such activities are essential it would require separate coordination with the NNDFW or NMGF and Arizona Game and Fish Department, and possibly the USFWS, depending on the location of the structures. All transmission structures are designed with adequate line clearances to prevent electrocutions and meet APLIC design guidelines. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

Red-tailed hawk

This species is common within the Navajo Nation and along the transmission line ROWs. The relatively flat terrain and open vegetation along the transmission line ROW provide potential foraging habitat and transmission structures may provide nesting substrate for red-tailed hawks.

Impacts to this species would occur only if required maintenance activities and associated disturbances were conducted during nesting periods and nests were located on the transmission structures or in close proximity. Such activities are prohibited under the MTBA, which prevents activities that have the potential to disturb a bird on an active nest or the nest itself. If such activities are essential it would require separate coordination with the NNDFW or NMGF and Arizona Game and Fish Department, and possibly the USFWS, depending on the location of the structures. All transmission structures are designed with adequate line clearances to prevent electrocutions and meet APLIC design guidelines. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a minor adverse effect to the species and no mitigation is required.

Ferruginous hawk

Ferruginous hawks occur year round throughout the Navajo Nation, inhabiting dry, flat, or rolling grasslands and desert scrub (Ecosphere 2012b). This species prefers elevated nest sites and could utilize transmission-line towers. One record exists of a ferruginous hawk nest on a crossarm of a transmission tower.

Impacts to this species would occur only if required maintenance activities and associated disturbances were conducted during nesting periods and nests were located on the transmission structures or in close proximity. Such activities are prohibited under the MTBA, which prevents activities that have the potential to disturb a bird on an active nest or the nest itself. If such activities are essential it would require separate coordination with the NNDFW or NMGF, and possibly the USFWS, depending on the location of the structures. All transmission structures are designed with adequate line clearances to prevent electrocutions and meet APLIC design guidelines. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a minor adverse effect to the species and no mitigation is required.

Plants

Mesa Verde Cactus

The habitat for the Mesa Verde cactus along the existing transmission lines was surveyed as described above. Ten potential habitat locations, identified by the habitat assessment model, were surveyed along the FCPP to Moenkopi Substation transmission line and two potential habitat locations were surveyed along the FCPP to Cholla Substation line. Survey results identified 11 locations as low quality habitat and one location was moderate quality habitat. No populations of the target species were observed along the ROWs during field surveys.

Given the limited suitable habitat within the ROW area and this species distribution, continued operation of the transmission lines and performance of required maintenance activities as previously authorized and using current BMPs could result in minor impacts to individuals but would not result in any new or additional impacts to the limited suitable habitat, or any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide.

Fickeisen's Plains Cactus

Five potential habitat locations identified by the habitat assessment model were projected to occur, along the FCPP to Moenkopi Substation transmission line ROW. These five locations were surveyed and identified as low quality habitat. No individuals of the target species were observed during field surveys.

Given the limited suitable habitat within the ROW area and this species distribution, continued operation of the transmission lines and performance of required maintenance activities as previously authorized could result in minor impacts to individuals but would not result in any new or additional impacts to the limited suitable habitat, or any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

Mancos Milk-vetch

The habitat for the Mancos Milk-vetch along the existing transmission lines was surveyed. Two potential habitat locations, as identified by the habitat assessment model, along the FCPP to Moenkopi Substation transmission line and four along the FCPP to Cholla Substation line were surveyed and identified as high quality habitat (five locations) and one location was moderate/low quality habitat. One individual population of the target species was observed along the FCPP to Cholla line during field surveys.

One population of Mancos milk-vetch was identified below and around FCPP to Cholla line structure MP 18. The population consisted of 8 colonies totaling 15 individuals. Some of the colonies covered a large area but only had approximately 20 percent living plants. The continued operation of the transmission lines and performance of required maintenance activities as previously authorized, along with associated BMPs could result in minor impacts to individuals but would not result in any new or additional impacts to the limited suitable habitat, known populations or any population level impacts. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

Naturita Milk-vetch

Habitat for the Naturita Milk-vetch along the existing transmission lines was surveyed as described above. Three potential habitat locations identified by the habitat assessment model, along the FCPP to Moenkopi Substation transmission line and four potential habitat locations along the FCPP to Cholla Substation line were surveyed. Two of these locations were identified as low quality habitat, three high-quality habitat and one each were moderate- or moderate/low-quality habitat. No populations of the target species were observed along the ROWs during field surveys.

A portion of the suitable habitat is high to moderate quality but no populations were observed within the ROWs in these higher quality suitable habitat areas. Given the limited amount of suitable habitat identified and because no populations were found within the ROW area and this species' distribution, continued operation of the transmission lines and performance of required maintenance activities is not likely to result in a loss of species viability rangewide. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

Round Dunebroom

The habitat for the Round Dunebroom along the existing transmission lines was surveyed, as described above. Three potential habitat locations were identified along the FCPP to Moenkopi line ROW by the habitat assessment model and surveyed. Survey results identified two locations as high quality habitat and one location was moderate/low quality habitat. No populations of the target species were observed along the ROWs during field surveys.

No populations of the target species were observed along the ROWs during field surveys and only limited suitable habitat was found within the ROW area. Continued operation of the transmission lines and performance of required maintenance activities as previously authorized utilizing current BMPs could result in minor impacts to individuals but would not result in any new or additional impacts to the limited habitat, or any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a negligible adverse effect to the species and no mitigation is required. Fish

No special-status fish occur within the FCPP to Moenkopi or Cholla Sun Station ROWs and proposed actions within the ROW would, therefore, have no effect on such species.

PNM Lines: FCPP to San Juan Generating Station and FCPP to West Mesa Switchyard

Wildlife

Pronghorn Antelope

The pronghorn is wide-ranging, mobile and their potential habitat occurs throughout the region. Much of the FCPP to West Mesa Switchyard and FCPP to San Juan Generating Station transmission line ROWs could be considered potential habitat for pronghorn however, no indications exist of pronghorn (tracks, droppings, or direct observation) within the transmission line corridors during the 2012 surveys. The occupied range of antelope on the Navajo Nation includes only the checkerboard lands in New Mexico. The maintenance activities associated with the ROW would have minimal disturbance impacts on any pronghorn within or along the ROW, as this species is highly mobile and could easily avoid any disturbance.

Although extensive potential habitat exists along the line corridor, no pronghorn were found on Navajo lands or any other land holdings along the corridor. None of the Project activities are likely to alter pronghorn habitat or preclude pronghorn use of Navajo land in the future. Since no pronghorn were present in the ROI and no permanent loss of suitable habitat for the species would occur, no effect on pronghorn is anticipated at this time.

Golden eagle

Hunting habitat for golden eagles occurs along the entire length of the FCPP to West Mesa Switchyard transmission line ROW. Although golden eagles could occur anywhere in the Project Area, only a few areas along the transmission line corridor provide suitable nesting habitat for this species. Aside from large man-made structures such as the FCPP and transmission line structures, potential golden eagle nesting habitat also occurs where high ridges or mesa sides for cliffs of sufficient height where golden eagles nest exist. The birds have been observed using the transmission structures as perches. Five documented historic nest locations exist and one newly discovered nest is located between 0.6 to 1.5 miles from the FCPP to West Mesa Switchyard ROW corridor, but none are located on Navajo lands. Impacts to golden eagles would occur if required maintenance activities and associated disturbances were conducted during nesting periods and nests were located on the transmission structures or in close proximity. Such activities are prohibited under the MTBA, which prevents activities that have the potential to disturb a bird on an active nest or the nest itself. If such activities are essential it would require separate coordination with the NNDFW or NMGF, and possibly the USFWS, depending on the location of the structures. All transmission structures are designed with adequate line clearances to prevent electrocutions and meet APLIC design guidelines so no risk of electrocution exists.

None of the six documented golden eagle nests adjacent to the transmission line corridor are on Navajo lands, within the FCPP to West Mesa Switchyard transmission line corridor or within 0.5 mile of the corridor. Navajo Nation guidelines for avoiding impacts to golden eagles call for no brief activity within 0.37 mile of a nest site, no light activity within 0.5 mile of a nest site, and no heavy activity within 0.75 mile of a nest site from January 15 to June 15. Continued operation of the transmission lines and performance of required maintenance activities as previously authorized would not result in any new or additional impacts to the suitable habitat, or any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

Ferruginous Hawk

Hunting and nesting habitat for ferruginous hawks occurs along the entire length of the FCPP to West Mesa Switchyard transmission line ROW. The birds have been observed using the transmission structures as perches and for nesting. During the course of the survey, six active ferruginous hawks were observed. All six of these nest sites were on FCPP to West Mesa transmission line poles and five were located on Navajo Nation lands. Impacts to this species would occur if required maintenance activities and associated disturbances were conducted during nesting periods and nests were located on the transmission structures

or in close proximity. All transmission structures are designed with adequate line clearances to prevent electrocutions and meet APLIC design guidelines so no risk of electrocution exists.

Five of the six documented ferruginous hawk nests on the transmission line structures are on Navajo lands. Navajo Nation guidelines for avoiding impacts to ferruginous hawks call for no disturbance activity within 0.50 mile of a nest site, from March 1 to June 15. Heavy activity can occur within 0.75 mile of an occupied nest site and loud activity should not occur within 1 mile of an active nest site. One ferruginous hawk nests on the transmission line structure is on private in Sandoval County. Unoccupied nests are not subject to the restrictions so all maintenance activates could be scheduled outside of the breeding season. Continued operation of the transmission lines and performance of required maintenance activities as previously authorized would not result in any new or additional impacts to the suitable habitat, or any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

Bald Eagle

Limited suitable foraging habitat for the bald eagle occurs along the FCPP to San Juan Generating Station ROW and no suitable foraging habitat exists along the FCPP to West Mesa ROW. The species is not likely to occur so no impacts are anticipated.

Southwestern willow flycatcher

No suitable habitat for this species existed on Navajo Nation lands within or adjacent to the FCPP to West Mesa Switchyard transmission line corridor. Although a migrating flycatcher was documented at the northeast corner of Morgan Lake in Spring 2012, approximately 1 mile north of the FCPP to West Mesa Switchyard transmission line ROW corridor. Potential migration habitat does occur along the southern portion of the line where it crosses the Rio Puerco in Sandoval County between poles FW 757-758.

The observation of the flycatcher at Morgan Lake is more than a mile away from the line and any proposed maintenance activities would not have an impact on flycatchers in that location. Given no suitable habitat lies within the ROW area on the Navajo Nation, continued operation of the transmission lines and performance of required maintenance activities as previously authorized would not result in any new or additional impacts, or any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide.

Vegetation management is part of the routine maintenance and has been ongoing since the line was constructed and if it is done outside of the breeding season then continued operation of the transmission lines and performance of required maintenance activities as previously authorized would not result in any new or additional impacts, or any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a negligible adverse effect to the species and no mitigation is required. .

Baird's sparrow

A survey of the Project Area was conducted in May and June 2012. Baird's sparrow nest north of New Mexico so would not be present at the time, so the survey was implemented primarily to ascertain potential migration habitat for the species. Baird's sparrow wintering habitat is generally composed of dense grasslands with a minor shrub component. Field surveys determined no likely wintering habitat lies within the Project Area, although some of the grassland habitats in the northern end and near the southern end of the FCPP to West Mesa Switchyard transmission line corridor are suitable for migration.

None of the proposed actions are likely to alter this habitat beyond the conditions that already exist or preclude its use by Baird's sparrow. The proposed maintenance activities should have no impact on this species. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

Grey vireo

Potential habitat for gray vireo was confined to the woodland and savanna portions of the FCPP to West Mesa Switchyard transmission line. Five occupied gray vireo territories were discovered during the survey of the transmission line. All of these are in close proximity to the line and four are tightly clustered between poles FW 326-333. The remaining outlying territory occurred west of the line between poles FW 357-358. The territories were located along the southern portions of the ROW corridor on BLM lands.

All five of these gray vireo territories are on BLM land and BLM has no published prescriptions regulating the activities around gray vireo sites. Routine line patrols along the existing cleared ROW would not impact the nesting activities of gray vireo between poles FW 326-331 because the nesting vegetation has been removed and any other maintenance activities would be conducted outside of the breeding season and within the existing cleared ROW. A major access road to oil wells currently exists from FW 331-333 that provides access for line patrols. None of the proposed actions are likely to alter this habitat beyond the conditions that already exist or preclude its use by grey vireo. The proposed maintenance activities should have no impact on this species. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

Loggerhead shrike

Surveys for loggerhead shrike were conducted during May through July 2012. Large portions of the FCPP to West Mesa Switchyard transmission line corridor can be considered potential habitat for the loggerhead shrike. However, multiple surveys over many portions of the line identified just one bird along the northern end of FCPP to West Mesa transmission line corridor on Navajo lands. No loggerhead shrike observations occurred on BLM lands anywhere within the FCPP to West Mesa transmission line corridor.

Because loggerhead shrike habitat was found but no nests either within the FCPP to West Mesa Switchyard transmission line corridor or adjacent to the ROW, none of the proposed maintenance activities for the line within the existing ROW should impact this species if activities are conducted outside of the breeding season. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

Western burrowing owl

Potential habitat for western burrowing owl occurs throughout the Project Area. Although prairie dogs were present, they were mainly concentrated within the northern one-quarter of the FCPP to West Mesa Switchyard transmission line corridor. If owls were present, noise from line maintenance activities may cause burrowing owls to avoid using the limited suitable habitat near the ROW corridor and migrate to adjacent areas. Impacts from avoidance would be low and short to long term.

No burrowing owls were documented along this transmission line ROW. It is possible that future burrowing owls could occupy areas in other suitable habitat within the ROW and any impacts to this species are expected to be low or none if maintenance work is performed outside of the breeding season. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a minor adverse effect to the species and no mitigation is required.

American peregrine falcon

A protocol survey for peregrine falcon was conducted in the early Spring and Summer 2012 and peregrine falcons were observed only in the FCPP area. There, were no indications of falcon nests on any of the transmission line structures along the FCPP to West Mesa Switchyard transmission line corridor. However, over a dozen other areas have potential nesting habitat for peregrine falcon at several locations near the transmission line on BLM lands. Impacts to this species would occur if required maintenance activities and associated disturbances were conducted during nesting periods and nests were located on the transmission structures or in close proximity. Such activities are prohibited under the MTBA, which prevents activities that have the potential to disturb a bird on an active nest or the nest

itself. If such activities are essential it would require separate coordination with the BIA or NMGF, and possibly the USFWS, depending on the location of the structures. All transmission structures are designed with adequate line clearances to prevent electrocutions and meet APLIC design guidelines so no risk of electrocution exists.

Peregrine falcons are known to occur adjacent to the FCPP to West Mesa Switchyard transmission line near the FCPP. Any proposed line maintenance activities at this location (which are generally far less than the daily activity at the plant) are not anticipated to adversely affect peregrine falcons that occur there. Although no peregrine falcons were present at the other potential habitat locations along the corridor, it is possible that in the future peregrine falcons could establish nests at these cliff locations. Continued operation of the transmission lines and performance of required maintenance activities as previously authorized would not result in any new or additional impacts to the suitable habitat, or any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

Special-Status Bat Complex - Spotted Bat, Big-freetail Bat, Small-footed bat, long-legged myotis, Yuman myotis, occult little brown bat, and fringed myotis.

The roosting habitat likely to be utilized by bats is primarily the small sandstone outcrops that are scattered throughout the central and southern portions of the FCPP to West Mesa Switchyard transmission line corridor. Although at least marginal potential habitat existed for these species of bats none were found within the Project Area, nor was any bat use indicated within the FCPP to West Mesa Switchyard transmission line corridor based on an extensive survey.

It is likely that no more than 100 acres of habitat along the entire length of the line would be considered suitable roosting areas for these bat species. None of the proposed actions are likely to alter this habitat beyond the conditions that already exist or preclude its use by these seven bat species. The proposed maintenance activities should have no impact on this species. Therefore, there would be no effect to the species and no mitigation is required.

Plants

Mesa Verde Cactus

The habitat for the Mesa Verde cactus along the existing FCPP to San Juan Generating Station transmission line was surveyed in 2012 in San Juan County. Potential habitat for Mesa Verde cacti occurred along two portions of the transmission line corridor. These included between poles FC38-42 (on Navajo lands), and between poles FC5-18 (on a mixture of BLM, private, and state lands). Although suitable habitat occurred between poles FC38-42, no Mesa Verde cacti were present along this portion of the FCPP to San Juan Generating Station line corridor. However, four Mesa Verde cactus population sites were found scattered between poles FC13-18. Three of these sites had living healthy plants although the fourth site had only the remains of dead plants present; however, this fourth site cannot be discounted as Mesa Verde cacti populations often have large seed banks and the seeds are believed to be long-lived. Most of these populations are at least 30 meters from the nearest transmission line poles, although the one site has Mesa Verde cactus plants as close as 5 meters to pole FC17.

The proposed maintenance activities could have several potential impacts on Mesa Verde cactus. These potential effects fall into direct impacts and indirect impacts. The potential direct impacts would include vehicles driving over Mesa Verde cactus and crushing them; excavation within active population areas that would not only remove cacti but potentially destroy their habitat; and direct disposal of fill or waste materials on top of Mesa Verde cactus. Indirect impacts would occur if excavated fill materials silted over Mesa Verde cacti due to stormwater runoff. Continued operation of the transmission lines would include routine maintenance using current BMPs to avoid known populations. The work may affect individuals of this species, but would not adversely affect suitable habitat, known populations or have population level impacts.

Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

San Juan Milkweed

This plant is limited to areas with suitable habitat in San Juan County. During surveys conducted in 2012 two populations of San Juan milkweed were found within the FCPP to West Mesa transmission line ROW corridor near poles FW 260 and FW 269. The population at FCPP to West Mesa 260 occurs on BLM lands and the population at FCPP to West Mesa 269 occurs on state lands.

PNM patrols are required to stay on the existing trails or access roads in their management plan; as such they would have no impact upon the two discovered populations of San Juan milkweed within the FCPP to West Mesa transmission line ROW. Given the limited suitable habitat within the ROW area and this species distribution, continued operation of the transmission lines and performance of required maintenance activities as previously authorized could affect individuals of this species but would not result in any new or additional impacts to the limited suitable habitat, or any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

Aztec gila

Portions of the Nacimiento formation surfaced along the FCPP to West Mesa transmission line from approximately poles 154-478. In most cases these outcrops of suitable habitat extended under only short segments of the FCPP to West Mesa transmission line. Although suitable habitat for Aztec gilia occurred along portions of the transmission line in the southeast corner of San Juan County and northeast corner of McKinley County, this species was not present in the Project Area. No populations of the target species were observed along the ROWs during field surveys.

Suitable habitat for Aztec gilia occurred in scattered areas along much of the northern half of the FCPP to West Mesa transmission line corridor. Field surveys of these areas were completed within the known flowering season and none were found in the Project Area. The proposed line maintenance activities would have no effect upon this species. Therefore, there would be no effect to the species and no mitigation is required.

Parish's alkali grass

A survey of the potential habitat for this species was conducted in early May 2012. No springs or marshes were in the Project Area and the vast majority of the washes were too dry to provide suitable habitat. However, two of the arroyos in the northern quarter of the transmission line corridor did support marginal habitat for Parish's alkali grass. No Parish's alkali grass existed at either of these locations, or at any other locations along the FCPP to West Mesa transmission line corridor.

Survey results did not identify any occurrences of the target species in the areas of potential habitat. Given the limited potential habitat within the ROW area and this species distribution, continued operation of the transmission lines and performance of required maintenance activities as previously authorized could affect individual species but would not result in any new or additional impacts to the suitable habitat, or any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

Brack's fishhook cactus

A survey of the potential habitat for this species was conducted in early May 2012. Potential habitat for this species is similar to Aztec gila and occurred in the northern half of the FCPP to West Mesa transmission line corridor. Three locations with the most suitable habitat and substrate vegetation were within similar climate conditions to the known populations of Brack's fishhook cactus. Brack's fishhook

cactus appears to have a slightly wider range of habitat tolerance than Aztec gilia so it could occur in these areas although none have been documented that far south.

Survey results did not identify any occurrences of the target species in the areas of suitable habitat. However, this species has not been observed this far south, so the suitable habitat along the transmission line corridor is outside of the known range for the species. Given the limited suitable habitat within the ROW area and this species distribution, continued operation of the transmission lines and performance of required maintenance activities as previously authorized could affect individuals of this species but would not result in any new or additional impacts to the suitable habitat, or any known populations or population level impacts. Impacts are not likely to result in a loss of species viability rangewide. Therefore, there would be a negligible adverse effect to the species and no mitigation is required.

Naturita milkvetch

A survey of the potential habitat for this species was conducted in early May 2012. The only known occurrence of this species is near the FCPP approximately 3 miles from the FCPP to West Mesa ROW corridor. Field surveys determined that the limited sandstone outcrops were of insufficient size and structure to provide suitable habitat. Field surveys determined no suitable habitat for this species within the transmission line corridor.

No suitable habitat for Naturita milkvetch existed within or adjacent to the FCPP to West Mesa transmission line corridor and the Project activities should have no effect on this species.

Fish

The FCPP to San Juan Generating Station ROW spans the San Juan River and therefore, crosses over potential habitat for Colorado pikeminnow, razorback sucker, and roundtail chub. However, the transmission towers are located outside of the active river channel and are not located within the riparian zone. Therefore, inspection and maintenance activities associated with these towers would not impact these species or their habitat. Vegetation management activities associated with the ROW would keep large riparian trees from becoming established within the ROW, but this ROW represents a very small portion of the total potential habitat for these species and represents a continuation of the existing condition. Therefore, no impact to special-status fish species would occur from these activities.

No special-status fish occur within the FCPP to West Mesa transmission line ROW. The proposed actions relating to this ROW would have no effect on special-status fish species.

4.8.4.2 Alternative B – Navajo Mine Extension Project

Navajo Mine

Under Alternative B, OSMRE would approve an alternative mine plan for the Navajo Mine, the NMEP.

Additional special-status species habitat and foraging areas would be permanently lost due to the expanded construction area, power lines and roadways in Alternative B. Also, a greater likelihood of disturbance and vehicle collisions exists with the additional 5 miles of roadways and 28 acres of disturbance. Alternative B would result in potentially greater impacts to special-status species than Alternative A.

FCPP

Under Alternative B, FCPP would operate as described under the Proposed Action. No changes are proposed and any identified impacts to special-status species would be the same.

Transmission Lines

Under Alternative B, the transmission line ROWs would be approved and they would continue to be operated and maintained as described under–the Proposed Action. No changes are proposed and any identified impacts to special-status species would be the same as describe in Alternative A.

4.8.4.3 Alternative C – Alternative Pinabete Mine Plan

Navajo Mine

Under Alternative C, OSMRE would approve an alternative mine plan for the Navajo Mine, known as the Alternative Pinabete Mine Plan.

Additional special-status species habitat and foraging areas would be permanently lost due to the expanded construction area, power lines and roadways in Alternative C. This alternative would result in potentially greater impacts to special-status species than Alternative A.

FCPP

Under Alternative C, FCPP would operate as described under the Proposed Action. No changes are proposed and any identified impacts to special-status species would be the same.

Transmission Lines

Under Alternative C, the transmission line ROWs would be approved and they would continue to be operated and maintained as described under the Proposed Action. No changes are proposed and any identified impacts to special-status species would be the same.

4.8.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action. No changes are proposed and any identified impacts to special-status species would be the same as described for the Proposed Action.

Four Corners Power Plant

Under this alternative, the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The types of direct and indirect effects on special-status species resulting from the DFADAs would be of the same nature as those described for the Proposed Action but would result in less potential impact to the biological community. As described in the Proposed Action, four special-status species have the potential to be impacted by the proposed DFADAs based on their known historical ranges or known suitable habitat; the southwestern willow fly catcher, golden eagle and ferruginous hawk and the Mesa Verde Cactus. The 10% reduction in surface area of the DFADAs would result in less potential for impacts to suitable habitat and an associated reduction in the potential impacts to population level impacts. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

Under this alternative, the transmission line ROWs would be approved and they would continue to be operated and maintained as described for the Proposed Action. No changes are proposed and any identified impacts to special-status species would be the same as described for the Proposed Action.

4.8.4.5 Alternative E – No Action Alternative

Alternative E would have no FCPP construction or operation, no use of existing transmission lines, access road, and water-supply system or need for new ash disposal sites. No mine permit or ROW renewal approvals or additional loss or modification of vegetation communities or special-status species habitat would occur. The demolition of FCPP and the loss of Morgan Lake would reduce habitat, at least temporarily. In the event of No Action, further analysis is speculative because the future disposition of the assets is not known with certainty.

Navajo Mine

Under the No Action Alternative, mining would cease when the ROD is issued in 2015. The Pinabete Permit Area (Areas IV North and South) would not be mined. Burnham Road would not be realigned. Upon permit expiration, NTEC would begin reclamation activities in Areas III and IV North. Reclamation activities would continue until OSMRE approval that all reclamation requirements have been met and OSMRE jurisdiction is terminated. It is expected that all reclamation would be completed by June 2021. All ancillary buildings and facilities (e.g., communication lines, railroad) would be removed, and the land would be reclaimed according to OSMRE requirements and performance standards. No loss of habitat would be associated with the No Action Alternative, so for special-status species, these activities would not lead to adverse effects and could result in potential beneficial impacts due to replacement of habitat.

FCPP

Under the No Action Alternative, FCPP would shut down and the DFADAs would not be constructed. APS would decommission all facilities that are not required or permitted to be left behind by the 1960 and 1966 leases. As such, decommissioning and dismantling activities would need to be coordinated with the Navajo Nation so that the area meets the specific needs of any planned reuse. APS has not yet prepared a decommissioning plan, but any demolition activities would comply with all environmental laws and regulations applicable at the time, potentially including NEPA review. Decommissioning would require environmental abatement activities in the power block, including removal of environmental and safety hazards (e.g., asbestos, lead paint), and chemicals and oils. All waste generated during this phase would be managed and disposed of in accordance with applicable Federal environmental regulations. Dismantling and demolition would commence following the removal of asbestos, PCB, lead paint and any other hazardous chemicals. Upon removal of structures and facilities, the structural foundations would be removed to 24 inches below grade, the site profiled to allow for proper drainage, and native vegetation planted as applicable. In addition to the five units, decommissioning and dismantling may also include removal of all three switchyards. The timeline for this process is at the discretion of APS and the Navajo Nation. For special-status species, these activities and this time would not lead to adverse effects and could result in potential beneficial impacts due to reduction in emissions and revegetation efforts.

Transmission Lines

Under the No Action Alternative, the ROWs for the four subject transmission lines would not be approved. Since the subject lines primarily transmit power from the FCPP, under the No action Alternative, the power source for the transmission lines would be removed. The lines would either be decommissioned and dismantled or left in place. As with the FCPP, decommissioning and dismantling activities would need to be coordinated with the Navajo Nation and the BLM such that the area meets the specific needs of the planned reuse. Compliance with all environmental laws and regulations would occur throughout the demolition process. The timeline for this process is not mandated in regulatory statutes and is unknown at this time. For special-status species, these activities and this time would not lead to adverse effects.

4.8.5 Special-Status Species Mitigation Measures

The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific mitigation measures for certain environmental impacts, standard operating procedures that reduce or avoid environmental impacts, and best management practices for specific activities. These are described in Section 3.2.6.8. These measures are part of their application materials and are enforceable through permit or lease conditions. In addition, the Project Applicants must comply with additional protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section for each resource category. Where the environmental analysis in this EIS recommends additional

protective measures, over and above the applicant proposed measures and regulatory compliance, they are listed below as specific mitigation measures.

The Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, including continued implementation of all existing BMPs, would not result in major adverse effects to any special-status species. Therefore, no additional mitigation is recommended.

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4.9 Land Use and Transportation

This section describes land uses and the transportation and access network within the Project Area and evaluates the potential effects of the Proposed Action and alternatives on these resources. The ROI for land use and agriculture is the FCPP's footprint, Navajo Mine Lease Area, and transmission line ROWs; however, to provide context for the land use in these areas, a description of the general land use on the Navajo Nation and Hopi Reservation is provided, as well as a regional description of the San Juan Basin. In addition, land use within 0.5 mile of the subject transmission lines is described to provide a general idea of the land uses directly within and next to the Project Area. The ROI for transportation is the roadway network within the Navajo Nation (including state and Federal highways that traverse it) as well as access roads used for maintenance of the transmission lines.

4.9.1 Regulatory Compliance Framework

4.9.1.1 Federal Regulations

Surface Mining Control and Reclamation Act Permit

The OSMRE may approve surface mining after consultation with the BIA and in conjunction with appropriate environmental reviews (30 CFR 750.6). SMCRA restricts mining within the boundary of the National Park System, the National Wildlife Refuge System, the National Trail System, the National Wilderness Preservation System, the Wild and Scenic Rivers System, National Recreation Areas, National Forest Land, within 100 feet of the outside ROW of any public road, or within 300 feet of occupied dwellings unless certain regulatory conditions are met (30 CFR 761.11). A brief summary of the SMCRA provisions and regulations related to land use are included below:

30 U.S.C 1236 (b) Conservation and development plans

> The landowner, including the owner of water rights, resident, or tenant shall furnish to the Secretary of Agriculture a conservation and development plan setting forth the proposed land uses and conservation treatment which shall be mutually agreed by the Secretary of Agriculture and the landowner, including owner of water rights, resident, or tenant to be needed on the lands for which the plan was prepared. In those instances where it is determined that the water rights or water supply of a tenant, landowner, including owner of water rights, resident, or tenant have been adversely affected by a surface or underground coal mine operation which has removed or disturbed a stratum so as to significantly affect the hydrologic balance, such plan may include proposed measures to enhance water quality or quantity by means of joint action with other affected landowners, including owner of water rights, residents, or tenants in consultation with appropriate State and Federal agencies.

30 U.S.C 1272 (a) Establishment of State planning process; standards; State process requirements; integration with present and future land use planning and regulation processes; savings provision

> (3) Upon petition pursuant to subsection (c) of this section, a surface area may be designated unsuitable for certain types of surface coal mining operations if such operations will --
>
> (A) be incompatible with existing State or local land use plans or programs; or
>
> (4) To comply with this section, a State must demonstrate it has developed or is developing a process which includes –
>
> (A) a State agency responsible for surface coal mining lands review;

(B) a data base and an inventory system which will permit proper evaluation of the capacity of different land areas of the State to support and permit reclamation of surface coal mining operations;

(C) a method or methods for implementing land use planning decisions concerning surface coal mining operations; and

(D) proper notice, opportunities for public participation, including a public hearing prior to making any designation or redesignation, pursuant to this section.

(5) Determinations of the unsuitability of land for surface coal mining, as provided for in this section, shall be integrated as closely as possible with present and future land use planning and regulation processes at the Federal, State, and local levels.

30 U.S.C 1265 (b) General performance standards shall be applicable to all surface coal mining and reclamation operations and shall require the operation as a minimum to –

(1) conduct surface coal mining operations so as to maximize the utilization and conservation of the solid fuel resource being recovered so that reaffecting the land in the future through surface coal mining can be minimized;

(2) restore the land affected to a condition capable restore the land affected to a condition capable of supporting the uses which it was capable of supporting prior to any mining, or higher or better uses of which there is reasonable likelihood, so long as such use or uses do not present any actual or probable hazard to public health or safety or pose any actual or probable threat of water diminution or pollution, and the permit applicants' declared proposed land use following reclamation is not deemed to be impractical or unreasonable, inconsistent with applicable land use policies and plans, involves unreasonable delay in implementation, or is violative of Federal, State, or local law;

(19) establish on the regraded areas, and all other lands affected, a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area of land to be affected and capable of self-regeneration and plant succession at least equal in extent of cover to the natural vegetation of the area; except, that introduced species may be used in the revegetation process where desirable and necessary to achieve the approved postmining land use plan;

Through the following sections of SMCRA, OSMRE regulates mining activities to protect public roads and mine roads. Public roads are defined in the regulation as those maintained with public funds, with substantial public use, and meet road construction standards similar to other public roads. Compliance with these regulations would be a requirement before the SMCRA permit could be granted. A listing and brief summary of the SMCRA regulations applicable to transportation are included below:

- **30 CFR 761.11.** Under 761.11(d) surface coal mining is prohibited within 100 feet of the outside ROW of a public road unless the public road authority or regulatory authority allows the road to be relocated or closed according to 30 CFR 761.14;
- **30 CFR 761.14.** Describes the procedures and approvals necessary to relocate, close, or mine within a buffer zone of a public road;
- **30 CFR 816.150.** Defines the roads used to facilitate surface coal mining as either primary or ancillary roads and describes the performance standards for each road classification;
- **30 CFR 816.151.** Provides further design criteria and requirements for primary roads

Energy Transmission Line ROW Renewal

The BIA is responsible for reviewing ROW renewal applications. Given the consent of landowners, a renewal may be granted for a like time if no change in the location or status of the original ROW grant is requested (25 CFR 169.19).

Mine Safety and Health Administration

Mine Safety and Health Administration has described general safety requirements for loading and haulage activities in 30 CFR Part 77 Subchapter Q. The former US Department of Interior – Bureau of Mines had published manuals to assist surface mine operators with the design requirements for mine haulage roads.

Taylor Grazing Act

Under this act (43 USC 315, et seq.), the Federal government regulates grazing on public lands, including tribal lands, to improve rangeland conditions. Under this act, the Department of the Interior established grazing districts. Section 3 of this act provides for the issuance of grazing permits on public lands within established grazing districts. The designation of grazing districts and grazing permits within the Project Area is described below and is used to assess the effects of the Proposed Action on this land.

4.9.1.2 Tribal Regulations

Navajo Nation Local Governance Act

The local government subdivisions within the Navajo Nation are identified as Chapters (Navajo Chapters 2012). This act grants governmental authority to decide local matters to the Navajo Nation chapters. Each chapter must have a chapter land use plan approved by the Transportation and Community Development Committee. After approval, chapters may issue home and business leases (JJ Clacs and Company 2002). The following chapter land use plans were reviewed:

- Shiprock Chapter Land Use Plan and Housing Planning Project, 2001
- Nenahnezad Chapter Community Based Land Use Plan, 2004
- San Juan Chapter Community Based Land Use Plan, 2002
- Burnham (Tiis Tsoh Sikaad) Chapter Community Land Use Plan, 2005

Navajo Nation Homesite Lease

The Resource Committee of the Navajo Nation has the authority to approve or delegate to the Department Director of the Navajo Land Department the authority to approve homesite leases. The homesite lease policy is intended to help qualified applicants qualify for home and landownership within the Navajo Nation. It is open to Navajo tribal members and spouses over the age of 18 (Navajo Land Department n.d.).

4.9.2 Affected Environment Pre-2014

4.9.2.1 Land Use

Overview of Regional Land Use

Land use patterns in and near the ROI are characterized primarily by dispersed housing, grazing, agriculture (including dispersed family farm plots and commercial farming), mining, oil and gas extraction, electricity production, and recreation. A variety of roads (from paved to dirt) traverse the land, primarily within the Navajo Nation (Figure 4.9-1). Much of the population, as well as commercial activity in the region, are north of the ROI in the San Juan River corridor along US Highway 64 where the towns of

Shiprock, Kirkland, and Farmington are located. With the exception of the transmission line ROW renewal, the Project Area is within the Navajo Nation's Shiprock Chapter and intersects the Nenahnezad, San Juan, and Burnham (Tiis Tsoh Sikaad) chapters.

Housing in and near the ROI is low density and characterized as rural. Many residences feature multiple generations occupying housing structures on the same land. Some residences are associated with Customary Use Areas (CUAs) which refers to an area where an individual traditionally confined his or her traditional grazing use and occupancy or can be referred to as an area traditionally inhabited by his or her ancestors (25 CFR Part 161.1). CUAs may only be occupied temporarily during the year when and where they are using the land for grazing. Since a CUA can be quite large, animals may be herded in a large geographic region, stopping for only a few weeks or months at a building or dwelling on a seasonal basis (Baldwin 2012). The San Juan, Nenahnezad, and Burnham chapters include planning for additional or updated housing in their land use plans. The San Juan Chapter has proposed 11 locations suitable for new housing (JJ Clacs and Company 2002). The Nenahnezad Chapter has located four blocks of land suitable for new housing (Nizhoni'go Nahata Consulting Service 2004). The Burnham Chapter is considering encouraging some clustered housing projects in addition to new scattered housing (Architectural Research Consultants, Incorporated 2005). The nearest areas proposed for new development to the ROI are located about 5 miles south of the Navajo Mine lease area.

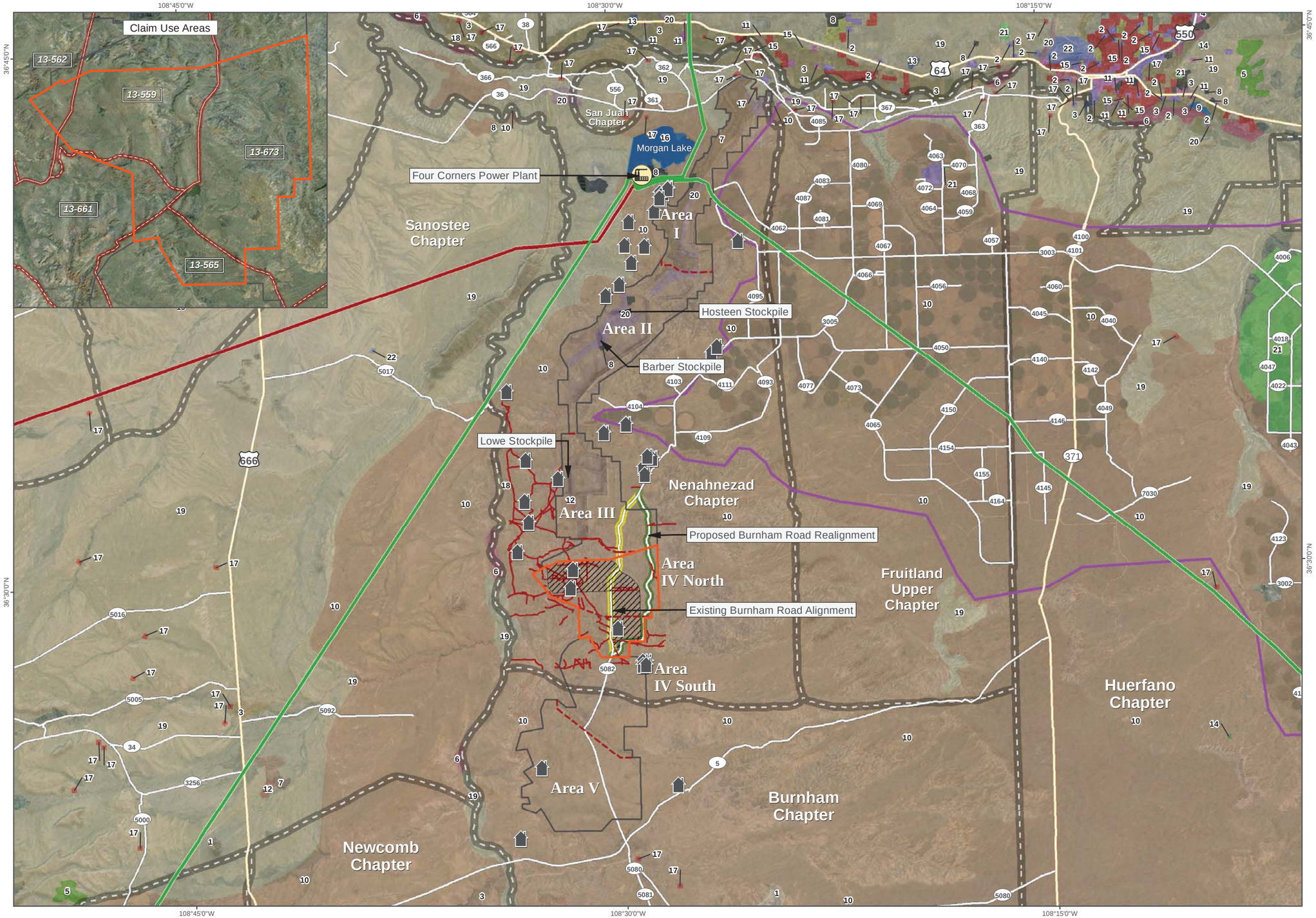
Traditional, ceremonial, and sacred land uses include burial locations, historic gathering locations, geographically important features, and ceremonial community buildings. See Section 3.4, Archaeology and Cultural Resources, for a detailed description of these resources.

As discussed in greater detail in Section 3.16, Recreation, currently designated recreation areas in the Project vicinity include Morgan Lake (a human-made reservoir that is part of the FCPP Project Area), a large area in the San Juan Chapter south of Navajo Route N36, and Bisti Wilderness Area in the Burnham Chapter (JJ Clacs and Company 2002; Architectural Research Consultants, Incorporated 2005). Currently undesignated recreation areas include the Badlands and Chaco Wash (i.e., Chaco River) areas. The Burnham Chapter proposed land use plan designates these areas as protected open space with only low-impact uses permitted (Architectural Research Consultants, Incorporated 2005). According to the San Juan Chapter Land Use Plan (2002), the San Juan Chapter would like to enhance the Morgan Lake recreation center to include additional hiking trails and diverse recreational opportunities to enhance fitness opportunities for its citizens. The San Juan Chapter would also like to designate sacred and culturally sensitive spaces as protected open spaces where only low-impact activities would be permitted (JJ Clacs and Company 2002).

Commercial land uses in and near the ROI are limited given its rural nature. The nearest hospitals are the Northern Navajo Medical Center located in Shiprock, New Mexico, and San Juan Regional Medical Center in Farmington, New Mexico (JJ Clacs and Company 2002). The Nenahnezad Chapter is planning a 10-acre small business development site at the junction of N36 (Nizhoni'go Nahata Consulting Service 2004). One of the Navajo Nation's future business objectives includes encouraging increased commercial activity on tribal land. Tribal members regularly travel to Shiprock, Kirkland, or Farmington to do their shopping, which minimizes economic activity on tribal lands. Increased commercial capacity on the reservation would allow local citizens and businesses to capture more of that revenue (Navajo Nation Division of Economic Development 2010).

Figure 4.9-1

Land Use Within the Project Area



PROJECT FACILITIES

- Four Corners Power Plant
- Navajo Mine Lease Area
- Navajo Mine Resource Areas
- Proposed Pinabete Permit Boundary
- Development Area
- Navajo Agricultural Products Industry
- Navajo Chapter Boundaries
- Residences

TRANSMISSION LINES

- 345kV
- 500kV

ROAD NETWORK

- State Highways
- Public Roads
- Access Roads, 2-Track

Land use data produced by the New Mexico Water Resources Research Institute, November 2003.

The data was compiled from digital data provided by the New Mexico Resource Geographic Information System Program (RGIS). Original base maps digitized from 1:500,000 mylar sheets and 100,000 paper maps for New Mexico. These data meets National Mapping Accuracy Standards for 1:500,000 and 1:100,000 scale maps. Landuse coverage developed by USGS/EPA at 1:250,000 scale.

LAND USE CLASSIFICATIONS

1 Bare Exposed Rock	5 Evergreen Forest Land	9 Lakes	13 Orchards, Groves, Vineyards, and Nurseries	17 Residential	21 Transitional Areas
2 Commercial and Services	6 Forested Wetland	10 Mixed Rangeland	14 Other Agricultural Land	18 Sandy Areas Other Than Beaches	22 Transportation, Communications and Utilities
3 Cropland and Pasture	7 Herbaceous Rangeland	11 Mixed Urban or Built-up Land	15 Other Urban or Built-up Land	19 Shurb-Brushland Rangeland	
4 Decidous Forest Land	8 Industrial	12 Nonforested Wetland	16 Reservoirs	20 Strip Mines, Quarries, and Gravel Pits	

N

0 1.75 3.5 7
Scale in Miles

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Industrial land uses in and near the ROI include mining, oil and gas extraction, and utilities such as power plants, power lines, and water treatment facilities. The Navajo Mine Lease Area is on the San Juan and Nenahnezad chapter lands. The FCPP, including Morgan Lake, is also located on the San Juan and Nenahnezad chapter land. A series of transmission lines extends from the FCPP to the north, west, southwest, and southeast. The region has a number of oil and gas wells with plans to add more. Several gas companies plan to extract oil and gas in the Navajo Agricultural Products Industry (NAPI) land, and Western Oil and Gas has proposed approximately 600 natural gas wells in eastern Burnham Chapter extending north into Upper Fruitland, Nenahnezad, and San Juan chapters (DOI and BIA 2007). The San Juan Chapter states that one of its land use goals is to identify and minimize the impacts of major power lines, railroads, and mining within its chapter lands by developing standards to minimize the negative impacts of expansions to existing power plants, oil and gas, and mines; it views industrial land uses as intrusions and does not want to encourage additional industry in its chapter (JJ Clacs and Company 2002). The Nenahnezad Chapter has a goal of promoting orderly and environmentally sound industrial development by keeping similar land uses near one another to avoid conflicts; it supports industrial land uses if they encourage local employment opportunities and do not conflict with other nearby land uses (Nizhoni'go Nahata Consulting Service 2004). The Burnham Chapter land currently has no industrial activity, but the chapter supports increased industrial activity on its land.

Agriculture is also a primary land use in and near the ROI. The Navajo Nation has over 12,000 farms, totaling nearly 16 million acres (USDA 2009). While the USDA estimates that approximately 16 million acres of the Navajo Reservation is considered "farmable" land, the known land that is currently being farmed is under one million acres. The majority of farms are small, comprising 1 to 9 acres (USDA 2009). An estimated 9,000 acres of Hopi land have been traditionally cultivated, mostly in 1- to 5-acre plots. No designated prime or unique farmland is located within 2 miles of the plant or the Navajo Mine Lease Area (USDA 2001). Also, no Navajo zoning ordinances designate any of the Project Area for farming. Agricultural parcels are located to the south, east, and north of the FCPP on Navajo Nation Tribal Trust Lands. These lands consist of both NAPI crop circles and family-run agricultural parcels. NAPI lands are also located between the Navajo Mine Lease Area and US Highway 550; the nearest plots to the Navajo Mine Lease Area are approximately 5 miles north of Area IV North. The majority of agricultural plots are used for growing sweet corn. Other common crops grown include alfalfa, squash, watermelon, cantaloupe, and potatoes.

Livestock grazing on Navajo Nation Tribal Trust Lands and Hopi Tribe Tribal Trust Lands takes place in grazing districts, which are established and managed by the BIA. There are 10,922 grazing permits issued by the BIA. Lands not designated for a specific use (i.e., business site leases, roads, homesite leases) are designated as grazing lands. Sheep and cattle grazing occurs on the land surrounding the power plant, typically in the spring when annual grasses sprout (see Figure 4.9-1 for a map of agricultural resources in the area). On Navajo Nation Tribal Trust Lands, individuals and families are granted permits by the BIA to use land for grazing. Claims to land use are based on traditional (claim) use rights and grazing permits. Grazing permits issued by the BIA Regional Director are based on recommendations of the Navajo Nation's District Grazing Committee and entitle the permittee to a grazing area of sufficient size to graze a specified number of animals.

Navajo Mine

The Navajo Mine Lease Area is located wholly within the boundaries of Navajo Nation Tribal Trust Lands. All mining operations at the Navajo Mine occur within the Navajo Mine Lease Area in Areas III, IV North and IV South. The Pinabete Permit Area is immediately south of the existing mining in Area III. The Pinabete Permit application also includes realignment of Burnham Road out of Area IV North to accommodate local, non- mining traffic without interfering with mining activities. The proposed permit area and road realignment is within the San Juan, Nenahnezad, and Burnham chapters. The San Juan and Nenahnezad chapters do not agree upon boundaries and may overlap. Common land uses located within the ROI are described in more detail below.

Existing land use in the Pinabete Permit Area is characterized by dispersed livestock grazing (principally small numbers of sheep, goats, cattle, and horses), with a few scattered dwellings and primitive roads crossing the area. Five residences were identified within 0.5 mile of the Pinabete Permit Area. Of these five residences, three are located within the Project boundary. BNCC has begun negotiation with two of the residents for relocation out of the proposed mining area (DOI and BIA 2007; OSMRE 2012a). The land's primary use is grazing. All three of the chapters whose land overlaps with the Pinabete Permit Area plan for additional housing sites; however, none of the proposed housing sites are within 0.5 mile of the Pinabete Permit Area. Both the San Juan and Nenahnezad chapters plan on this area being returned to grazing land in the future.

Five CUAs intersect with the Pinabete Permit Area (BNCC 2012a). Original grazing permits established by the BIA were limited to 10 head of horses or 350 sheep units annually per grazing area. The actual grazing capacity within each CUA was based on carrying capacity, which is a function of vegetative productivity and acreage. These CUAs are presented on Figure 4.9-1.

Four Corners Power Plant

The FCPP is located 20 miles west of Farmington, New Mexico, on Navajo Nation Tribal Trust Land. It is on the overlapping/disputed lands of the San Juan and Nenahnezad chapters. Its primary components include five power generating units, Morgan Lake - a 1,200-acre human-made reservoir that provides water - a series of wet and DFADAs, a coal handling and processing system, and an electric rail line that transports coal from the Navajo Mine to FCPP.

The FCPP site is currently used for electricity production, fly ash disposal, and coal transport. No other land uses currently exist in the proposed location. Twenty-six residences/structures are within 0.5 mile of the FCPP. They are located south of the FCPP and northwest of reclaimed Navajo Mine leased land in Area I, as shown on Figure 4.9-1 (DOI and BIA 2007).

Both chapters have also planned for future housing development; however, none of the proposed housing sites are within 0.5 mile of FCPP's proposed expansions (JJ Clacs and Company 2002; Nizhoni'go Nahata Consulting Service 2004). The nearest potential housing development is proposed by The Nenehnezad Chapter, which has identified multiple potential housing sites of which two sites are approximately 1 mile northeast of the FCPP.

Transmission Lines

A general discussion of land use along each transmission corridor is presented below.

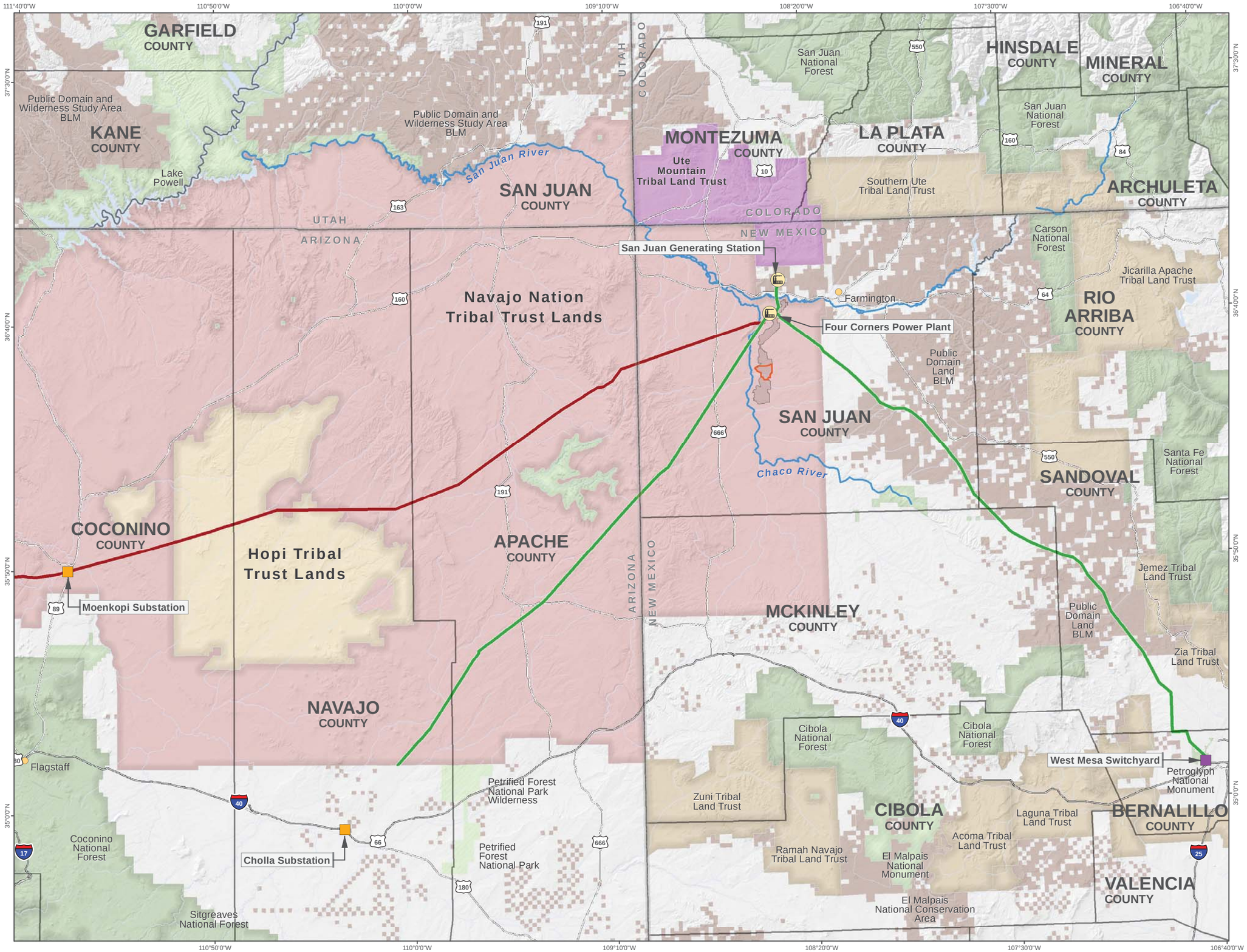
<u>Four Corners – Moenkopi 500-kV Transmission Line</u>

This transmission line is approximately 180 miles long and is owned by APS and runs from the FCPP to the Moenkopi Substation in Arizona to the west. The primary use of this transmission line is to deliver power from the FCPP to other regions such as Arizona (U.S. Department of Energy n.d.). It traverses Navajo Nation and Hopi Tribe Tribal Trust lands and ends in Cameron, Arizona (Figure 4.9-2). The land along this transmission line features open space (i.e., grassland and shrubland), mountains, and very small patches of agriculture. Houses are primarily scattered with few populated patches in the towns of Lukachukai and Chinle, both in Arizona. Few industrial/commercial uses other than the transmission line ROW are within 0.5 mile of the transmission line.

The transmission line crosses Chaco Wash at Mile 3 and Hogback Mountain at Mile 4 of the transmission line originating at the FCPP. Both sites are culturally important to the Navajo people. Big Gap Reservoir is within 0.5 mile of the transmission line at Mile 23. A gas station is within 0.5 mile of the transmission line at Mile 95. The transmission line ends at Moenkopi Substation. Additionally, approximately 215 dwellings lie within 0.5 mile of the path of the 180-mile-long transmission line. Cathedral Cliff is an informal recreation area located within 0.5 mile of the transmission line path at Mile 13.

Figure 4.9-2

Jurisdictional Boundaries Crossed by the Subject Transmission Lines



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Four Corners – Cholla 345-kV Transmission Lines

These transmission lines are a series of two parallel lines owned by APS. They run from the FCPP to the Cholla Station, which is over 155 miles to the southwest of the FCPP in Arizona. The primary use of this transmission line is to deliver power from FCPP to other regions in Arizona and New Mexico (U.S. Department of Energy n.d.). It traverses Navajo Nation Tribal Trust Lands and Arizona lands to end near Joseph City, Arizona. The land along this transmission line features open space (i.e., grassland and shrubland), mountains, and very small patches of agriculture. Houses are mainly dispersed with a few patches of population, such as in the town of Kinlichee, Arizona. Also, a limited number of industrial buildings lie within 0.5 mile of the transmission line. Approximately 192 dwellings lie within 0.5 mile of the path of the 155-mile-long transmission line. Kinlichee Tribal Park is a recreation area located within 0.5 mile of the transmission line corridor at Mile 83.

Four Corners – San Juan 345-kV Transmission Line

This transmission line is approximately 10 miles long and is owned by PNM. It runs from the FCPP to the San Juan Generating Station to the north. It traverses Navajo Nation Tribal Trust Lands and New Mexico lands to north of Waterflow, New Mexico. The land along this transmission line features agriculture, industry, residential, and open space (i.e., shrubland). Houses are clustered within the area near the San Juan River and US Highway 64 between the towns of Waterflow and Nenahnezad, New Mexico.

Approximately 108 dwellings lie within 0.5 mile of the path of the 10-mile-long transmission line. Between Miles 5 and 7, the transmission line crosses the town of Waterflow, New Mexico, where the primary land use is agriculture. This area also contains commercial and industrial uses including two churches, a general store, and a quarry. Informal recreation takes place along the San Juan River, which the transmission line crosses at Mile 6.

Four Corners – West Mesa 345-kV Transmission Line

This transmission line is approximately 135 miles long and is owned by PNM and runs from the FCPP to the West Mesa Switchyard. It traverses Navajo Nation Tribal Trust Lands and federal lands in New Mexico (BLM and National Park Service) to end northwest of Rio Rancho, New Mexico. The land uses along this transmission line include agriculture, industrial, open space (i.e., shrubland), and mountains. The transmission line also runs through Petroglyph National Monument. Houses are primarily scattered with a few patches of population near major roads.

The transmission line runs through the NAPI lands, irrigated agricultural lands on Navajo Nation Tribal Trust Land. Oil and gas wells lie along most of the transmission line. Additionally, approximately 195 dwellings lie within 0.5 mile of the path of the transmission line. Informal recreation takes place at Mesa Prieta, which extends into the area 0.5 mile from the transmission line at Mile 113.

4.9.2.2 Transportation and Access

Navajo Mine and FCPP Access

The Project Area is primarily accessed from US Highway (US) 64 to the north, New Mexico Highway (NM) 371 to the east, or US 491 to the west. From the major highways listed above, access to the Project Area is via infrastructure of San Juan County and/or BIA roads (Figure 4.9-3). US 64 is the primary transportation route running east to west between Farmington and Shiprock. New Mexico Department of Transportation (NMDOT) classifies NM 371, which runs north to south, as a rural minor arterial route for travel between Farmington and Interstate (I)-40 at Thoreau to the south (NMDOT 2007). According to the City of Farmington, Major Thoroughfare Plan, BIA Highway N-36 is considered a minor arterial road (NMDOT 2007). US 491 links I-40 at Gallup with US 191 in Monticello, Utah. To access the FCPP and the Navajo Mine from the main arterial roads listed above, the following paved BIA roads and San Juan County roads must be used:

- From south on NM 371 via BIA Highway N-5 going west to Burnham Road (BIA Road 5082) going north to access Area IV;
- From east on NM 371, via west on BIA Road 3003 to BIA Road 3005 to Burnham Road (BIA Road 5082) to access Area IV;
- From east on US 491, Table Mesa Road, a dirt road, which enters the mining lease near the Area III facilities and continues east to west across the mining lease;
- From west (Shiprock) or east (Farmington) on US 64, via south on San Juan County Road (CR) 6675 to BIA Highway N-36 to BIA Road 3005 to Burnham Road (BIA Road 5082) to access Area IV;
- From north on US 491, via east on BIA Highway N-36 to BIA Road 3005 to Burnham Road (BIA Road 5082) to access Area IV;
- From south on US 491, via BIA Highway N-5 going east to Burnham Road (BIA Road 5082) going north to access Area IV;
- Within the Project Area, Ramp 7, a graded dirt road travelling generally east to west in Area I connects the Navajo North facilities and FCPP with paved roads to the east of the mine lease;

Running through the Project Area, Pinto Reroute or Doby Road goes through the center in a north-south direction from the FCPP. It turns into Yazzie Skyline Road, which runs through the middle of mining operations in Areas I and II where it meets BIA Road N-4104, from which one can access BIA Road 3005. This road runs north to south in the eastern Project Area and then can be used to access Burnham Road (BIA Road 5082). Directly south of the intersection of BIA Road N-4104 and Yazzie Skyline Road is a series of dirt and gravel roads, which may be used to access Areas III, IV, and V.

Burnham Road (BIA Road 5082), which runs primarily north to south in the Project Area, enters the mining lease in Area III and currently runs through the middle of Areas IV and V. Burnham Road is a BIA-managed and -maintained gravel road and is one of the main access roads to the Tiis Tsoh Sikaad/ Burnham Chapter (Architectural Research Consultants, Incorporated 2005). BNCC rerouted Burnham Road in 2009 through and immediately adjacent to Area III and Area IV North. Travel on this road can be hazardous due to inclement weather and a 20-mph sharp curve resulting from the 2009 rerouting of the road to avoid active mining in Area III (OSMRE 2009). Blasting and mining activities in Area III have gradually progressed to within 100 feet of the road. Currently, traffic can be restricted multiple times per month during active coal mining operations to keep the public at a safe distance from blasting operations. Access restriction on the Burnham Road can result in delays of up to 30 minutes.

Numerous other unpaved two-track roads intersect the mining lease in Areas IV North, IV South, and V. These two-track roads are single-lane, low-traffic-volume roads typically used by the local residents to access grazing areas or water sources. While these roads are used by the public, they are not maintained with public funds, nor have they been designated as public roads by the Navajo Nation or other applicable road authorities.

Roads within the mining lease utilized by NTEC for mining and reclamation are designated as either primary or ancillary roads. Primary roads are roads used primarily for coal haulage. These roads are designed, constructed, and maintained to meet applicable performance standards. Ancillary roads are those used infrequently by small vehicles for accessing environmental monitoring stations, ponds/water control structures, surveying, and power line service inspection, as well as haul roads to topsoil stockpiles and temporary roads used during construction of support facilities. Heavy mining equipment over 25 tons is delivered directly to the Navajo Mine facilities via US 491 to BIA Highway N-36 to CR 6675. Equipment weighing less than 25 tons can be delivered directly to Area IV facilities via the mining area access routes described above.

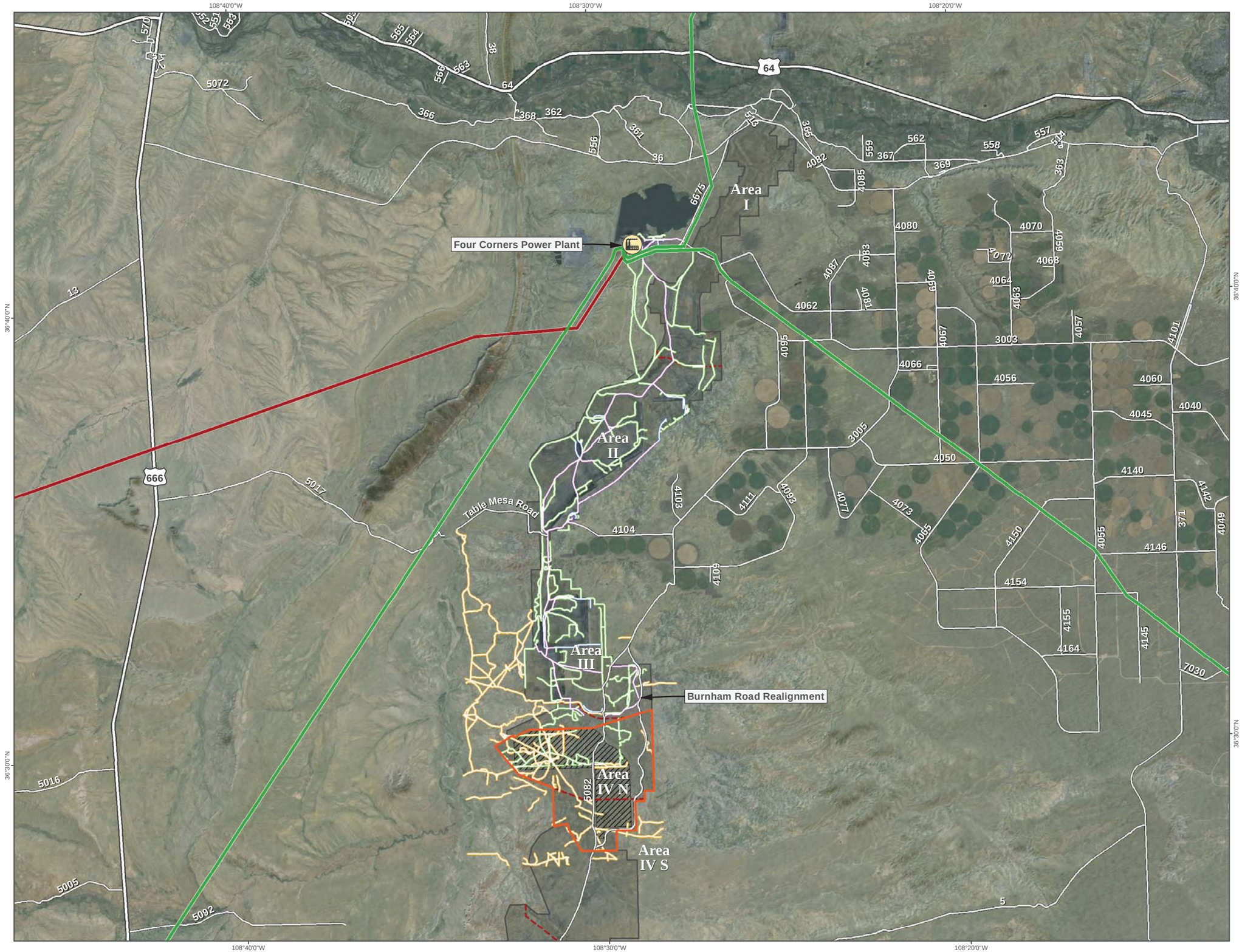

Figure 4.9-3

Local Road Network

PROJECT FACILITIES

Power Plant

PROJECT BOUNDARIES

Navajo Mine Lease Area

Navajo Mine Resource Areas

Proposed Pinabete Permit Boundary

Development Area

TRANSMISSION LINES

345kV

500kV

LOCAL ROAD NETWORK

Highways

Public Roads

Access Road

Ancillary Road

Primary Road

Other

N

0 1 2 4

Scale in Miles

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As described further below, grazing permit areas lie within the Navajo Mine Lease Area. Access to the grazing permit areas and CUAs is supported by the existing Burnham Road (BIA Road N-5082) and an array of unimproved two-track roads (Figure 4.9-3).

Transmission Line Maintenance and Operations Access

As discussed in Section 2, Access to the transmission line ROW is achieved exclusively through the use of public roads; neither APS nor PNM hold easements or access rights outside the transmission line ROW. Access to the transmission line ROW is generally open to the public unless access is restricted by the landowner; APS and PNM do not restrict access to the transmission line ROWs. In the ROW, access to the lines and towers is generally achieved through the use of unpaved roads. APS and PNM do not perform regularly scheduled maintenance on roads within the ROWs. If access roads do not exist due to terrain constraints, maintenance crews use foot access or helicopters to access the transmission lines.

Traffic Data

According to NMDOT, for locations along New Mexico and US Highways closest to the ROI, annual average daily traffic (AADT) volumes (NMDOT 2012) were as follows:

- AADT volumes in 2011 for the intersection of NM 371 and BIA Road N-36 directly north of the Project Area was 1,274 vehicles;
- AADT volumes for Upper Fruitland Road, which is northeast of the Project Area, was 3,578 vehicles in 2011;
- AADT volumes for the intersection of West Pinion Street and NM 371 within the city of Farmington, east of the Project Area, was 5,351 vehicles going northbound and 5,709 vehicles heading southbound;
- AADT volumes for US 491 going south toward Navajo was 880 vehicles in 2011;
- AADT for US 64 was 3,949 vehicles in 2011 heading towards the Colorado state line from New Mexico
- The average daily traffic (ADT) count for CR 6675 in 2007 was 1,219, and the projected future ADT is 1,810.

Traffic counts for the major routes used to access Navajo Mine facilities were taken in 2006 and 2009. Currently, the traffic levels for all segments of these access routes are well within the design volume for annual average and flow (BNCC 2011c).

According to the Indian Reservation Roads Program's Official Indian Reservation Road (IRR) inventory dated May 3, 2012 (BIA 2012), ADT counts for BIA roads within the FCPP and Navajo Mine areas, as well as future ADT volumes, which represent a 2 percent growth compounded annually for a 20-year period are as follows:

- Burnham Road (BIA Road 5082) in 1997 was 68 vehicles with a future ADT of 101 in 2017. More recently, BNCC traffic counts for Burnham Road (BIA Road 5082) conducted April 1, 2011, through June 14, 2011, found that traffic volume averages approximately 50 vehicles per day, with peak daily traffic occurring on Saturday when traffic counts increase to 70 or 80 vehicles per day (BNCC 2011c);
- BIA Highway N5 was 705 vehicles in 2009 with a future ADT of 1,047 in 2029;
- BIA Highway N-36 was 1,790 vehicles in 1998 with a future ADT of 2,658 in 2018;

- BIA Road 3005 was 841 vehicles on the southern end in 2000 with a future ADT of 1,249 in 2020 and 2,957 vehicles in 2000 at the northern end with a future ADT of 4,391 vehicles in 2020;
- BIA Road 3003 was 962 vehicles in 1998 with a future ADT of 1,429 in 2018.

Table 4.9-1 shows current employee commuting traffic at the FCPP.

Table 4.9-1 Current FCPP Operations Employee Traffic

Employee Traffic	Number of Daily Trips
Average # of Employees: Weekday Roundtrips	606 Trips
Average # of Employees: Weekend Roundtrips	172 Trips

NOTE: Estimated average commute distance = 55-Miles Roundtrip

Also, contract employees make 40,000 to 50,000 additional trips to the power plant during variable overhaul periods. Estimated average commute distance for contract employees to and from the power plant is 55 miles.

In addition to employee traffic, trucking of CCR occurs on a regular basis within the FCPP Lease Area, as shown in Table 4.9-2.

Table 4.9-2 Traffic Related to CCR Disposal

Activity	Number of Roundtrips per Year	Distance (Roundtrip Miles)	Maximum Traveling Speed (mph)
Contract trucking for all CCR and bottom ash produced by Units 4 and 5 (except CCR sold to SRMG) and bottom ash only from Units 1 through 3	15,800	3	30
Contract trucking for ash cleanout of sedimentation pond (Combined Waste Treatment Pond)	15,600	5	30
Vacuum trucks for equipment and area cleanup of ash and coal	1,095	3	30

Dedicated Railway

NTEC supplies coal for Units 4 and 5 of the FCPP from the Navajo Mine, utilizing a dedicated electric rail line that runs north to south between the mine and the power plant. The train carrying the coal is filled daily and travels uncovered to the power plant where it is offloaded. The railway is operated under a ROW agreement between BHP Minerals International and the BIA, Real Property Management, effective January 25, 1974 (BNCC 2012g).

Airports

Two local airports provide air access to the ROI from outside locations. Shiprock Airstrip, also known as Shiprock Airport, is south of the central business district of Shiprock (Google Earth 2010). Shiprock Airport is approximately 10 miles west of the ROI. No commercial flights come into or out of Shiprock Airport. The airstrip facility is owned by the Navajo Nation and is available for public use (AirNav 2012). Also, a landing strip is located about 1 mile south of the southernmost portion of the Navajo Mine Lease Area in the Burnham Chapter. The community would like to see the airstrip reactivated as a regional airstrip or airport for both emergency services and commercial development (Architectural Research Consultants, Inc. 2005).

Four Corners Regional Airport is located in Farmington and is approximately 13 miles northeast of the ROI. The airport is owned and operated by the City of Farmington and serves a regional population of over 100,000. Air service is provided by Great Lakes Airlines to and from Denver, Phoenix, Las Vegas, Page, and Show Low via six daily scheduled flights in and out of the airport (6 in and 6 out). The airport has two runways and is sited at a 5,506-foot elevation (City of Farmington 2012).

4.9.3 Changes to Land Use and Transportation Affected Environment Post-2014

Two completed federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions; and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared in the following Section. Neither of these completed federal actions would change the affected environment for land use or transportation, with the exception of the number of truck trips related to CCR disposal (as shown in Table 4.9-2). Post-2014, bottom ash from Units 1, 2, and 3 would no longer be hauled within the FCPP lease.

4.9.4 Environmental Consequences

This section contains a qualitative assessment of impacts to land use including agricultural uses and transportation and access. Assessment of impacts on land use and agricultural resources is based on the type and amount of disturbance that would be caused by operation of the Project facilities. Potential adverse impacts that are considered include land use changes that would be inconsistent with existing land use plans and/or major loss of agricultural fields or grazing areas. The magnitude of impact on agricultural resources is based on the amount and type of loss, with a major impact defined as one that would permanently remove cropland or grazing area or make such lands largely unavailable for future farming and/or grazing activity. Impacts on transportation were assessed based on the amount of disturbance to access and the potential for long-term effects on existing capacity for traffic flows.

4.9.4.1 Alternative A – Proposed Action

Navajo Mine

Land Use

Land uses in the Navajo Mine area include residential uses, limited recreation, grazing and mining. Mining activity in the Pinabete Permit Area would result in three direct impacts to existing land use: 1) three dwellings would require permanent relocation; 2) access to grazing areas in the Pinabete Permit Area and surrounding area would be permanently altered through the removal of some two-track roads; and 3) up to 5,569 acres of forage area and all grazing area within five CUAs would be temporarily removed in order to realign Burnham Road and mine within the proposed area and would be restored after reclamation. Each of these impacts is discussed in more detail below.

The Proposed Action would require the permanent relocation of three dwellings located within the proposed Pinabete Permit Area of the Navajo Mine Lease. NTEC's agreement with the Navajo Nation for the Navajo Mine Lease requires compensation of families and individuals with land use rights within the lease area (BNCC 2012g). Through compliance with the lease provisions, this impact although permanent, is considered minor. In addition increased dust and noise during construction associated with realignment of Burnham Road would result in short-term disturbance to residential land use (individual homesites in the unpermitted section of Area IV South)(see Section 4.14, Noise and Vibration and Section 4.1, Air Quality.

Relocation of Burnham Road and associated unnamed two-track roads would result in permanent changes to access to grazing areas, specifically the five CUAs that intersect the Pinabete Permit Area (Figure 3.9-2). However, this impact is considered minor because the relocated Burnham Road and the

altered two-track roads would still provide access to grazing areas outside of the Pinabete Permit Area but still within the grazing district. Further, any two-track roads removed during development of the Pinabete Permit Area would be re-established in the post-mine landscape, in accordance with proposed reclamation activities.

The Proposed Action would change the existing land use within the Pinabete Permit Area from grazing to mining during the permit period (2016–2041) and during the reclamation period (approximately 10 years). The five CUAs that intersect the Pinabete Permit Area and seven associated BIA grazing permittees would be unable to graze within their CUA for the duration of mining operations and reclamation activities (BNCC 2012a); however, NTEC would compensate customary users for loss of grazing areas in accordance with Navajo Nation and BIA requirements and would restore the land in the Pinabete Permit Area to conditions suitable for livestock grazing post-mining (BNCC 2012a),except for the 2.8 mile (approximately 22 acres) area lost due to the relocation of Burnham Road. The post-mining land use for the Pinabete Mine Plan permit area has been designated as rangeland for the grazing of domestic livestock and wildlife habitat. The grazing capability of the reclaimed lands is expected to be equal to or greater than the pre-mining capability (BNCC 2012g). According to SMCRA 30 U.S.C 1265(2), applicants are required to “restore the land affected to a condition capable of supporting the uses which was capable of supporting prior to any mining…”, thereby holding the applicant to return the land to grazing after mining operations have ceased.

During mining activities, however, there is potential for grazing outside of each customary user’s CUA and in the general project area outside the confines of the Pinabete Permit Area. This long-term change in land use would occur within the existing Navajo Mine Lease Area, which was planned for use in mining operations as per NTEC’s lease with the Navajo Nation. The post-reclamation land use likely would revert back to the present-day land use of grazing within the CUAs.

Transportation and Access

NTEC would construct approximately 5 miles of primary roads and approximately 22 miles of ancillary roads within the Pinabete Permit Area to support coal extraction. To facilitate operations in the Pinabete Permit Area, the Navajo Mine would also realign the 2.8 miles of the existing Burnham Road and construct two new haul roads. It is anticipated that realignment of Burnham Road will take two to three months. Primary roads including Burnham Road would be designed by a New Mexico-registered professional engineer, in consultation with the BIA Transportation, to meet the SMCRA performance standards of 30 CFR Subchapter K, as well as 30 CFR Subchapter G, 780.33 for the public portions of Burnham Road, and the MSHA standards and requirements for roads. Under SMCRA regulations (30 CFR 761.14), NTEC is also required to develop adequate resource protection measures to eliminate, minimize, and/or mitigate any effect on public roads. As a result, NTEC would be required to coordinate through public outreach and community involvement with the Navajo Nation and each individual chapters affected by the Proposed Action. The Proposed Action wholly incorporates these administrative requirements.

Primary and ancillary roads would continue to be used during mining of the Navajo Mine Lease Area, as well as in the Pinabete Permit Area. Primary roads are those used to transport coal and spoil, are main access roads to the mining areas used by small and heavy equipment, and provide access roads to the support facilities.

Road widths for primary roads may vary between 30 and 120 feet wide, include multiple traffic lanes, and may separate light and heavy equipment. Additionally, primary roads would be designed, constructed, and maintained in a manner to minimize the contribution of additional suspended solids to surface water runoff. Primary road crossings would use engineered crossing designs according to all applicable permit regulations. Culverts may be placed at topographic lows or areas where roads intersect drainage channels and are designed to safely pass the peak discharge from a 10-year, 6-hour storm event and minimize the alteration of the stream channel in order to improve traffic safety.

Ancillary roads generally would be constructed using a road grader to create the road surface. Typical widths range between approximately 12 feet for small vehicle roads and approximately 80 feet for topsoil haulage roads. Ancillary roads utilize low water crossings or culvert crossings depending upon how deeply incised the intersecting channels are.

Restriction or modification of existing access routes specifically used for grazing activities would result in potential short-term impacts to traffic flow during realignment of Burnham Road. Direct short-term to long-term beneficial impacts resulting from the proposed realignment of Burnham Road would include improved road surface conditions and increased traffic safety compared to existing conditions. The realignment would eliminate a sharp curve that currently exists, thus improving safety on the roadway. In addition, realignment of Burnham Road would eliminate the need to stop traffic during blasting operations, which would improve both safety and traffic flow. Realignment of the Burnham Road would have minor to moderate beneficial effects upon traffic safety associated with use of this road. Following completion of Burnham Road realignment, long-term changes to this portion of the transportation network would provide access for post-mining land use for livestock grazing.

Under the Proposed Action, road construction would occur in order to allow for road construction. Construction related truck trips are anticipated to temporarily increase to accommodate construction materials and equipment. However, this temporary and minor increase in traffic is not expected to significantly increase traffic on any local roads, therefore, no impacts would occur. Mining in the expanded Pinabete Permit Area would utilize mining equipment already onsite from existing Navajo Mine Permit Area, such that new mining equipment would not be brought on-site, so existing mining-related traffic volumes would not change.

As part of the SMCRA permit for the Pinabete Permit Area, NTEC would prepare a Traffic Management Plan. All roads in the Project Area would be established to minimize impacts on affected parties in the Project Area such as the Burnham Chapter and those with grazing permits under CUAs. The Traffic Management Plan shall include provisions to provide reasonable access for grazing and necessary local traffic, emergency response agency notification, and notification of the public and emergency responders of all detours. In addition, affected parties shall be notified prior to initiation of new mining activities in Area IV as well as the realignment of Burnham Road. Notification shall include information regarding detours and contact numbers of the Proponent and the contractor. The plan shall be submitted to OSMRE for review and approval at least 60 days prior to initiation of any activity. With the implementation of this plan, short-term traffic impacts during construction of Burnham Road would be minimized.

Mining operations in Area IV South would likely require removing, restricting, and/or relocating unimproved two-track roads used for livestock grazing access. Temporary use restrictions would occur on some public roads and unimproved access routes to ensure public safety during active mining operations such as blasting, resulting in a minor impact that would last for the duration of mining. Adequate signage and security would be provided to communicate timing of such activities to the public and minimize the impact of mining activities.

In terms of post mining plans for roads constructed for the Navajo Mine and Pinabete Permit Area, NTEC does not plan to retain any of the mine roads for post-mining land use; however, prior to removal of roads NTEC will consult with the Navajo Nation and identify any roads that the Navajo Nation would like retained (BNCC 2009, 2012a).

Consequently, the following reclamation measures are planned:

1. Where a road traverses otherwise undisturbed land, the natural drainages would be restored unless reestablishment would not enhance environmental values;
2. All culverts would be removed along with the removal of the associated road. All culvert work completed in waters of the US would be completed in accordance with CWA Section 404 requirements.

The culverts would be salvaged or recycled, if possible, otherwise they would be disposed in accordance with Section 20.6. ;

3. Roadbeds would be ripped, plowed, and scarified;
4. Fill slopes would be ripped and rounded or reduced and shaped to conform to the surrounding terrain and to meet natural drainage restoration;
5. Cut slopes would be shaped to blend with the regraded or natural contour;

Regraded surfaces would be covered with topdressing and revegetated according to the Reclamation Plan.

Four Corners Power Plant

Land Use

The primary effect to land use at the FCPP which would occur under the Proposed Action is the proposed expansion of the DFADAs and borrow areas which are currently undeveloped. The expansion areas would occur within the boundaries of the FCPP Lease Area; therefore, no major changes to existing land use within the FCPP Lease Area would occur. The Proposed Action would not change land use associated with Morgan Lake. Also, no land use changes would be associated with continued use of the electric rail line that transports coal from the mine to the FCPP. No dwellings are located in this area, and no residents would be directly impacted by the proposed DFADAs. DFADAs would be closed as they reach capacity, such that by 2041 all DFADAs are closed via evapotranspiration covers. APS would be responsible for developing a closure and post-closure management plan for areas where coal combustion residues have been disposed. The closure of any disposal unit would be required to be done in accordance with this closure plan that would include assurance criteria for financial liability. APS would decommission all facilities that are not required or permitted to be left behind by the 1960 and 1966 leases. As such, decommissioning and dismantling activities would need to be coordinated with the Navajo Nation so that the area meets the specific needs of any planned reuse. APS has not yet prepared a decommissioning plan, but any demolition activities would comply with all environmental laws and regulations applicable at the time, potentially including NEPA review.

Under the Proposed Action, there would be no change to the footprint of the lease boundary for the FCPP or to the facilities surface water rights (as described in Section 3.5, the FCPP would only draw as much water as allocated under its existing water rights agreement); therefore, none of the proposed changes to the current FCPP footprint would impact current or future agricultural operations on Navajo Nation Tribal Trust Lands. Expansion of the ash area would be adjacent to the existing ash disposal area and proposed borrow areas would be located in this same area. No grazing occurs in this portion of the lease area; therefore, no impact would occur.

Transportation and Access

Construction-related activities at the FCPP would involve installation of new (selective catalytic reduction) SCR devices on Units 4 and 5. Units 1 through 3 were shut down December 30, 2013 and could be dismantled and demolished prior to the end of the lease. During the installation of SCR devices on Units 4 and 5, and dismantling and demolition activities associated with Units 1-3, additional construction equipment would be used and additional truck trips would be anticipated; however, these additions would be temporary, lasting only until construction and dismantling were completed. Activities during construction and dismantling would include delivery of construction materials related to installation of SCR devices.

During operations at the FCPP employment levels would be anticipated to remain at the same levels as existing conditions. Therefore, daily commuter trips to the FCPP during the new lease period are not anticipated to change as a result of the Proposed Action. With the installation of SCR devices on Units 4 and 5, ammonia delivery would be required. It is uncertain what form of ammonia would be used. The approximate number of truck trips that would be required per week to deliver the necessary supply to

operate the plant have been estimated based on the three forms that are feasible options for FCPP. If anhydrous urea is used, it is estimated as a bounding analysis that approximately 11 truck trips would be required per week to deliver the necessary supply. If dry urea is used, it is estimated that 15 truck roundtrips would be required per week to deliver enough urea to the plant. If 29 percent aqua ammonia or 45 percent aqua urea is used, the number of truck trips required would increase to 25 and 28 trips per week, respectively. Based on the current ADT on roadways to the FCPP, the increased truck trips would amount to approximately 2 to 4 additional trucks on the roadways per day. Therefore, impacts on transportation systems over the 25-year lease period would be minor. Delivery of ammonia and associated hazards are discussed in Section 4.15, Hazardous and Solid Wastes and Section 4.17, Health and Safety.

Transmission Lines

Land Use

Renewal of the current ROW would not result in any changes to land use associated with the four existing transmission lines. All land uses would remain as described in the Affected Environment.

Continued operation of the transmission lines would not impact existing or future farming or grazing operations because no new construction activities would occur. Continued operation and maintenance activities would be conducted using existing access roads, within the current ROW; therefore, no impacts would result.

Transportation and Access

No new transmission line construction is proposed as part of the Project, nor are new access roads or any change in the frequency or type of maintenance activities to be conducted along the transmission corridor. Therefore, the Project would have no impacts associated with transportation and access related to transmission lines.

4.9.4.2 Alternative B – Navajo Mine Extension Project

Navajo Mine

Land Use

Implementation of this alternative would potentially result in the permanent relocation of three dwellings from within the Pinabete Permit Area. This alternative would require an increased disturbance footprint of approximately 894.5 acres as compared to the Proposed Action. Additionally, Alternative B would require construction of 5 more miles of roadways and 8 more miles of transmission lines than described for the Proposed Action.

The overall land use would remain the same as discussed in the Proposed Action. Impacts would also be similar but at a greater magnitude than the Proposed Action due to the increased disturbance footprint related to mining activities and road construction as well as greater disturbance to Pinabete Arroyo.

Transportation

Alternative B would require construction of 5 more miles of roadways and 8 more miles of transmission lines than described for the Proposed Action. As a result of the increased construction, increased traffic, dust, and noise would occur during construction associated with additional road construction as well as with realignment of Burnham Road, which would result in short-term moderate adverse disturbance to residential land use (individual homesites in the unpermitted section of Area IV South) and public traffic on Burnham Road. Impacts during construction would be similar to the Proposed Action but at a greater magnitude due to the additional road construction activity under Alternative B.

During operations, the haul distance from the field coal stockpiles to the Lowe Stockpile would also increase by approximately 3 miles, which would require increased truck trips during operations. However,

these activities would occur within the boundary of active mining operations and would not affect traffic levels on public roadways. Additionally, direct short-term to long-term beneficial impacts would be realized for the realignment of Burnham Road, which would improve road surface conditions and safety compared to existing conditions.

Four Corners Power Plant

Under Alternative B, the BIA would approve the lease amendment for the FCPP and the FCPP would operate as described under the Proposed Action. No additional land use or transportation impacts related to the FCPP would be anticipated from implementation of Alternative B.

Transmission Lines

Under Alternative B, the transmission line ROWs would be approved and they would continue to be operated and maintained as described under the Proposed Action. No additional land use or transportation impacts related to existing transmission lines would occur from implementation of Alternative B.

4.9.4.3 Alternative C – Alternative Pinabete Mine Plan

Navajo Mine

Land Use

Implementation of Alternative C would result in the permanent relocation of three dwellings from within the Pinabete Permit Area. This alternative would require an increased disturbance footprint of approximately 2,389 acres as compared to the Proposed Action. Additionally, Alternative C would require an additional 3.4 miles of realignment of Burnham Road, 9.9 additional miles of primary roads and 0.8 mile less of ancillary roadways as compared to the Proposed Action. Alternative C would also require 7.8 more miles of transmission lines than as described for the Proposed Action. The Navajo Mine would also need to construct additional infrastructure and support facilities (16 arroyo crossings). Reclamation activities would be conducted as described under the Proposed Action.

As a result of the increased construction, there would be increased traffic, dust and noise during construction associated with additional road construction as well as with the additional realignment of Burnham Road which would result in short-term minor adverse disturbance to residential land use (individual homesites in the unpermitted section of Area IV South) similar to the Proposed Action but at a greater magnitude due to increased construction and disturbance footprint.

The overall land use would remain the same as discussed in the Proposed Action. Impacts would also be similar but at a greater magnitude as compared to the Proposed Action due to the increased disturbance footprint related to mining activities and road construction as well as greater disturbance to the Pinabete Arroyo.

Transportation

Overall, Alternative C would require construction of approximately 12.5 more miles of roadways and 8 more miles of transmission lines than as described for the Proposed Action. As a result of the increased construction, there would be increased traffic, dust and noise during construction associated with additional road construction as well as with realignment of Burnham Road which would result in short-term minor adverse disturbance to residents in the area (individual homesites in the unpermitted section of Area IV South) and public traffic on Burnham Road. Impacts during construction would be similar to the Proposed Action but at a greater magnitude due to the additional road construction activity under this Alternative.

During operations, the haul distance from the field coal stockpiles to the Lowe Stockpile would also increase by approximately 3 miles, which would require increased truck trips during operations. However,

these activities would be occurring within the boundary of active mining operations and would not affect public traffic. Additionally, direct short-term to long-term beneficial impacts would be realized for the realignment of Burnham Road which would improve road surface conditions and safety compared to existing conditions.

Four Corners Power Plant

Under Alternative C, the BIA would approve the lease amendment for the FCPP and the FCPP would operate as described under the Proposed Action. No additional land use or transportation impacts related to the FCPP are anticipated from implementation of Alternative C.

Transmission Lines

Under Alternative C, the transmission line ROWs would be approved and they would continue to be operated and maintained as described under the Proposed Action. No additional land use or transportation impacts related to existing transmission lines would occur from implementation of Alternative C.

4.9.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action. No additional land use or transportation impacts related to the Navajo Mine are anticipated from implementation of Alternative D. As such, impacts would be the same as described for the Proposed Action.

Four Corners Power Plant

Under this alternative, the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The 10 percent reduction in surface area of the DFADAs would result in the same land use and transportation related impacts as described for the Proposed Action. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

Under this alternative, the transmission line ROWs would be approved and they would continue to be operated and maintained as described for the Proposed Action. No additional land use or transportation impacts related to existing transmission lines would occur from implementation of Alternative D. As such, impacts would the same as described for the proposed action.

4.9.4.5 Alternative E – No Action Alternative

Under Alternative E, no mining would be permitted past 2014 on NTEC lease land, and the FCPP would subsequently shut down. No road realignment would occur, and the DFADAs would not be expanded. The No Action Alternative would not change land use along any of the four transmission lines if they were left in place. However, if they were dismantled, then changes to land use along the transmission corridor would potentially change if ROW is purchased and developed on a case by case basis. These changes would be addressed in subsequent environmental documents.

Navajo Mine

<u>Land Use</u>

Alternative E would result in no change in land use for the Pinabete Permit Area and, therefore, no relocation of the three affected dwellings in the permit area would be required. Also, grazing and CUAs

would not change. Alternative E would result in no additional noise, dust, and traffic during the road realignment construction period.

Additionally, under Alternative E, the existing CUAs and access roads to the grazing areas within the proposed Pinabete Permit Area would not change. It is assumed that these lands would continue to be used for livestock grazing through the entire Project timeline (2041). In the Navajo Mine Permit Area, NTEC would mine until the ROD is issued in 2015 and then reclaim the land, as described in the existing Navajo Mine Permit.

Transportation and Access

Under Alternative E, two track access routes and Burnham Road would continue to experience short-term impacts associated with restricted use for the life of Area III operations. Burnham Road would not be rerouted and public benefits to transportation and safety would not be realized. No impacts on 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 until 2016 when Area III would no longer be mined. Mine-related traffic would decrease as early as 2021 when reclamation activities would be completed.

Four Corners Power Plant

Land Use

Alternative E would result in a shutdown of FCPP Units 4 and 5. Wet and dry fly ash deposits would be closed via evapotranspiration covers and therefore, the land use would not change. APS would decommission all facilities that are not required or permitted to be left behind by the 1960 and 1966 leases. As such, decommissioning and dismantling activities would need to be coordinated with the Navajo Nation so that the area meets the specific needs of any planned reuse. Several potential future uses of the site are possible. It could continue as an energy generation site with several potential technology scenarios. The infrastructure could also be demolished and the site redeveloped for industrial, commercial, or residential uses. It is entirely speculative at this time to predict the likely alternative future uses for the site. Any decisions regarding the future uses must be with the concurrence of the other owners. Currently the site is undivided by all of the owners; future uses may therefore require subdivision of the property.

APS has not yet prepared a decommissioning plan, but any demolition activities would comply with all environmental laws and regulations applicable at the time, potentially including NEPA review. Decommissioning would require environmental abatement activities in the power block, including removal of environmental and safety hazards (e.g., asbestos, lead paint), and chemicals and oils. All waste generated during this phase would be managed and disposed of in accordance with applicable federal environmental regulations. Dismantling and demolition would commence following the removal of asbestos, PCB, lead paint and any other hazardous chemicals. Upon removal of structures and facilities, the structural foundations would be removed to 24 inches below grade, the site profiled to allow for proper drainage, and native vegetation planted as applicable. In addition to the five units, decommissioning and dismantling may also include removal of all three switchyards. The timeline for this process is at the discretion of APS and the Navajo Nation.

In the absence of FCPP operations no water would be drawn from the San Juan River for use at the power plant and then subsequently discharged into Morgan Lake, so the lake would evaporate and cease to exist. If APS chose to leave the river pumping plant and the pipeline behind, and the Navajo Nation took possession of those facilities, it is not known if or how the river pump station would be operated. Following the possible dismantlement of the power plant and any associated remediation activities, additional land may be available for grazing, although it is uncertain at this time.

Transportation and Access

Under Alternative E, Units 4 and 5 would be shut down by 2016. During the demolition of FCPP, there would be temporarily increasing worker traffic and traffic of heavy machinery. However, future uses of the site are speculative and subject to environmental review at the tribal or federal level at the time they are developed and proposed. Under Alternative E, the electric rail line would no longer be required to transport coal from the mine to the FCPP.

Transmission Lines

Land Use

Since the subject lines primarily transmit power from the FCPP, under Alternative E, the power source for the transmission lines would be removed. Since the FCPP would cease operations, the amount of electricity carried by the transmission lines would decrease substantially. It is unlikely that they would be decommissioned and demolished however, because they still support interconnection of the Western US energy grid and potential future energy supplies could use the excess capacity. If however, the lines are decommissioned and dismantled, such activities would be subject to environmental review at either the tribal or federal level, possibly including NEPA analysis, and compliance with all environmental laws and regulations would occur throughout the demolition process.

4.9.5 Land Use and Transportation Mitigation Measures

The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific mitigating measures for certain environmental impacts, standard operating procedures that reduce or avoid environmental impacts, and best management practices for specific activities. These are described in Section 3.2.6.9. These measures are part of their application materials and are enforceable through permit or lease conditions. In addition, the Project Applicants must comply with additional protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section for each resource category. Where the environmental analysis in this EIS recommends additional protective measures, over and above the applicant proposed measures and regulatory compliance, they are listed below as specific mitigation measures.

The Proposed Action, including the continued operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects to land use and transportation. Therefore, no additional mitigation is recommended.

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4.10 Socioeconomics

This section characterizes the current and future socioeconomic conditions in the Four Corners region, accounting for ongoing and future operations of FCPP and Navajo Mine. The affected environment is described in two distinct sections, one for conditions prior to 2014 and another for baseline conditions (i.e. 2016) that assumes the installation of SCR on Units 4 and 5, shutdown of Units 1-3, and NTEC ownership of Navajo Mine. Impacts from the proposed alternatives are provided to allow for a comparative analysis between current and future operations.

The CEQ regulations implementing NEPA state that when economic or social effects and natural or physical environmental effects are interrelated, the EIS will discuss these effects on the human environment (40 CFR 1508.14). The CEQ regulations further state that the "human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment." This socioeconomic analysis evaluates how elements of the human environment such as population, employment, and public services might be affected by the Proposed Action.

This section describes the key attributes and resources pertaining to the human environment in the ROI, including population, demographics, housing, the economy, social characteristics, and public services. Following a description of the ROI, socioeconomic information in this section is organized into four subsections:

- **Population and General Demographics.** This subsection provides data on the number of residents of the ROI and the racial/ethnic, gender, and age composition of those residents.
- **Economic Conditions.** This subsection provides data on industry composition as well as employment and unemployment characteristics in the ROI. Detailed data are presented on the economic and fiscal contributions of the FCPP and Navajo Mine to San Juan County.
- **Indicators of Social and Economic Well-Being.** This subsection provides information on social issues as well as data on educational attainment, income and poverty, housing, and health status and risks.
- **Navajo Public Services.** This subsection provides information on the staffing levels and service populations of Navajo Nation public service departments. Navajo Nation departments for which data are presented include:
  - Navajo Nation Department of Diné Education
  - Navajo Nation Department of Emergency Management
  - Navajo Nation Department of Fire and Rescue Services
  - Navajo Nation Department of Highway Safety
  - Navajo Nation Emergency Medical Service
  - Navajo Police Department

Information presented in this affected environment section provides two sets of socioeconomic conditions: current conditions (Section 4.10.2) and baseline conditions (Section 4.10.3). Baseline conditions are the conditions that will be present at the time a decision is made regarding the Proposed Action and are the appropriate point of comparison to identify impacts due to the alternatives (rather than due to other, concurrent changes). Due to the shutdown of FCPP Units 1, 2, and 3,[1] associated reduction in coal production at the Navajo Mine, and the sale of the Navajo Mine to NTEC, the baseline socioeconomic

[1] To comply with Title V of the Clean Air Act, APS opted to shutdown Units 1-3 and apply SCRs to Units 4 and 5. The shutdown of Units 1-3 occurred December 30, 2013 and the installation of SCRs on Units 4-5 will be initiated in 2014 and likely completed by 2018.

conditions in the ROI will differ slightly from current conditions. Specifically, current conditions and the majority of available data on the ROI reflect a higher level of economic activity at the FCPP and Navajo Mine than the baseline conditions that will be experienced prior to implementing the Proposed Action. Socioeconomic data describing baseline conditions is based on calculated changes in economic activity due to the shutdown of Units 1, 2, and 3; and the transfer in ownership of the mine. For other socioeconomic attributes and resources, the section discusses qualitatively how baseline conditions may differ from data presented on current conditions.

Data sources include the US Census Bureau (Census), OSMRE, University of New Mexico Bureau of Business and Economic Research, Arizona State University (ASU) study of the FCPP and Navajo Mine, Navajo Nation public service departments, and several studies on the social issues/concerns in the ROI.

4.10.1.1 Region of Influence

The ROI for this analysis is McKinley County; San Juan County, NM; the city of Farmington; Navajo Nation tribal trust lands; and Hopi tribal trust lands (see Figure 4.10-1). Of primary interest are the Navajo Nation tribal trust lands and San Juan County, NM, as nearly all actions considered under the alternatives would be in these jurisdictions. The Hopi tribal trust lands are included in the ROI because the ROWs for transmission lines that are proposed for renewal also extend to Hopi tribal trust lands. Other areas are included in the ROI because they are near the Navajo Mine and FCPP, and share an economic or social connection. Farmington, a city in San Juan County, shares a strong economic connection to mining and FCPP operations; many local businesses that support mining and FCPP operations are located in Farmington. McKinley County[2] borders San Juan County and includes Navajo Nation tribal trust lands and residents that may be affected by the alternatives. The State of New Mexico is also considered in the analysis to offer a comparison between how the project affects the local and state economies.

4.10.2 Affected Environment Pre-2014

This section outlines the current socioeconomic conditions within the ROI; these current conditions represent conditions present while all five units at FCPP are in operation, and NTEC and MMCo are the owners/operators of the Navajo Mine. Information presented in this section includes data gathered from the 2010 Census, from various research reports and other environmental documents, and from information provided directly by Navajo Nation public service providers.

[2] As McKinley County consists largely of Navajo Nation lands, data presented for McKinley County are nearly a subset of the data presented for the Navajo Nation.

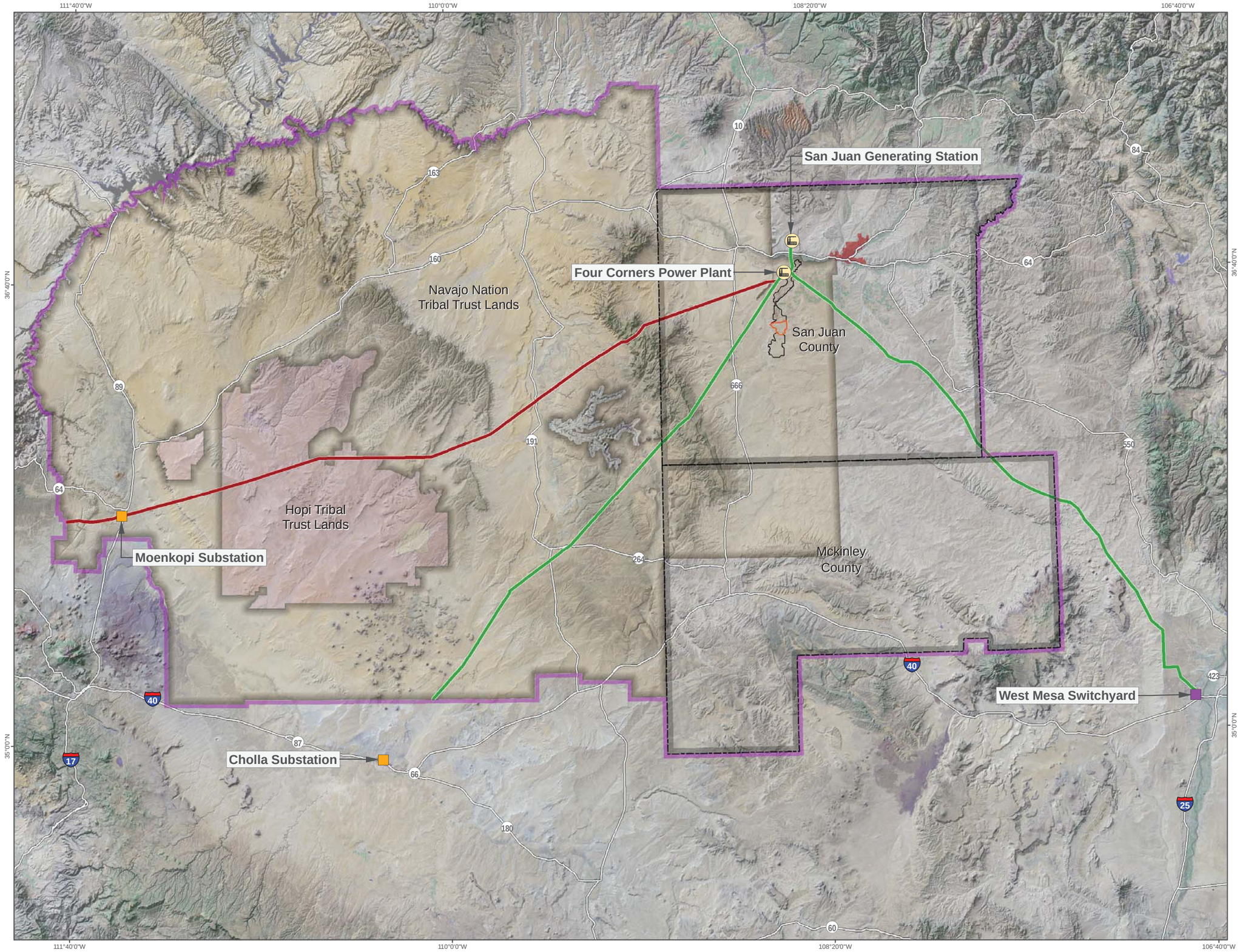

Figure 4.10-1

Region of Influence

PROJECT FACILITIES

- Four Corners Power Plant
- Substation
- Switchyard

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Proposed Pinabete Permit Boundary
- Region of Influence

TRANSMISSION LINES

- 345kV
- 500kV

OTHER FEATURES

- County Boundaries
- Hopi Tribal Trust Lands
- Navajo Nation Tribal Trust Lands

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Scale in Miles

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4.10.2.1 Population and Demographics

This section provides data on the number of residents of the ROI and the racial/ethnic, gender, and age composition of those residents.

Population

Table 4.10-1 provides information on total population for the years 1990, 2000, and 2010, and the percent changes between those years. In 2010, the population on the Navajo Nation was 173,667; this jurisdiction had the largest population when compared to the other ROI locales. That Navajo Nation population grew by 22 percent from 1990 to 2000 and decreased by 4 percent from 2000 to 2010, resulting in an overall population growth of 17 percent from 1990 to 2010. This overall population growth from 1990 to 2010, coupled with a population decline from 2000 to 2010, also occurred in McKinley County, San Juan County, the City of Farmington, and the State of New Mexico. In contrast, population on Hopi tribal trust lands decreased by 6 percent from 1990 to 2000, and increased by 3 percent from 2000 to 2010; an overall decrease by 2 percent from 1990 to 2010.

San Juan County population grew faster than any other area in the ROI, increasing 42 percent from 1990 to 2010. The State of New Mexico as a whole (36 percent) and the City of Farmington (35 percent) grew almost as quickly. Both McKinley County and Navajo Nation's populations increased by a little more than 20 percent from 1990 to 2000, and both decreased by 4 percent from 2000 to 2010, resulting in population growth from 1990 to 2010 of 18 and 17 percent, respectively.

Table 4.10-1 Population, 1990-2010

	1990	2000	2010	% Change 1990 to 2000	% Change 2000 to 2010	% Change 1990 to 2010
Navajo Nation	148,451	180,462	173,667	22%	-4%	17%
McKinley County	60,686	74,798	71,492	23%	-4%	18%
San Juan County	91,605	113,801	130,044	24%	14%	42%
City of Farmington	33,997	37,844	45,877	11%	21%	35%
Hopi Reservation	7,360	6,946	7,185	-6%	3%	-2%
New Mexico	1,515,069	1,819,046	2,059,179	20%	13%	36%

Sources: Census 1990, 2000, 2010a

Table 4.10-2 provides population projections for McKinley County, San Juan County, and the State of New Mexico, for the years 2020 and 2030. Both counties are expected to have a smaller increase in population than New Mexico; however, all are projected to experience population growth. McKinley County is expected to grow by 3 percent and San Juan County is expected to grow by 24 percent between 2010 and 2030. Population growth for New Mexico overall is projected to be 27 percent from 2010 to 2030. No published population projections were available for the city of Farmington and the Hopi Reservation. Population projections for the Navajo Nation were developed for the Navajo Nation Comprehensive Economic Development Strategy (NN-CEDS) (Navajo Nation Division of Economic Development 2010); however, these projections have not been updated to account for the reduction in population from 2000 to 2010 that was identified in the 2010 Census. As the NN-CEDS projection estimated a large population increase from 2000 to 2010 while population actually declined, population figures projected for 2020 and 2030 no longer appear valid.

Table 4.10-2 Population 2010 and Population Projections 2020-2030

	2010	2020	2030	% Change 2010 to 2020	% Change 2010 to 2030
Navajo Nation	173,667	NA	NA	NA	NA
McKinley County	71,492	73,483	73,805	2.8%	3.2%
San Juan County	130,044	146,388	161,593	12.6%	24.3%
City of Farmington	45,877	NA	NA	NA	NA
Hopi Reservation	7,185	NA	NA	NA	NA
New Mexico	2,059,179	2,351,724	2,613,332	14.2%	26.9%

Sources: Census 2010a; University of New Mexico Bureau of Business and Economic Research 2012; Navajo Nation of Economic Development 2010

Demographics

As shown in Table 4.10-3, in 2010, race in the ROI and New Mexico overall was made up primarily of two groups – White and American Indian. The Navajo Nation was predominately American Indian (97.5 percent); this concentration of American Indians was the highest in the ROI. Hopi tribal trust lands and McKinley County were the only other locations that had a higher concentration of American Indians than any other racial group (96.2 and 77.9 percent, respectively). The population of the State of New Mexico, as a whole, was primarily comprised of Whites (71.5 percent), Hispanic or Latinos (16.5 percent), and American Indians (10.7 percent). The city of Farmington, which was largely White (66.4 percent), is the only location in the ROI with a Hispanic or Latino population above 10 percent (10.6 percent). San Juan County was primarily White (54.5 percent) and also had a substantial American Indian population (38.7 percent). Overall, the Navajo Nation had the smallest percentage of Whites (2.8 percent), Black or African Americans (0.4 percent), Hispanic or Latinos (0.4 percent), Asians (0.3 percent), and Native Hawaiian or other Pacific Islander (0.1 percent).

Table 4.10-3 Race and Ethnicity 2010

	White	Black or African American	Hispanic or Latino	Asian	American Indian or Alaska Native	Native Hawaiian or Other Pacific Islander
Navajo Nation	2.8%	0.4%	0.4%	0.3%	97.5%	0.1%
McKinley County	17.2%	1.0%	5.8%	1.0%	77.9%	0.1%
San Juan County	54.5%	1.0%	8.4%	0.7%	38.7%	0.1%
City of Farmington	66.4%	1.6%	10.6%	1.0%	24.5%	0.2%
Hopi Reservation	3.5%	0.5%	0.2%	0.4%	96.2%	0.3%
New Mexico	71.5%	2.8%	16.5%	2.0%	10.7%	0.2%

Source: Census 2010a

Note: Census surveys allow respondents to identify as more than one race; therefore, totals may exceed 100 percent.

Table 4.10-4 provides information on gender and age for the ROI and the State of New Mexico overall, for the year 2010. The Navajo Nation, like all of the locales included in the ROI, had more females than males (50.9 and 49.1 percent, respectively). This gender makeup is very similar to New Mexico overall which was 50.6 percent female and 49.4 percent male. The Navajo Nation consists primarily of working age people, 18 to 64 (57.1 percent), which was less than New Mexico overall (61.6 percent) and all of the other ROI locales but very similar to the makeup of the Hopi Reservation (57 percent). Every locale in the ROI had a higher percentage of children 17 and younger compared to New Mexico overall. The Hopi Reservation had the largest percentage of children under the age of 5 (9 percent), followed by the Navajo Nation (8.7 percent) and McKinley County and the city of Farmington (both 8.6 percent). The Navajo Nation had the largest percentage of school-age children between 5 and 17 (24.7 percent), followed by the Hopi Reservation (23 percent) and McKinley County (22.7 percent). The city of Farmington and the Hopi Reservation had the largest percentage of retirement age residents 65 and older (11.1 and 11.0 percent, respectively), but was still less than New Mexico (13.2 percent). Overall, the breakdown in the ages of residents on Hopi tribal trust lands was most similar to that of the Navajo Nation.

Table 4.10-4 Gender and Age, 2010

	Gender		Age			
	Male	**Female**	**Under 5**	**5-17**	**18-64**	**65 and Over**
Navajo Nation	49.1%	50.9%	8.7%	24.7%	57.1%	9.5%
McKinley County	48.4%	51.6%	8.6%	22.7%	59.2%	9.5%
San Juan County	49.6%	50.4%	8.4%	20.6%	60.2%	10.8%
City of Farmington	49.3%	50.7%	8.6%	19.3%	61.0%	11.1%
Hopi Reservation	48.7%	51.3%	9.0%	23.0%	57.0%	11.0%
New Mexico	49.4%	50.6%	7.0%	18.2%	61.6%	13.2%

Source: Census 2010a

4.10.2.2 Economic Conditions

This section provides data on industry composition as well as employment and unemployment characteristics in the ROI. Additionally, the economic and fiscal contributions of the FCPP and Navajo Mine to San Juan County under the pre-2014 condition (all five FCPP units operational, BNCC Navajo Mine owner) are presented.

Employment by Industry

Table 4.10-5 displays employment by industry for the ROI and New Mexico overall, for 2010. The educational services and healthcare and social assistance industries were the leading employers for every location in the ROI and New Mexico overall; the Navajo Nation had the highest percentage employed in this sector (36.2 percent). The Navajo Nation's other large employers for 2010 were the construction industry (11.2 percent), the public administration industry (10.5 percent), the arts, entertainment, and recreation, and accommodation and food services industry (10 percent), and the retail trade industry (9.9 percent). Compared to the State of New Mexico, jurisdictions in the ROI had relatively low employment in the following sectors: finance and insurance, and real estate and rental and leasing industry; and the professional, scientific, and management, and administrative and waste management services industry.

Labor Force, Employment, and Unemployment

Table 4.10-6 provides 2000 and 2010 labor force, employment, and unemployment statistics for the ROI and New Mexico. The Navajo Nation saw the smallest increase in the civilian labor force between 2000 and

2010 (3 percent), while the Hopi Reservation saw the largest increase (52 percent). Most of the locations in the ROI saw an increase in the civilian labor force from 2000 to 2010; only McKinley County had a decline in the labor force (-1 percent). The City of Farmington had the same increase in its labor force as the State of New Mexico (16 percent) and San Juan County's labor force increased by 13 percent.

From 2000 to 2010, the largest decrease in the unemployment rate was on the Navajo Nation (decrease of -9.4 percentage points), closely followed by McKinley County (-8.1 percentage points). All of the jurisdictions in the ROI experienced a decrease in the unemployment rate, with a larger decrease than experienced in New Mexico overall (-0.1 percentage point).

Even though the Navajo Nation experienced the largest reduction in its unemployment rate, it still had the highest unemployment rate in both 2000 and 2010 (25.1 and 15.6 percent, respectively). The 2010 unemployment rate on the Navajo Nation (15.6 percent) was more than twice that for the State of New Mexico (7.2 percent). The Hopi Reservation (14.4 percent) and McKinley County (8.9 percent) also had unemployment rates higher than New Mexico overall. Within the ROI only the city of Farmington and San Juan County had unemployment rates in 2010 that were lower than New Mexico overall (4 and 4.6 percent, respectively).

Economic and Fiscal Role of the FCPP and Navajo Mine

The economic role of the FCPP and Navajo Mine are provided in terms of contributions made to the economy of San Juan County for the year 2011. Contributions are expressed in terms of jobs, labor income, and economic output, defined as follows:

- *Jobs* represent the number of jobs, including part-time jobs, currently located in San Juan County that can be attributed to the FCPP and Navajo Mine.
- *Labor income* represents the income generated through the jobs at the FCPP and Navajo Mine; includes proprietor income (profits).
- *Gross State Product* (GSP) represents the dollar value of all goods and services produced for final demand in a state or county. It excludes the value of intermediate goods and services produced as inputs to final production.

Jobs, labor income, and economic output are measured in three ways – direct effects, indirect effects, and induced effects defined as follows:

- *Direct effects* are associated with the FCPP and Navajo Mine operations themselves. Direct jobs include jobs at the Navajo Mine and FCPP. Direct labor income is the incomes earned by workers at the Navajo Mine and FCPP. Direct economic output is associated with initial purchases of local materials and supplies needed to operate the Navajo Mine and FCPP.
- *Indirect effects* are the jobs, income, and economic output generated by the businesses that would supply goods and services needed to operate the Navajo Mine and FCPP. Indirect jobs include jobs at companies that supply goods and services to the Navajo Mine and FCPP. Indirect jobs can extend to include jobs related to the manufacture of products used to maintain operations (if the manufacturer is in San Juan County). Indirect labor income includes the income earned by people working indirect jobs. Indirect output includes the total sales volume related to the supply of goods and services to suppliers of goods and services.
- *Induced effects* are the result of spending of the wages and salaries of the direct and indirect employees on items such as food, housing, transportation, and medical services. This spending supports induced employment in nearly all sectors of the economy, especially service sectors.

The fiscal role of the FCPP and Navajo Mine includes tax and royalty payments to governments. Fiscal contributions are closely associated with the ability of local governments to provide public services such as police and fire protection and educational services.

Table 4.10-5 Employment by Industry, 2010

	McKinley County		San Juan County, NM		City of Farmington		Hopi Reservation		Navajo Nation		New Mexico	
Total Civilian Employment	23,970	**100%**	52,735	**100%**	20,308	**100%**	2,964	**100%**	44,757	**100%**	888,761	**100%**
Agriculture, forestry, fishing and hunting, and mining	618	2.6%	6,895	13.1%	2,603	12.8%	79	2.7%	1,847	4.1%	36,726	4.1%
Construction	1,557	6.5%	4,328	8.2%	1,484	7.3%	73	2.5%	5,021	11.2%	75,349	8.5%
Manufacturing	2,137	8.9%	1,875	3.6%	730	3.6%	270	9.1%	1,803	4.0%	47,079	5.3%
Wholesale trade	505	2.1%	1,671	3.2%	703	3.5%	91	3.1%	472	1.1%	19,887	2.2%
Retail trade	3,580	14.9%	6,244	11.8%	2,603	12.8%	291	9.8%	4,449	9.9%	103,278	11.6%
Transportation and warehousing, and utilities	803	3.4%	4,490	8.5%	1,626	8.0%	146	4.9%	2,428	5.4%	40,748	4.6%
Information	200	0.8%	630	1.2%	376	1.9%	43	1.5%	243	0.5%	16,994	1.9%
Finance and insurance, and real estate and rental and leasing	965	4.0%	1,951	3.7%	870	4.3%	67	2.3%	933	2.1%	45,111	5.1%
Professional, scientific, and management, and administrative and waste management services	910	3.8%	2,906	5.5%	1,148	5.7%	74	2.5%	908	2.0%	95,697	10.8%
Educational services, and healthcare and social assistance	7,343	30.6%	11,766	22.3%	4,364	21.5%	1,021	34.4%	16,189	36.2%	207,969	23.4%
Arts, entertainment, and recreation, and accommodation and food services	2,130	8.9%	4,531	8.6%	1,837	9.0%	215	7.3%	4,472	10.0%	91,649	10.3%
Other services, except public administration	994	4.1%	2,527	4.8%	1,073	5.3%	38	1.3%	1,272	2.8%	41,988	4.7%
Public administration	2,228	9.3%	2,921	5.5%	891	4.4%	556	18.8%	4,720	10.5%	66,286	7.5%

Source: Census 2010b

Table 4.10-6 Labor Force, Employment, and Unemployment, 2000 and 2010

		Civilian Labor Force	Number Employed	Number Unemployed	Unemployment Rate*
Navajo Nation	2000	51,330	38,465	12,865	25.1%
	2010	53,056	44,757	8,299	15.6%
	% Change	3%	16%	-35%	-9.4
McKinley County	2000	26,487	21,940	4,547	17.2%
	2010	26,300	23,970	2,330	8.9%
	% Change	-1%	9%	-49%	-8.3
San Juan County, NM	2000	48,985	44,541	4,444	9.1%
	2010	55,277	52,735	2,542	4.6%
	% Change	13%	18%	-43%	-4.5
City of Farmington	2000	18,198	16,928	1,270	7.0%
	2010	21,149	20,308	841	4.0%
	% Change	16%	20%	-34%	-3.0
Hopi Reservation	2000	2,280	1,869	411	18.0%
	2010	3,463	2,964	499	14.4%
	% Change	52%	59%	21%	-3.6
New Mexico	2000	823,440	763,116	60,324	7.3%
	2010	957,903	888,761	69,142	7.2%
	% Change	16%	16%	15%	-0.1

Sources: Census 2000, 2010a

* Changes in unemployment rates from 2000 to 2010 are presented in terms of difference in percentage points (rather than percentage difference).

Economic Contribution

The economic contributions of the FCPP and Navajo Mine under the current condition and under the baseline condition were estimated in an economic impact analysis prepared by W.P. Carry School of Business at Arizona State University (ASU 2013). The ASU study estimated total economic impacts at both the county level (San Juan County, New Mexico) and the state level (State of New Mexico). The modeled economic contributions from FCPP and Navajo Mine in San Juan County include both direct economic effects in the mining and power generation sectors as well as the indirect ripple effects that result from mine and power plant-related spending in other sectors.

Navajo Mine

As estimated in the ASU study, Tables 4.10-7 and 4.10-8 show the economic contribution of the Navajo Mine to San Juan County and the State of New Mexico under the pre-2014 condition (all five FCPP units in operation, BNCC Navajo Mine owner). In 2011, the Navajo Mine directly employed approximately 530 people. Mining operations generated $64 million in direct labor income and $143 million was added to GSP. In total, including indirect and induced effects, coal production at the Navajo Mine supported an estimated 1,580 full and part-time jobs with an estimated $107 million in labor income, and added an estimated $214 million to GSP in San Juan County, NM. As provided in Table 4.10-8, the state-level economy experiences larger indirect and induced effects because the economic benefits from Navajo

Mine operations ripple outwards from the local economy to the larger state-level economy, as there are support services/goods sourced from elsewhere in New Mexico and not just in the ROI.

Table 4.10-7 Navajo Mine – Current Economic Contribution to San Juan County, New Mexico (2011)

	Jobs	Labor Income (Millions of 2011 $s)	GSP (Millions of 2011 $s)
Direct Effects from Navajo Mine Operations	530	$63.8	$141.3
Indirect Effects from Navajo Mine Supplier Purchases	280	$14.4	$25.3
Induced Effects	770	$29.2	$47.6
Total Economic Contribution	**1,580**	**$107.4**	**$214.3**

Source: ASU 2013

Table 4.10-8 Navajo Mine – Current Economic Contribution to State of New Mexico (2011)

	Jobs	Labor Income (Millions of 2011 $s)	GSP (Millions of 2011 $s)
Direct Effects from Navajo Mine Operations	530	$63.8	$141.3
Indirect Effects from Navajo Mine Supplier Purchases	300	$15.3	$27.6
Induced Effects	1280	$52.4	$80.6
Total Economic Contribution	**2,110**	**$131.5**	**$254.0**

Source: ASU 2013

Four Corners Power Plant

Tables 4.10-9 and 4.10-10 show the economic contribution of the FCPP to San Juan County and State of New Mexico under the current condition (all five FCPP units operational), as estimated by the ASU study. In 2011, the FCPP directly employed approximately 500 people. FCPP operations are estimated to support $75 million in labor income, and $253 million in GSP. In total, including indirect and induced effects, FCPP operations supported 1,360 jobs, $106 million in labor income, $302 million in GSP in San Juan County, NM. As provided in Table 4.10-10, the state-level economy experiences larger indirect and induced effects because the economic benefits from FCPP operations ripple outwards from the local economy to the larger state-level economy since more support services/goods are provided from across New Mexico and not just from businesses in the ROI.

Table 4.10-9 Four Corners Power Plant – Current Economic Contribution to San Juan County, New Mexico (2011)

	Jobs	Labor Income (Millions of 2011 $s)	GSP (Millions of 2011 $s)
Direct Effects from FCPP Operations	500	$75.3	$253.1
Indirect Effects from FCPP Supplier Purchases	220	$6.6	$8.5
Induced Effects	640	$24.4	$40.1
Total Economic Contribution	**1,360**	**$106.4**	**$301.7**

Source: ASU 2013

Table 4.10-10 Four Corners Power Plant – Current Economic Contribution to State of New Mexico (2011)

	Jobs	Labor Income (Millions of 2011 $s)	GSP (Millions of 2011 $s)
Direct Effects from FCPP Operations	500	$75.3	$303.5
Indirect Effects from FCPP Supplier Purchases	200	$7.1	$9.1
Induced Effects	750	$29.0	$48.0
Total Economic Contribution	**1,460**	**$111.4**	**$360.6**

Source: ASU 2013; Totals may not sum due to rounding.

Right-of-Ways for Transmission Lines & Access Roads

All ROWs for the transmission lines and access roads proposed for renewal are existing and would not require any additional construction or maintenance beyond current activities. The access roads proposed for renewal do not require regular maintenance and the economic contribution from the limited maintenance activities are nominal. All operations and maintenance employees for the APS and PNM transmission lines work out of the FCPP. Therefore, the economic contributions from maintenance of the transmission lines (i.e. line and tower maintenance) and associated ROWs (i.e. vegetative management) are considered part of FCPP operations and accounted for in those sections.

Fiscal Contribution

Navajo Mine – Federal Government Taxes

Table 4.10-11 summarizes the total amount of Federal Government taxes paid by BNCC, based on coal sales, from 2008 through 2011. BNCC annually paid taxes in the form of the Black Lung Excise Tax and the Reclamation Act Levy (also known as the Abandoned Mine Land Fund). The Black Lung Excise Tax goes towards helping to fund the Black Lung Disability Benefit Program, which is managed by the US Department of Labor. Former coal miners who are disabled due to pneumoconiosis (black lung disease) resulting from their coal mine employment are eligible for compensation and medical benefits through the Black Lung Disability Benefit Program. Survivors of coal miners who have died due to pneumoconiosis are also eligible for benefits through this program. BNCC paid over $4 million annually to this program in the form of taxes between 2008 and 2013 (OSMRE 2013).

Abandoned Mine Land Fund payments are returned to states through grants to fund Abandoned Mine Land reclamation projects. This fund was established through SMCRA in 1997. BNCC paid over $2 million annually to this fund in the form of taxes. The annual average of total Federal taxes paid by BNCC (prior to the transfer of mine ownership to NTEC) is over $7 million (OSMRE 2013).

Table 4.10-11 Summary of Federal Government Taxes Paid by BNCC

Category	2008	2009	2010	2011
Black Lung Excise Tax	$4,519,639	$4,855,014	$4,327,713	$4,038,268
Reclamation Act Levy (Abandoned Mine Land Fund)	$2,558,620	$2,780,599	$2,478,162	$2,567,231
Annual Average of Total Federal Taxes	$7,031,312			

Source: OSMRE 2013

Navajo Mine – State of New Mexico and Local Government Payments

Table 4.10-12 summarizes the annual total of New Mexico state taxes paid by BNCC from 2008 through 2011. BNCC paid production taxes in the form of severance tax, resource excise tax, and conservation tax. The annual average of these taxes and property tax paid between 2008 and 2011 was approximately $10.4 million. The gross receipt tax (GRT) is paid to the State of New Mexico on purchases of equipment, supplies, and services related to Navajo Mine operations; on average, between 2008 and 2011, $9.5 million per year was paid in GRT (OSMRE 2013).

Table 4.10-12 Summary of New Mexico State Taxes Paid by BNCC 2008-2011

Category	2008	2009	2010	2011
Property Tax	$2,103,764	$2,241,690	$2,328,629	$2,261,502
Severance Tax	$7,860,170	$10,171,600	$5,332,543	$1,588,599
Conservation Tax	$406,196	$406,537	$333,974	$395,369
Resource Excise Tax	$1,601,621	$1,602,753	$1,321,265	$1,559,205
Annual Average of Total Navajo Mine Production Taxes Paid	$10,378,854			
GRT	$10,036,430	$9,732,285	$8,539,857	$9,769,753
Annual Average of Total GRT Paid	**$9,519,581**			

Source: OSMRE 2013

Navajo Mine – Revenue to Navajo Nation

Table 4.10-13 summarizes the annual Navajo Nation taxes and royalties that BNCC paid from 2008 through 2011. The Navajo Nation has collected approximately $40 million annually from BNCC through taxes and royalties. According to the Navajo Nation Tribal Council, this money makes up about one-third of the Navajo Nation's general fund (OSMRE 2013).

Table 4.10-13 Summary of Navajo Nation Taxes and Royalties Paid by BNCC

Category	2008	2009	2010	2011
Tribal Royalties	$32,219,881	$32,202,529	$26,802,424	$31,375,436
Navajo Business Activity Tax	$4,775,853	$5,108,425	$3,940,000	$5,399,599
Navajo Possessory Interest	$4,799,922	$3,672,030	$3,799,253	$4,700,144
Navajo Fuel Excise Tax	$977,387	$964,137	-	-
Annual Average of Total Navajo Nation Payments	**$40,184,255**			

Source: OSMRE 2013

Four Corners Power Plant – State of New Mexico and Local Government Payments

In 2011, the FCPP paid $3.7 million in property taxes, most of which was spent at the state level. FCPP's gross receipt payments and compensating tax totaled $475,000. Taxes paid by FCPP employees amounted to over $7 million (including federal taxes). The total 2011 state tax impact of the FCPP was approximately $8.7 million (ASU 2013).

Four Corners Power Plant – Revenue to Navajo Nation

The FCPP paid approximately $18.4 million in taxes to the Navajo Nation in 2011 (ASU 2013). PNM makes annual payments of approximately $6.0 million to the Navajo Nation for all PNM lease and ROW agreements, 21 in total, with the Navajo Nation. PNM and APS also contribute to community and youth programs on an annual basis.

Right-of-Ways for Transmission Lines & Access Roads

Any taxes associated with the ROWs for the transmission lines and access roads are captured under the FCPP and Navajo Mine fiscal contributions discussed above.

4.10.2.3 Indicators of Social and Economic Well-Being

This section provides an overview of the primary social concerns and health status and risks in the Navajo Nation and in San Juan County and, then, provides data on educational attainment, income, poverty, and housing conditions. Overall, as measured by common indicators, residents of the Navajo Nation are less well-off economically compared to San Juan County, the State of New Mexico, and the US overall. Compared to these other areas, the Navajo Nation has higher rates of poverty and unemployment as well as lower median household income. On several social measures, residents of the Navajo Nation also experience more adverse conditions than surrounding counties – the Navajo Nation has higher mortality and crime rates, lower graduation rates, and poorer health outcomes and housing conditions.

Data are presented for current conditions. Social and economic well-being may be slightly reduced under the baseline condition compared to the current condition, as described in Section 4.10.3.3. As income levels and social support programs may be reduced due to declines in overall economic activity at the Navajo Mine and the FCPP, social and economic conditions, including educational attainment, crime and recidivism, healthcare access, and housing stock quality could tend to decline.

Social Concerns and Risks

Many of the social issues identified for San Juan County as a whole are also relevant to the Navajo Nation. However, the issues do differ, as the cultural and economic landscapes are distinct. The 2009-2010 NN-CEDS (2010) and the Navajo Nation Division of Economic Development have both published data that identify the economic challenges facing the Navajo Nation. Among the greatest challenges is the unemployment rate, which according to the NN-CEDS was 51 percent of the labor force in 2010; this contrasts with the Census 2010 estimate of 15.6 percent unemployment rate on the Navajo Nation. The NN-CEDS rate, however, does not take into consideration the informal economy on the Navajo Nation, which includes those who may work in the arts and crafts industry, tourist industry, and domestic services, as well as exchanges of goods and services outside of the market place. In addition to high unemployment, Navajo Nation poverty rates are much higher than the State of New Mexico and San Juan County.

Many Navajo travel to border towns to shop for food, clothing, and other needs. Thus, a great deal of Navajo money leaves the Navajo Nation, rather than circulating within the Navajo economy. A challenge facing the Navajo Nation is building retail sales on the Nation to both meet the needs of the residents who now travel far for services and to increase economic development opportunities. Major employers on the Navajo Nation are the Tribal Enterprises, which are Navajo Nation-owned. Private sector employment includes mining and extraction operations.

As described in detail in the statistics presented below, among the social concerns on the Navajo Nation is lack of infrastructure and access to services. Over 20 percent of Navajos live in houses without plumbing, telephones, kitchen facilities, and electricity (National Indian Health Board 2009; Census 2010b). Furthermore, many Navajo do not own vehicles and have no access to public transportation. The rural character of the Navajo Nation means that sometimes individuals must travel significant distances to access health and education facilities and meet basic shopping needs (First Things First Navajo Nation Regional

Partnership Council 2010). Poverty rates are substantially higher than national, state, and San Juan County rates; and high school graduation rates are substantially lower (Federal Reserve Bank of Kansas City 2008; McKinley Community Health Alliance 2009). The Navajo Nation has a greater proportion of the population with disabilities than the US, New Mexico, and San Juan County (Solop et al. 2006). A greater proportion of Navajo work in industries with high occupational risk than New Mexicans in general (New Mexico Occupational Health Registry 2006). Substance and alcohol abuse as well as suicide are social concerns on Navajo land (National Indian Health Board 2009; Indian Health Services 2011).

Also, health outcomes for Navajo are worse than for the general population in San Juan County. Life expectancy is lower, and mortality rates far exceed the national rates. Investment in healthcare services on Navajo land is about half of that for the general population. Healthcare disparities between Navajo and the general population are pronounced due to lack of access and funding (National Indian Health Board 2009).

Educational Attainment

Table 4.10-14 provides information on educational attainment within the ROI and for the State of New Mexico as of 2010. As of 2010, residents on the Navajo Nation were twice as likely to have not completed high school compared to New Mexico as a whole and, in general, residents within the ROI had a lower level of educational attainment than residents of New Mexico. In the ROI, the percentage of residents who did not complete high school is the highest on the Navajo Nation (34.2 percent), followed by McKinley County (30.4 percent), San Juan County (19.1 percent), and the Hopi Reservation (19.0 percent). With the exception of the City of Farmington, all jurisdictions in the ROI had a smaller percentage of residents with some college education or a college degree than New Mexico as a whole (55.8 percent). The Navajo Nation and McKinley County had the lowest percentage of residents with either some college education/associates degree or a college degree at 32.8 and 34.7 percent, respectively, compared to 55.8 percent for the State of New Mexico. The State of New Mexico had the highest percentage of residents obtaining a bachelor's degree or advanced degree (25.5 percent), while the Navajo Nation had the lowest percentage (7.1 percent).

Table 4.10-14 Educational Attainment*, 2010

	Did Not Complete High School	High School or Equivalent, No College	Some College or Associate Degree	Bachelor's Degree or Advanced Degree
Navajo Nation	34.2%	33.0%	25.7%	7.1%
McKinley County	30.4%	34.9%	23.8%	10.9%
San Juan County	19.1%	33.0%	32.9%	15.0%
City of Farmington	15.5%	28.7%	36.1%	19.7%
Hopi Reservation	19.0%	30.1%	41.0%	9.9%
New Mexico	17.3%	27.0%	30.3%	25.5%

Source: Census 2010b

*Educational attainment for individuals 25 years and older.

Household Size, Income, and Poverty Levels

Table 4.10-15 shows household characteristics for the ROI and for the State of New Mexico in 2010. All areas within the ROI had a larger average household size than the State of New Mexico (2.5 people). Navajo Nation and the Hopi tribal trust lands had the largest average household size at 3.5 people. Similarly, the Navajo Nation had the highest percentage of family households (76 percent) followed closely by the Hopi Reservation (75 percent) and McKinley County (74 percent). The percent of family households on the Navajo Nation was 10 percent more than the percentage of family households in New Mexico as a whole (76 and 66 percent, respectively).

Median household income was highest in the City of Farmington ($49,705) and San Juan County ($46,189), both of which were higher than that of New Mexico ($43,820). The Navajo Nation had the lowest median household income ($26,232), $5,000 less than that of McKinley County ($31,335). The City of Farmington had the highest income per household member ($18,406), which is also higher than New Mexico's ($17,197). The Navajo Nation had the lowest income per household member ($7,580) in the ROI. The City of Farmington had the lowest percentage of households below the poverty level (14.4 percent), followed by the State of New Mexico as a whole (16.9 percent) and San Juan County (18.9 percent). The Navajo Nation had the highest rate of households below the poverty level (38.0 percent).

Table 4.10-15 Household Characteristics, 2010

	Population in HHs*	Total Households	Avg. HH Size	% Family HHs	Median HH Income	Income Per HH Member	% HHs Below Poverty Level
Navajo Nation	172,842	49,946	3.5	76%	$26,232	$7,580	38.0%
McKinley County	70,712	21,968	3.2	74%	$31,335	$9,735	29.7%
San Juan County	128,290	44,404	2.9	73%	$46,189	$15,987	18.9%
City of Farmington	44,412	16,446	2.7	70%	$49,705	$18,406	14.4%
Hopi Reservation	7,185	2,081	3.5	75%	$34,016	$9,852	31.4%
New Mexico	2,016,550	791,395	2.5	66%	$43,820	$17,197	16.9%

Source: Census 2010b

* By definition, population in households consists of the resident population excluding people living in group quarters (i.e., 9 or more people living together who are unrelated to the householder).

Housing

Table 4.10-16 provides information on the number of total housing units, occupied housing units, vacant housing units, and the percentage of housing units that are vacant for the ROI and New Mexico, as of 2010. Of the 71,571 housing units on the Navajo Nation, 43,389 were occupied and 28,173 were vacant. The vacancy rate for homes on the Navajo Nation (39 percent) was the highest in the ROI and more than twice that of New Mexico (15 percent) and San Juan County (14 percent). McKinley County had the second highest percentage of vacant homes (32 percent), while the city of Farmington has the lowest vacancy rate (6 percent).

Table 4.10-16 Housing Units, Occupancy, and Vacancy, 2010

	Total Housing Units	Occupied Housing Units	Vacant Housing Units	% Vacant
Navajo Nation	71,571	43,398	28,173	39%
McKinley County	25,940	17,631	8,309	32%
San Juan County	48,412	41,767	6,645	14%
City of Farmington	16,553	15,569	984	6%
Hopi Reservation	2,823	2,223	600	21%
New Mexico	887,890	756,112	131,778	15%

Source: Census 2010b

Table 4.10-17 provides information on the number of total occupied housing units, owner- and renter-occupied housing units, housing that was occupied by occupants that moved in between 2000 and 2010, vehicle availability to housing occupants, and the percentage of units that had more than 1.5 occupants per room.

Table 4.10-17 Occupancy Characteristics, 2010

	Occupied Housing Units	Owner Occupied	Renter Occupied	Occupant Moved in Since 2000	Occupant Has No Vehicle Available	More Than 1.5 Occupants Per Room
Navajo Nation	43,398	75.0%	25.0%	32.3%	15.9%	9.8%
McKinley County	17,631	73.4%	26.6%	37.3%	13.1%	5.4%
San Juan County	41,767	73.9%	26.1%	51.8%	5.3%	2.1%
City of Farmington	15,569	65.4%	34.6%	62.4%	4.5%	0.8%
Hopi Reservation	2,223	69.5%	30.5%	37.3%	18.9%	10.4%
New Mexico	756,112	69.6%	30.4%	57.8%	5.5%	0.8%

Source: Census 2010b

The Navajo Nation had the largest percentage of owner-occupied housing units (75 percent), followed closely by McKinley County (73.4 percent) and San Juan County (73.9 percent). The city of Farmington and the Hopi Reservation had a smaller percentage of owner-occupied housing (65.4 and 69.5 percent, respectively) than that of the State of New Mexico (69.6 percent).

Since 2000, new occupants moved into slightly more than one-third of the housing on the Navajo Nation (32.3 percent), the lowest percentage of occupants moving into housing in the ROI. McKinley County and San Juan County had the second lowest percentages, both 37.3 percent. In San Juan County, the City of Farmington, and the State of New Mexico new residents occupied more than half of the housing units (51.8, 62.4, and 57.8 percent, respectively).

As of 2000, approximately 15.9 percent of occupants on the Navajo Nation had no vehicle available to them; this percentage was almost 3 times higher than that of the State of New Mexico overall (5.5 percent). The Hopi tribal trust lands were the only location that had a higher percentage of occupants without access to a vehicle, 18.9 percent. McKinley County had approximately 13.1 percent of occupants with no vehicle access; and San Juan County and the City of Farmington had the lowest percentages of occupants with no access to vehicles (5.3 and 4.5 percent, respectively).

Compared to all other ROI locales, housing on the Navajo Nation was crowded; approximately 9.8 percent of housing had more than 1.5 occupants per room. The Hopi Reservation was the only location with a higher percentage of more than 1.5 occupants per room, 10.4 percent. Housing in McKinley County was a little less crowded than those on the reservations (5.4 percent of units with more than 1.5 occupants per room). Three percent or less of the housing units in San Juan County, the City of Farmington, and the State of New Mexico had more than 1.5 occupants per room (2.1, 0.8, and 0.8 percent, respectively).

Table 4.10-18 provides information on the median number of rooms, average number of bedrooms, the percentages of occupied housing units without plumbing facilities and kitchen facilities, the percentage of housing units without available telephone service, and those occupied housing units heated with gas or electricity.

Table 4.10-18 Characteristics of Occupied Housing Units, 2010

	Median Rooms	Average Bedrooms	Lacking Complete Plumbing Facilities	Lacking Complete Kitchen Facilities	No Telephone Service Available	Heated with Gas or Electricity
Navajo Nation	4.0	1.7	21.3%	18.4%	39.4%	35.6%
McKinley County	4.9	2.2	10.0%	7.7%	32.4%	62.9%
San Juan County	5.1	2.5	3.6%	3.5%	15.6%	83.4%
City of Farmington	5.4	2.7	0.8%	0.8%	9.1%	97.3%
Hopi Reservation	4.6	2.1	26.8%	24.8%	13.4%	29.6%
New Mexico	5.3	2.6	1.2%	1.1%	6.1%	92.3%

Source: Census 2010b

Occupied housing units on the Navajo Nation had the fewest rooms (4.0). The median number of rooms on the Hopi Reservation, in McKinley County, and San Juan County was higher (4.6, 4.9, and 5.1 respectively). The City of Farmington had the highest median number rooms per occupied housing unit (5.4), which was slightly higher than the State of New Mexico overall (5.3).

Similarly, occupied housing units in the Navajo Nation had the fewest bedrooms, an average of 1.7 per unit. The average number of bedrooms in McKinley County occupied housing units and on the Hopi Reservation was slightly higher (2.2 and 2.1, respectively). San Juan County and the State of New Mexico had a similar average number of bedrooms per occupied housing unit (2.5 and 2.6, respectively); while the City of Farmington had the highest average number of bedrooms (2.7).

A little more than one-fifth (21.3 percent) of occupied housing units on the Navajo Nation lacked complete plumbing facilities, 20 percent more than homes in New Mexico (1.2 percent) overall. The Hopi Reservation was the only location with a higher percentage of occupied housing units lacking complete plumbing facilities (26.8 percent). Ten percent or fewer of occupied housing units in McKinley County, San Juan County, and the City of Farmington lacked plumbing facilities.

Navajo Nation and Hopi tribal trust lands had the highest percentages of occupied housing units without complete kitchen facilities (18.4 and 24.8 percent, respectively). The City of Farmington had the fewest occupied housing units lacking complete kitchen facilities (0.8 percent), slightly less than the percentage in the State of New Mexico overall (1.1 percent). The percentages of occupied housing units in McKinley County and San Juan County fell in the middle (7.7 and 3.5 percent, respectively).

The Navajo Nation had the highest percentage of occupied housing units without available telephone service (39.4 percent), almost 3 times as many as those occupied housing units located on the Hopi tribal trust lands (13.4 percent). McKinley County had the second largest percentage of occupied housing units

without available telephone service (32.4 percent), followed by San Juan County (15.6 percent) and the City of Farmington (9.1 percent). The State of New Mexico had the fewest occupied housing units without access to telephone service (6.1 percent).

Approximately one-third of occupied housing units on Navajo Nation and Hopi tribal trust lands were heated with gas or electricity (35.6 and 29.6 percent, respectively). McKinley County was the third location with the smallest percentage of occupied homes heated with gas or electricity (62.9 percent). Occupied housing units in San Juan County, the City of Farmington, and the State of New Mexico were more than 2 times as likely to be heated with gas or electricity (83.4, 97.3, and 92.3 percent, respectively) than homes on the Navajo Nation.

4.10.2.4 Navajo Nation Public Services

Navajo Nation public services are funded through tribal government tax revenues. The tax and royalty revenue received by the Navajo Nation from the operations of the FCPP and Navajo Mine is, in part, used to fund Navajo Nation public services.

This section provides information on Navajo Nation public service departments, including the types of public services provided, and, as available, staffing levels and service populations. Ratios of staffing to service population are developed to indicate the overall level of current service provided by each department. Navajo Nation departments for which data are presented include:

- Navajo Nation Department of Diné Education
- Navajo Nation Department of Emergency Management
- Navajo Nation Department of Fire and Rescue Services
- Navajo Nation Department of Highway Safety
- Navajo Nation Emergency Medical Service
- Navajo Police Department

Navajo Nation Department of Diné Education

The Navajo Nation Department of Diné Education is a federally recognized tribal education authority that runs 11 programs related to education, libraries, youth development, and social assistance. Between 2010 and 2012 employment at the Department of Diné Education has been stable at approximately 840 full-time equivalent (FTE) staff, with 842 FTE in 2012. These staff serve a population of approximately 175,000 people (2010 Navajo population was 173,667); thus, the ratio of the 2012 FTE staff members to the Navajo Nation population served is approximately 1 to 210. According to the Department of Diné Education (2013), the department has had difficulty filling vacant skilled positions for a variety of reasons, including: noncompetitive salaries, high turnover rates, no available housing for potential candidates, no applicants interested in the location of the vacant position, job applicants lacking the required education and work experience, and the reclassification of job positions delaying the hiring of staff for 4 months up to a year.

Table 4.10-19 provides information on the level of services provided by programs within the Navajo Nation Department of Diné Education between the years 2010 and 2012.

Table 4.10-19 Navajo Nation Department of Diné Education – Services Provided, 2010–2012

	2010	2011	2012
A. Office of Monitoring, Evaluating, and Technical Assistance			
Educational Institutions Assisted:	21	11	25
B. Diné Culture, Language, and Community Services			
Number of Instructional Programs:	78	75	50
Apprenticeships Coordinated:	44	45	24
C. Office of Special Education and Rehabilitation			
Disabled Individuals Assisted:	5,179	5,959	5,285
D. Office of Navajo Nation Scholarship and Financial Assistance			
Number of Scholarships Provided:	9,698	7,047	2,991
Total $ Amount of Scholarships Provided:	$18,121,733	$14,536,385	$14,278,759
E. Office of Youth Development			
Youth Served:	55,823	80,466	74,306
F. Navajo Nation Library			
Patrons Served:	73,455	57,623	70,973
G. Office of Diné Science, Math, and Technology			
Services provided: • Direct service to schools on Navajo Nation (AZ, NM, UT) regardless of school classification (e.g., Bureau of Indian Education [BIE], Grant, public, private, etc.) • Direct service in the form of professional development for teachers without using external sources (i.e., consultants) which utilizes actual student data to close the academic achievement gap by developing and implementing school action plans in math, reading, and science. • Direct service to students to provide enrichment opportunities in science, technology, engineering, arts, and mathematics. • Direct service to policy makers to assist with updating existing and formulating new laws that promote academic success for Navajo Nation students.			
H. Office of Educational Research and Statistics			
Publications: • Adequate Yearly Progress (AYP) booklet for Arizona, New Mexico, and Utah Public, Charter, BIE, and Grant schools. The AYP booklets provide information on AYP determinations (whether schools have met AYP or not), No Child Left Behind designations, and letter grades each school receives. • Enrollment booklets for Arizona, New Mexico, and Utah Public, BIE, and Grant schools. Enrollment booklets provide information on enrollment for all schools including the eight Residential Halls. • Academic Progress Report for the Reauthorization process for Grant schools. This booklet provides information on Annual Measurable Objectives (AMOs) for reading and math for Arizona and New Mexico Grant Schools. AMOs for Language Arts and math for Utah Grant schools.			
I. Department of Early Childhood Development			
Children Served:	2,800	2,674	2,367

Source: Navajo Nation Department of Diné Education 2012, 2013

Note: Other departments in the Navajo Nation Department of Diné Education are the Johnson O'Malley Program and NCA/AdvancED.

Navajo Nation Department of Emergency Management

The Navajo Nation Department of Emergency Management operates under the Navajo Nation Division of Public Safety. The department works to educate residents on emergency preparedness, supports communities in monitoring and evaluation of emergency preparedness, and encourages communities to engage in planning for the coordination of response efforts during times of emergency (Navajo Nation Division of Public Safety 2012a). While in 2012, the department had three field offices (Shiprock, New Mexico; Window Rock, Arizona; and Crownpoint, New Mexico). In 2013, the Crownpoint and Shiprock offices were closed and the number of FTE staff was reduced from 9 to 3 (Navajo Nation Division of Public Safety 2013a). These 3 FTE staff serve a population of approximately 175,000, for a ratio of approximately 1 FTE staff to 58,000 people served.

According to the Department of Emergency Management (Navajo Nation Division of Public Safety 2013a), the remaining Window Rock office is in fair condition, but work-related equipment is in need of repair. In addition, the department noted a need for additional staff to effectively function and provide emergency management services for all of the Navajo Nation.

Navajo Nation Department of Fire and Rescue Services

The Navajo Nation Department of Fire and Rescue Services was established in 1985. The department is responsible for emergency medical response, hazardous materials response, and technical rescues (e.g., vehicle/machinery, high angle, trench, ice/swift water, structural collapse, and confined space). Response to fires accounts for approximately 10 percent of the calls received by the department, while vehicle crashes are the most common type of call received (Navajo Nation Department of Fire and Rescue Services 2012).

The department operates five fire stations in Arizona: Window Rock (Fire Station 10), Fort Defiance (Fire Station 12), Chinle (Fire Station 50), Tuba City (Fire Station 40), and Leupp (Fire Station 80). Each fire station provides service to an area of 2,000 to 3,000 square miles. Geographical areas that the department does not cover typically receive fire protection services from municipal government fire departments or from BIA's Branch of Wildland Fire Management (Navajo Nation Department of Fire and Rescue Services 2013).

Between 10 and 15 volunteer firefighters and 1 to 2 paid firefighters are stationed at each location. In total, all stations in 2012 had 8 FTE paid firefighters, 3 FTE paid administrative personnel, and 51 volunteer firefighters. While the number of paid FTE has fluctuated slightly between 10 and 12 paid FTE between 2010 and 2012, the number of volunteer firefighters has fluctuated more on an annual basis, from 44 in 2010 to 38 in 2011 to 51 in 2012. While staffing levels have remained fairly stable, the population residing in areas serviced by the department has risen 32 percent, from 19,770 in 2010 to 26,173 in 2012. The 2012 service ratio was, thus, approximately 1 FTE staff member per 2,400 people served, a lower level of service compared to 2010 when the ratio was 1 FTE per 1,650 people served. The biggest challenge for the Navajo Nation Fire Department and Fire and Rescue Services is retaining both FTE and volunteer firefighters. According to the Navajo Nation Fire Department, the department is not competitive with other neighboring fire departments because the department relies solely on revenues generated by the Navajo Nation, and the Navajo Nation budget is constantly decreasing each year (Navajo Nation Department of Fire and Rescue Services 2013).

Navajo Nation Department of Highway Safety

The department was established in 1982 under the Navajo Nation Division of Public Safety. The purpose of the Department of Highway Safety is to establish and implement highway safety standards to provide safer roadways throughout the Navajo Nation. In addition, the department offers training in Defensive Driving in a course sanctioned by the National Safety Council, issues Navajo Nation vehicle operators permits, provides training on the correct use of seatbelts and infant/child car seats, provides Navajo Nation employee identification cards, promotes community awareness on safe vehicle operation, and conducts safety and injury prevention presentations (Navajo Nation Division of Public Safety 2012b).

Table 4.10-20 provides information on the several of the services provided by the Navajo Nation Department of Highway Safety and the number of attendees at the programs.

Table 4.10-20 Navajo Nation Department of Highway Safety – Services Provided, 2010-2012

Services Provided	2010	2011	2012
Defensive Driving Courses	46	39	50
• Number of Attendees	1,503	764	1,044
Child Passenger Safety Clinics	~10	~15	~15
• Number of Attendees	1,000	1,100	1,200
Public Service Announcements	4	5	5

Source: Navajo Nation Division of Public Safety 2013b

In 2012, the Navajo Nation Department of Highway Safety had 6 FTE personnel (up from 5 in 2010) servicing a population of approximately 175,000, resulting in a staffing to service population ratio of approximately 1 to 35,000. According to Navajo Nation Department of Highway Safety, the small number of FTE staff results in the department relying heavily on partnerships with outside entities to get their public safety awareness message out to the public (Navajo Nation Division of Public Safety 2013b).

Navajo Nation Emergency Medical Service

The Navajo Nation Emergency Medical Service (EMS) was established in the 1970s and currently operates under the Navajo Nation Division of Public Safety. The Navajo Nation EMS' purpose is to provide advanced life support capabilities and emergency transportation. The Navajo Nation EMS also provides CPR training and Heart Saver First Aid training, and offers courses for emergency medical technicians and first responders (Navajo Nation EMS 2012). Of 13 field offices, 8 are in Arizona and 5 in New Mexico. As of 2012, the Navajo Nation EMS had 153 FTE emergency medical technicians (up from 143 in 2010) and 17 administrative personnel, for a total of 170 FTE staff. These personnel fielded 17,908 service calls in 2012, a steady rise from the number of service calls in 2010 (11,120) and in 2011 (12,397). In 2012, the ratio of FTE staff members (170) to service calls (17,908) was 105 to 1 (i.e., 1 FTE Navajo Nation EMS staff member for every 105 service calls) (Navajo Nation EMS 2013).

Navajo Police Department

The Navajo Police Department operates under the Navajo Nation Division of Public Safety. The Navajo Police Department consists of seven districts located throughout the Navajo Nation, five in Arizona and two in New Mexico. Navajo police officers work in jurisdictions that can cover multiple states and are responsible for handling crimes committed by tribal members and nontribal members (Navajo Nation Division of Public Safety 2012c).

Summary of Navajo Nation Public Service Levels

Table 4.10-21 shows the 2012 staffing to service population/call volume ratios for five of the Navajo Nation public service departments. In general, as the service population and call volume have risen over the last several years, the public service department staffing levels have either stayed fairly constant or have actually declined, indicating that public service levels may have declined in recent years due to resource constraints. This finding is consistent with information provided by several departments; for example, questionnaires indicated that equipment needs improvement (Department of Emergency Management), that positions are vacant partly due to noncompetitive salary levels (Department of Diné Education), and that they need to rely on outside partnerships to enhance public safety (Department of Highway Safety).

Table 4.10-21 Navajo Nation Public Service Departments – Staffing to Service Population Ratios, 2012

Navajo Nation Public Service Department	2012 FTE Staffing	Approximate Service Population/Service Calls	Approximate Staffing to Service Ratio
Navajo Nation Department of Diné Education	842	175,000 (population)	1 to 210
Navajo Nation Department of Emergency Management	3	175,000 (population)	1 to 58,000
Navajo Nation Department of Fire and Rescue Services	11	26,173 (population)	1 to 2,400
Navajo Nation Department Highway Safety	6	175,000 (population)	1 to 35,000
Navajo Nation EMS	170	17,908 (service calls)	1 to 105

Sources: Navajo Nation Department of Diné Education 2013; Navajo Nation Division of Public Safety 2013a, 2013b; Navajo Nation Department of Fire and Rescue Services 2013; Navajo Nation EMS 2013

Given the expected decline of about $19 million in payments to the Navajo Nation under the baseline condition compared to the current condition, the Navajo Nation will have less funding to support public services. The lower level of funding would likely mean fewer FTE staff for some Navajo Nation public service agencies and lower staffing to service population ratios (and subsequently, lower service levels) than under the current condition.

4.10.3 Changes to Socioeconomics Affected Environment Post-2014

This section outlines the baseline socioeconomic conditions within the ROI; these baseline conditions represent conditions present after FCPP Units 1, 2, and 3 shut down and NTEC has taken ownership of the Navajo Mine. Information presented in this section describes how these actions will change socioeconomic conditions from current conditions presented in Section 4.10.2. Some information is quantified, such as the economic and fiscal contributions of the FCPP and Navajo Mine, while other information is presented in a more qualitative fashion.

Compared to current conditions, the primary changes in socioeconomic conditions in the baseline is that the economic contributions of the FCPP and Navajo Mine to the ROI's economy would be less, due to reduced activity at both operations that would be associated with the shutdown of FCPP Units 1, 2, and 3, and the redistribution of tax revenue due to the purchase of Navajo Mine by NTEC. However, the reductions in economic contribution would not all occur immediately as MMCo and APS have stated that they will not lay people off; rather, reductions in direct employment will occur through natural attrition (retirements, employee turnover, etc.). Since reductions in employment would occur over time, data presented as baseline economic contributions represent the long-term baseline conditions (i.e., the period of time after all of the natural attrition has occurred).

4.10.3.1 Population and Demographics

Demographic changes from the current condition are unlikely; demographic composition and population growth in the ROI would likely be similar to what is presented in Section 4.10.2.1.

4.10.3.2 Economic Conditions

In general, it is expected that the ROI's economy would be smaller (in terms of overall output, employment, and income) under the baseline condition compared to the current condition. The smaller

economy would be a result of the lower level of economic activity generated at the FCPP and Navajo Mine and associated lower levels of economic activity generated by firms that provide goods and services to the FCPP and Navajo Mine and their workers. The bulk of the economic impact of reduced activity in the baseline condition will be felt within San Juan County, which is where most of the FCPP and Navajo Mine employees reside and where much of the FCPP and Navajo mine maintenance and supply purchases are transacted.

Compared to current conditions, total employment in all sectors in San Juan County, NM is expected to decline by approximately 870 jobs in the baseline condition, all else equal. This represents approximately 1.7 percent of the 2010 San Juan County, NM civilian employment. At the state-level, total employment in all sectors in the baseline condition is expected to decline by approximately 1,240 jobs compared to current condition (0.1 percent of statewide 2010 civilian employment), all else equal. Total economic changes from current conditions to baseline conditions at the state-level are slightly higher than in the ROI, as businesses outside of the ROI that supply goods and services to the FCPP and the Navajo Mine and their workers are also affected.

In the long-term, it is possible that the lower level of activity at the FCPP and the Navajo Mine would be at least partially offset by other economic activity as people formerly employed at the Navajo Mine and FCPP generate alternative economic activities.

Employment and Unemployment in ROI and State of New Mexico

At least in the short term, the number of persons employed in the ROI would be lower under the baseline condition than under the current condition; the lower level of employment would be due to reduced operational activity at the FCPP and Navajo Mine. Reduced operational activity at the FCPP and Navajo Mine would lead to fewer jobs at the FCPP and Navajo Mine as well as fewer jobs at businesses that provide goods and services to the FCPP and Navajo Mine and their employees. The number of unemployed individuals in the ROI would likely be higher under the baseline condition than the current condition, at least in the short-term, until people either find alternative employment or relocate.

Two sectors will directly experience diminished employment under baseline conditions (with FCPP Units 1, 2, and 3 shut down and after NTEC has taken ownership of the Navajo Mine): the mining sector (due to reduced activity at the Navajo Mine) and the utilities sector (due to reduced activity at the FCPP). Other sectors that supply goods and services to the FCPP and Navajo Mine and their employees are also expected to experience reduced employment under baseline conditions, as the FCPP and NTEC will require fewer services and goods from local vendors to operate the downscaled operations, and as reduced income results in less household spending. Due to reduced employment in these sectors, baseline unemployment rates as presented in Table 4.10-6 would also be slightly higher, all other factors being equal. All other sectors, including educational services, healthcare, social assistance and public administration, which constitute a large portion of employers in the ROI (approximately 47 percent on Navajo Nation tribal trust lands), are not anticipated to experience direct loss of employment opportunities as a result of the downscaled operations. However, nearly all sectors will experience reduced demand and may experience changes in employment due to the reduced economic activity at the FCPP and the Navajo Mine (captured in the analyses as indirect and induced effects).

Economic Role of the Power Plant and Navajo Mine in San Juan County and State of New Mexico

Economic Contribution

The economic contributions of the FCPP and Navajo Mine under the baseline condition were estimated in an economic impact analysis prepared by ASU (2013). The ASU study focused on San Juan County, NM and the State of New Mexico to identify economic contributions at the local and larger state-level economy. The modeled economic contributions from FCPP and Navajo Mine in San Juan County constitute the bulk of the effects within the ROI.

Navajo Mine

Tables 4.10-22 and 4.10-23 show the economic contribution of the Navajo Mine to San Juan County and the State of New Mexico under the baseline condition (shutdown of FCPP Units 1, 2, and 3). Under the baseline condition it is projected that, through natural attrition (as current employees retire new employees will not be hired to fill the positions), the Navajo Mine will directly employ 397 people. Mining operations would generate $48 million in direct labor income and $106 million would be added to GSP. In total, including indirect and induced effects, coal production at the Navajo Mine is estimated to support 1,120 jobs, $78 million in labor income, and $157 million in GSP in San Juan County, NM.

Under the baseline condition, the Navajo Mine's economic contribution to San Juan County will be less than conditions prior to shutdown of FCPP Units 1, 2, and 3. See Table 4.10-7 for the economic contribution of the Navajo Mine to San Juan County under pre-2014 conditions. On an annual basis 460 fewer total jobs would be supported, a reduction of 25 percent from current conditions, $30 million less in labor income generated, and $58 million less contributed to GSP. Effects on the State-level economy are magnified as the indirect and induced effects are larger. The State of New Mexico would experience a loss of approximately 800 jobs on an annual basis, $45.7 million in labor income, and $80.4 million in GSP. These declines would be due to reduced operational activity at the Navajo Mine that would be necessitated by a reduced coal requirement at FCPP, as Units 1, 2, and 3 are out of service.

Table 4.10-22 Navajo Mine – Baseline Economic Contribution to San Juan County, New Mexico (Annual until 2041)

	Jobs	Labor Income (Millions of 2011 $s)	GSP (Millions of 2011 $s)
Direct Effects from Navajo Mine Operations	400	$48.0	$106.3
Indirect Effects from Navajo Mine Supplier Purchases	200	$10.1	$17.8
Induced Effects	520	$19.4	$32.5
Total Economic Contribution	**1,120**	**$77.5**	**$156.6**

Source: ASU 2013

Table 4.10-23 Navajo Mine – Baseline Economic Contribution to State of New Mexico (Annual until 2041)

	Jobs	Labor Income (Millions of 2011 $s)	GSP (Millions of 2011 $s)
Direct Effects from Navajo Mine Operations	400	$48.0	$109.7
Indirect Effects from Navajo Mine Supplier Purchases	210	$10.7	$19.3
Induced Effects	700	$27.1	$44.6
Total Economic Contribution	**1,310**	**$85.8**	**$173.6**

Source: ASU 2013

Four Corners Power Plant

Tables 4.10-24 and 4.10-25 show the economic contribution of the FCPP to San Juan County and the State of New Mexico under the baseline condition (shutdown of FCPP Unit 1, 2, and 3). Under the baseline condition it is projected that, once natural attrition in employment is complete, the FCPP will directly employ 360 people. FCPP operations would generate $54 million in direct labor income and $181 million would be

added to GSP. In total, including indirect and induced effects, energy generation at the FCPP is estimated to support 950 jobs, generate $75 million in labor income, and add $215 million to GSP.

Under the baseline condition, the FCPP's economic contribution to San Juan County will be less than it currently is. On an annual basis 410 fewer total jobs would be supported, a reduction of 28 percent from current conditions, $31 million less in labor income generated, and $87 million less contributed to GSP. Similar to the effects to San Juan County, the State of New Mexico would experience a loss of approximately 440 jobs on an annual basis, $32.4 million in labor income, and $103.4 million in GSP. These declines would be due to reduced operational activity that would be necessitated by the shutdown of FCPP Units 1, 2, and 3.

Table 4.10-24 Four Corners Power Plant – Baseline Economic Contribution to San Juan County, New Mexico (Annual until 2041)

	Jobs	Labor Income (Millions of 2011 $s)	GSP (Millions of 2011 $s)
Direct Effects from FCPP Operations	360	$53.9	$181.3
Indirect Effects from FCPP Supplier Purchases	140	$4.4	$5.6
Induced Effects	450	$17.1	$28.1
Total Economic Contribution	**950**	**$75.4**	**$215.0**

Source: ASU 2013

Table 4.10-25 Four Corners Power Plant – Baseline Economic Contribution to State of New Mexico (Annual until 2041)

	Jobs	Labor Income (Millions of 2011 $s)	GSP (Millions of 2011 $s)
Direct Effects from Navajo Mine Operations	360	$53.9	$217.4
Indirect Effects from Navajo Mine Supplier Purchases	130	$4.7	$6.0
Induced Effects	530	$20.4	$33.8
Total Economic Contribution	**1,030**	**$79.0**	**$257.2**

Source: ASU 2013; Numbers may not sum due to rounding.

Fiscal Contribution

The fiscal contributions of the FCPP and Navajo Mine would be lower under the baseline condition than under the current condition. Taxes and fees paid by the FCPP and Navajo Mine are primarily based on production, or revenue, both of which have been reduced due to the shutdown of Units 1, 2, and 3.

In 2011, under the current condition, the FCPP and Navajo Mine paid a total of $59.9 million to the Navajo Nation in the form of royalties, taxes, and fees ($18.4 was paid by FCPP and $41.5 was paid by the Navajo Mine). The shutdown of FCPP Units 1, 2, and 3 are expected to reduce operations at the FCPP and Navajo Mine by about one-third, which would indicate that royalties, taxes and fees paid by the FCPP and Navajo Mine could be approximately one-third less under the baseline condition compared to the current condition.

If 2011 payments by FCPP and Navajo Mine to the Navajo Nation were to be one-third less under the baseline condition compared to the current condition, then in the baseline FCPP payments would be $12.5 million and Navajo Mine payments would be $28.1 million. Combined, annual payments by the FCPP and Navajo Mine to the Navajo Nation would be $40.6 million, $19.3 less than under the current condition.

Now that NTEC owns the Navajo Mine, the baseline fiscal contribution of the Navajo Mine to NTEC is expected to be higher than the estimated $28.1 million with existing ownership. Because NTEC would be exempt from some local, state, and Federal taxes, net revenues after taxes would be higher, so conceivably more revenue would be available to the tribal government. It is worth noting that a portion of the profits from NTEC operations would be directed to the investment in "research and development of renewable and alternative sources of energy, storage, and transmission technologies and facilities with priority given to the solar technologies and facilities with attendant storage and transmission capacity", according to the Navajo Tribal Council Resolution (April 29, 2013) that founded NTEC.

Thus, it is expected that on a net basis, with a reduction in fiscal contribution due to the shutdown of Units 1, 2, and 3 and an increase in fiscal contribution due to tribal ownership of the mine, the combined annual fiscal contribution of the FCPP and Navajo Mine in the baseline condition would be higher than $40.6 million but lower than the $59.9 million contribution identified as the current condition.

Right-of-Ways for Transmission Lines & Access Roads

All ROWs for transmission lines and access roads are existing and would not require any additional construction or maintenance beyond current activities. Therefore, the economic contributions to the local and state economies from these connected actions would remain the same under baseline conditions as in current operations (see Section 4.10.2.2).

4.10.3.3 Indicators of Social and Economic Well-Being

Social and economic well-being may be slightly reduced under the baseline condition compared to the current condition. Smaller economic and fiscal contributions from the operations of the FCPP and Navajo Mine would reduce income levels and funding for social support programs, potentially leading to reductions in educational attainment, increased crime and recidivism, and less ability to maintain or upgrade the housing stock. The ability of individuals to obtain healthcare may also be lower under the baseline condition as those with lower incomes tend to be more hesitant to pay for healthcare and healthcare assistance programs may see budget cuts.

The Tribal Resolution (13-277-2, April 2013) that established NTEC includes a provision to invest no less than 10 percent of net income from Navajo Mine operations towards renewable and alternative energy research and development, with an emphasis on solar technologies, energy storage, and transmission. This investment could fund the development of more energy generation and transmission facilities on Navajo Nation tribal trust lands, which would likely result in the creation of employment opportunities for the Navajo membership and a diversified energy portfolio for the Navajo Nation. These future developments would lessen the potential adverse social and economic effects discussed above, but there are no formal plans for any additional energy resource developments and data is not available at this time to estimate the socioeconomic benefits of these projects.

4.10.3.4 Navajo Nation Public Services

Given the expected decline of up to $19 million in payments to the Navajo Nation under the baseline condition compared to the current condition, it is expected that the Navajo Nation would have less funding to support public services under the baseline condition compared to the current condition. This loss may be offset by the profits and deferred taxes accrued by NTEC's ownership of Navajo Mine, but the difference is not expected to fully offset the payments traditionally realized by the Navajo Nation from BNCC. Therefore, the lower level of funding/revenue would likely mean that in the baseline, compared to current conditions, would be characterized by fewer FTE staff for some Navajo Nation public service departments and reduced levels of services for Navajo Nation members.

4.10.4 Environmental Consequences

This section discusses potential socioeconomic impacts resulting from the alternatives described in Section 3.2. Socioeconomic conditions that could be affected include population and demographics, economic conditions, social and economic well-being, and Navajo public services. To identify the impacts of the Alternatives (rather than the concurrent effects of shutdown of FCPP Unit 1, 2, and 3), this section identifies socioeconomic consequences by comparing the potential socioeconomic conditions under each Alternative against the baseline condition (and not the current condition). The baseline conditions most accurately represent the human environment after permitting and compliance is complete (i.e. post 2016).

4.10.4.1 Alternative A - Proposed Action

Under the Proposed Action, OSMRE would approve the proposed Pinabete Mine, BIA would approve Lease Amendment #3, access roads, and transmission line ROWs. As described in the baseline conditions, analysis for the Proposed Action incorporates the shut-down of FCPP Units 1-3, installation of SCRs on Units 4-5 and NTEC operation and ownership of Navajo Mine.

Population and Demographics

Under Alternative A, no expected changes would occur to the baseline conditions of population and demographics within the ROI. The baseline conditions are described in Section 4.10.3.1.

Population and demographics can shift if employment or income opportunities change in a region. However, under Alternative A, overall levels of economic activity at the FCPP and Navajo Mine would remain consistent with baseline levels, with essentially the same employment and income opportunities, and no associated expected change in demographics or population.

Economic Conditions

As noted above, overall levels of economic activity at the FCPP and Navajo Mine would remain consistent with baseline levels, with essentially the same employment and income opportunities. Under Alternative A, thus, no expected changes would occur to the baseline economic conditions (including total employment, industry size, labor force, and unemployment rate) within the ROI. The baseline conditions are described in Section 4.10.3.2.

Indicators of Social and Economic Well-Being

Economic conditions are a key determinant of social and economic well-being. As economic conditions would remain consistent with baseline levels, overall economic well-being is expected to also remain at baseline levels. In addition to being influenced by economic factors, social conditions can be affected by changes in population, demographics, and environmental conditions. None of these factors are anticipated to change compared to baseline levels, with the exception of potential changes in environmental conditions. It is possible for changes in environmental conditions due to mine expansion in the Pinabete Permit Area to translate into changes in social conditions, particularly for residents or workers in areas near the Pinabete Permit Area, who will experience increased industrial activities in their vicinity.

Thus, under Alternative A, little to no expected changes from baseline conditions in the indicators of social and economic well-being would occur within the ROI. The baseline conditions are described in Section 4.10.3.3.

Navajo Public Services

Revenue to the Navajo Nation from the FCPP and Navajo Mine is a key funding source for Navajo Nation public services. Under Alternative A, total revenue to the Navajo Nation from operation of the FCPP and Navajo Mine is expected to remain at baseline levels. Consequently, no expected changes would occur to the baseline condition of Navajo public services within the ROI. (The baseline conditions are described in Section 4.10.3.4).

As a possible exception, the use and transportation of ammonia for FCPP operations in Alternative A could impact public services if an accidental release occurred within city limits. The accidental release may require responses from some of already overburdened Navajo Nation public service providers adding to their responsibilities without additional revenue; however, FCPP has a mutual aid agreement with the San Juan County Fire Department, which includes 18 separate volunteer departments that answer to one central command center, to provide public services in case of emergency since the nearest Navajo Nation fire station is approximately 25 miles away. Valley Fire is the closest department San Juan County Fire Department station. The potential impacts of the use of ammonia are discussed in more detail in Section 4.15, Hazardous and Solid Wastes.

4.10.4.2 Alternative B – Navajo Mine Extension Project

Under Alternative B, OSMRE would approve an alternate mine plan for the Navajo Mine. The alternate mine plan has no additional socioeconomic implications compared to Alternative A. The BIA would approve the lease amendment for the FCPP, and FCPP would operate as described under Alternative A.

Population and Demographics

Potential impacts to baseline conditions of population and demographics due to Alternative B would be the same as described under Alternative A.

Economic Background

Potential impacts to baseline conditions of the economic background due to Alternative B would be the same as described under Alternative A.

Indicators of Social and Economic Well-Being

Potential impacts to baseline conditions of the indicators of social and economic well-being due to Alternative B would be the same as described under Alternative A.

Navajo Public Services

Potential impacts to baseline conditions of the Navajo Public Services under Alternative B would be the same as described under Alternative A.

4.10.4.3 Alternative C – Alternative Pinabete Mine Plan

Under Alternative C, OSMRE would disapprove the Pinabete permit application, and NTEC would seek approval from OSMRE for a new SMCRA permit area. For both the Navajo Mine Permit Area and the new SMCRA permit area, operations and reclamation would be conducted as described under Alternative A. The BIA would approve lease Amendment #3 for the FCPP, and FCPP would operate as described under Alternative A.

Population and Demographics

Potential impacts to baseline conditions of population and demographics due to Alternative C would be the same as described under Alternative A.

Economic Background

Potential impacts to baseline conditions of the economic background due to Alternative C would be the same as described under Alternative A.

Indicators of Social and Economic Well-Being

Potential impacts to baseline conditions of the indicators of social and economic well-being due to Alternative C would be the same as described under Alternative A.

Navajo Public Services

Potential impacts to baseline conditions of the Navajo Public Services under Alternative C would be the same as described under Alternative A.

4.10.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action. BIA would approve the amended lease for the FCPP, and the plant would continue to operate as described under the Proposed Action except with a different configuration for the DFADAs. No additional socioeconomic implications compared to Alternative A would result for the alternate DFADA configuration. The transmission line ROWs would be approved and they would continue to be operated and maintained as described for the Proposed Action.

Population and Demographics

Potential impacts to baseline conditions of population and demographics due to Alternative D would be the same as described under Alternative A.

Economic Background

Potential impacts to baseline conditions of the economic background due to Alternative D would be the same as described under Alternative A.

Indicators of Social and Economic Well-Being

Potential impacts to baseline conditions of the indicators of social and economic well-being due to Alternative D would be the same as described under Alternative A.

Navajo Public Services

Potential impacts to baseline conditions of the Navajo Public Services under Alternative D would be the same as described under Alternative A.

4.10.4.5 Alternative E– No Action Alternative

Under the No Action Alternative, the mining would continue until the ROD is issued in 2015, and then the Navajo Mine would close.

Population and Demographics

Under the No Action Alternative, the shutdown of the FCPP and Navajo Mine may result in a population decline, as net immigration to the area may slow, causing a reduction in population growth rates.

No expected major changes would occur to baseline condition demographics in the ROI due to the No Action Alternative.

Economic Background

Under the No Action Alternative, all activity at the FCPP would cease in 2016. Unless other economic activities, such as production of renewable energy, develop to replace the employment and income opportunities at the FCPP and Navajo Mine, the ROI's economy would become smaller. A total loss of 2,070 jobs, both direct and indirect, a total annual loss of $152.9 million in labor income, and an annual reduction in GSP of $372 million is projected to occur.

The fiscal contributions derived from FCPP and Navajo Mine operations would decline to $0. While this decline would affect local, state, and Federal governments, it would most significantly affect the Navajo Nation. The Navajo Nation would be expected to lose between $40 and $60 million per year; because this

revenue constitutes a large portion (approximately 1/3) of Navajo Nation revenues, this is considered a major impact.

Indicators of Social and Economic Well-Being

Under the No Action Alternative, social and economic well-being would be reduced. The shutdown of the FCPP and Navajo Mine would result in the loss of approximately 2,070 jobs (see Table 4.10-22). This loss of jobs would add to the already high unemployment rate (approximately 51 percent) in the Navajo Nation as 410 direct jobs at the Navajo Mine and 380 direct jobs at the FCPP are staffed by tribal members; these jobs are relatively high-skill, high-income jobs. The even higher unemployment rate and reductions in income could exacerbate some of the "pressing health challenges" identified by the San Juan Community Health Department, including those associated with financial burdens and related stress.

The end of economic and fiscal contributions from the operations of the FCPP and Navajo Mine could lead to reductions in education attainment, reduced economic well-being, increased recidivism, and a reduced ability to maintain or upgrade the housing stock. The ability of individuals to obtain healthcare could be negatively impacted as well. In summary, the weakened economy could result in moderate adverse impacts to overall social and economic well-being.

Navajo Public Services

Under the No Action Alternative, after 2016 no more tax revenues would be received from the operations and production associated with the FCPP and Navajo Mine. The net effect of the loss of all tax royalties paid to the Navajo Nation are shown in Table 4.10-26. All tax royalties paid to the Navajo Nation revenues associated with the Navajo Mine and FCPP would be eliminated. Unless replaced with revenue from other sources, this reduction in revenues would negatively impact the quality and quantity of the public services offered on the Navajo Nation. For example, the Navajo Nation Fire Department relies on money generated by the Navajo Nation to pay its firefighters. The Fire Department is already struggling to retain firefighters because it cannot pay wages that are competitive with neighboring fire departments, and the Fire Department is currently understaffed. A reduction in revenue would negatively impact the Navajo Nation Fire Department and other Navajo Nation public service providers and their ability to provide services to the Navajo Nation people.

Table 4.10-26 Navajo Mine and Four Corners Power Plant Combined – Alternative E Compared to Baseline Economic Contribution, Annual Until 2041

	Jobs	Labor Income (Millions of 2011 $s)	GSP (Millions of 2011 $s)
Direct Effects from Navajo Mine and FCPP Operations	-760	-$101.9	-$287.6
Indirect Effects from Navajo Mine and FCPP Supplier Purchases	-340	-$14.5	-$23.4
Induced Effects	-970	-$36.5	-$60.6
Total Economic Contribution	**-2,070**	**-$152.9**	**-$371.6**

Source: ASU 2013

4.10.5 Socioeconomics Mitigation Measures

The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific mitigating measures for certain environmental impacts, standard operating procedures that reduce or avoid environmental impacts, and best management practices for specific activities. These are described in Section 3.2.6.10. These measures are part of their application materials and are enforceable through permit or lease conditions. Where the environmental analysis in this EIS recommends additional protective measures, over and above the applicant proposed measures, they are listed below as specific mitigation measures.

The Proposed Action, including the continued operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects to socioeconomics. Therefore, no additional mitigation is recommended.

4.11 Environmental Justice

Environmental Justice is defined by the EPA as *"The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people including racial, ethnic, or socioeconomic groups should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies"* (EPA 1998b).

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority and Low-income Populations*, was issued in 1994 to focus the attention of federal government agencies on human health and environmental conditions in minority and low-income communities. In addition, EO 12898 was established to ensure that, if there were disproportionately high and adverse human health or environmental effects from Federal actions on these populations, that those effects would be identified and addressed. The EO specifically requires that Native American populations are included in discussions and analysis of potentially affected minority and low-income populations.

According to a memorandum accompanying EO 12898, environmental justice under the NEPA should be considered in the following ways:

1. Environmental effects, including human health, economic, and social effects of federal actions should be analyzed by each federal agency.
2. When it is feasible, mitigation measures, as outlined in an environmental assessment, environmental impact statement, or record of decision, should address disproportionately high and adverse human health or environmental effects on environmental justice populations.
3. Effective community participation in the NEPA process should be provided by each federal agency. This could include identifying potential effects and mitigation measures by working with the affected communities, in addition to improving accessibility of public meetings and applicable documents (Clinton 1994).

Additionally, the BIA NEPA Handbook states that to comply with EO 12898, "[t]he Bureau must therefore reach and communicate to the extent practicable with such [low income and minority] communities, from the earliest stages of planning through the decision to proceed with a proposed action, and to specifically address in the environmental analysis any such communities that might be affected by a proposed action" (BIA 2005).

The CEQ Environmental Justice Guidance (CEQ 1997) states that "[a]gencies should apply the guidance with flexibility, and may consider its terms a point of departure rather than conclusive direction in applying the terms of the Executive Order." The guidance also states that "[a]gencies should consider relevant public health data and industry data concerning the potential for multiple or cumulative exposure to human health or environmental hazards in the affected population and historical patterns of exposure to environmental hazards, to the extent such information is reasonably available. For example, data may suggest there are disproportionately high and adverse human health or environmental effects on a minority population, low-income population, or Indian tribe from the agency action. Agencies should consider these multiple, or cumulative effects, even if certain effects are not within the control or subject to the discretion of the agency proposing the action." In consideration of these cumulative effects, the EPA recommended the use of their Framework for Cumulative Risk Assessment, May 2003, which addresses health risk assessment.

Region of Influence

This environmental justice analysis focuses on the distribution of racial and low-income status' in areas potentially affected by the implementation of the Proposed Action. The aggregation of these potentially affected areas is referred to as the ROI. The ROI includes all of San Juan County, NM and tribal areas (the Navajo and Hopi Reservations). San Juan County is included in the ROI because it is the jurisdiction that the some aspects of the Proposed Action would take place. Tribal areas are included in ROI because the Proposed Action would take place on Navajo Nation land as well as Hopi land (transmission line placement). Furthermore, tribal areas are heavily populated with Native Americans, a recognized ethnic group, which according to EO 12898 are required to be included in discussions and analysis of environmental justice.

Identifying Environmental Justice Population Areas

Since it is critical to identify small pockets of minority and low-income populations, data on minority and low-income status is analyzed using the most detailed areas for which relevant statistical data is available (census block groups). The proportion of minority and low income populations, within each census block group in the ROI, is calculated using the following criteria:

- Minority is defined as the following racial and ethnic groups: Black or African American, Hispanic or Latino, Asian, American Indian or Alaska Native, and Native Hawaiian or other Pacific Islander.
- Low-income is defined as individuals that the Census identifies as living below the poverty line.

Once the proportions of minority and low-income residents in each census block group are calculated, the proportions are compared to reference areas. CEQ guidance (1997) is not specific as to the choice of reference population. For purposes of this analysis, the respective counties in which each census block group is located are used as the reference areas. Comparison of the Tribal area to the county area is most representative of the conditions in the ROI. The result of this comparison determines whether the census block group is considered an environmental justice population area. If there is a higher proportion of minority or low-income residents in a census block group than the proportion in the county in which the census block group is located, then the census block group is identified as an environmental justice population area.

The ROI is mapped, and data provided on low-income and minority status in Figure 4.11-1 and 4.11-2. The figures are used to highlight environmental justice population areas. In the environmental justice analysis, comparisons are also provided for state measures of social concerns.

Public Participation for Environmental Justice Communities

Throughout the NEPA process, a variety of steps have been taken to involve minority, low-income, and Tribal populations in a meaningful way, in accordance with Executive Order 12898 - *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (1994). A primary purpose of EO 12898 is to encourage minority and low-income populations to participate in the NEPA process so that the concerns of these populations can be analyzed during the environmental review process. The Executive Order 12898 guidance document states:

> *"The Executive Order requires agencies to work to ensure effective public participation and access to information. Thus, within its NEPA process and through other appropriate mechanisms, each Federal agency shall, wherever practicable and appropriate, translate crucial public documents, notices and hearings, relating to human health or the environment for limited English speaking populations. In addition, each agency should work to ensure that public documents, notices, and hearings relating to human health or the environment are concise, understandable, and readily accessible to the public."*

Furthermore, EPA's National Environmental Justice Advisory Council (NEJAC) published a report entitled "*Fostering Environmental Justice for Tribes and Indigenous People*" (January 15, 2013) that seeks to ensure that there is genuine and meaningful exchange of information between the federal agencies and the affected tribe(s). The report emphasizes the meaningful involvement of tribes under the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and states:

> *"A central-tenet of the UNDRIP is the recognition of indigenous peoples right to free, prior and informed consent as a requirement, prerequisite, and manifestation of the exercise of the fundamental, inherent right to self-determination as defined in international law".*

As defined by the UNDRIP,

- *Free* is the absence of coercion and outside pressure, including monetary inducements (unless they are mutually agreed to as part of a settlement process)
- *Prior* is having sufficient time to allow for information-gathering and full discussion, including translations into traditional languages, before a project starts. It must take place without time pressure or constraints. A plan or project must not begin before this process is fully completed and an agreement is reached.
- *Informed* is having all the relevant information available reflecting all views and positions. This includes the input of traditional elders, spiritual leaders, subsistence practitioners and traditional knowledge holders, with adequate time and resources to consider impartial and balanced information about potential risks and benefits.
- *Consent* is the demonstration of clear and compelling agreement, in keeping with the decision-making structures of the indigenous peoples in question, including traditional consensus procedures. Agreements must be reached with the full participation of authorized leaders, representatives or decision-making institutions as decided by the indigenous peoples themselves.

These Environmental Justice guidance documents were carefully considered and applied during this NEPA process. Public participation with tribal members was fostered throughout the NEPA scoping period, the SMCRA informal consultation process, and the Section 106 National Historic Preservation Act consultation process. Among the methods applied were translations into traditional languages, seeking input from elders, and providing opportunities to provide input in a variety of ways to help reduce cultural and language barriers and allow community members to express their views and opinions in a manner familiar to them. The steps taken to provide outreach and meaningful involvement to local communities are described in more detail below.

Public Scoping and Informal Conferences

OSMRE hosted nine public scoping meetings in August 2013 around the Four Corners region in order to involve Native American populations to the greatest extent possible. The locations were selected to ensure that Navajo and Hopi tribal members would be able to access the venues, and as such meeting were held in Hotevilla Village, the Burnham Chapter House, Nenahnezad Chapter House, Shiprock High School and the Navajo Nation Museum, in addition to meetings in larger cities including Farmington, Albuquerque, Cortez and Durango.

As required by NEPA, OSMRE conducted scoping in the early stages of EIS preparation to encourage public participation and solicit public comments on the scope and significance of the proposed action. The required NEPA scoping was substantially enhanced to ensure that the opportunity for participation was extended to the local minority, low-income, and Tribal populations. The 60-day scoping period (later extended and additional 45 days, for a total of 105 days, at the request the public) was initiated with the Federal Register Notice of Intent an EIS for the FCPP and Navajo Mine Energy Project, which was published on July 18, 2012. Concurrently, the Hopi and Navajo Cooperating agency participants were notified about the initiation of scoping for the project and were able to pass this information to their

communities. The scoping period was extended, in part, to ensure that tribal members would have sufficient time to gather information, engage in discussion and make informed comments about the project. Additional translated materials were provided during the extension time period to aid in this process.

Public announcements were also made via media releases in newspapers, public service announcements, notification fliers, and radio announcements. The public service and radio announcements were translated into native languages and all types of announcements were made widely available, including in remote areas.

The announcements were distributed in a variety of newspapers, including the Navajo-Hopi Observer, the Hopi Tutuveni and the Navajo Times, to ensure that the notification was provided in the periodicals that the Navajo and Hopi tribal members are most likely to read. Media announcements were provided multiple times to increase the likelihood that tribal members would read the announcement and to provide enough time for people to prepare for the meetings and make arrangements to attend. Two notifications were provided on the days immediately prior to the dates of the local scoping meeting (assuming that the newspaper was published daily). A summary of newspaper advertisements for scoping meetings is provided in Table 5-1. A public service announcement providing the dates and times of the local scoping meetings was distributed to 31 local radio stations. The public service announcement was translated and recorded in Navajo and Hopi. The English release and the Navajo and Hopi audio files were disseminated to radio stations based on the language of the radio station.

In addition, fliers announcing the public meetings were posted at various chapter houses on the Navajo Nation Tribal Trust Lands and Hopi Tribal Trusts lands, including the Chinle, Coalmine Canyon, Nenahnezad, Shiprock, Tiis Tsoh Sikaad (Burnham), and Upper Fruitland chapter houses, as well as throughout local communities at community centers, post offices, libraries, grocery stores, gas stations, trading posts, town halls, and other gathering places to further reach tribal community members and remote locations where interested stakeholders potentially resided. Many tribal members indicated that they had learned about the public meetings through the various means of communication discussed above.

The nine scoping meetings and two informal conferences were held in an open house format where members of the public could arrive at any time during the four-hour event. The goal of the open house setting was to provide a long and flexible time frame to maximize the number of people able to attend and participate in the meetings. The flexible format of the meeting also provided a comfortable setting for the Navajo and Hopi tribal members to take in the information and provide their opinions and comments. In addition to the scoping meetings, informal conferences were held concurrently with the open house scoping meetings at the Tiis Tsoh Sikaad (Burnham) and Nenahnezad Chapter Houses. Multiple actions were taken to make the scoping meeting welcoming for the tribal members, such as preparing the scoping materials in Hopi and Navajo, providing oral forms of communication (i.e. on site translators, videos, and subject area experts to describe the project) aligned with the verbal tradition of the Navajo and Hopi cultures, as well as providing refreshments at each of the scoping meetings that were familiar and preferred by the Navajo and Hopi tribal members.

Hopi and Navajo translators were present at scoping meetings held on the Navajo and Hopi Reservations. Translators with strong understanding of the Hopi and Navajo cultures and languages were chosen to ensure that more than a word-for-word translation was provided but rather the cultural context of the issues was maintained throughout the translation process.

At each scoping meeting, OSMRE team members greeted meeting attendees as they entered and immediately notified tribal members that translators were present at the meetings to provide assistance, as desired. The translators were effectively utilized at each scoping meeting; in general, they were consistently assisting tribal members throughout the each of the four hour scoping meetings, and tribal members provided positive feedback that the translators were culturally aware and helpful.

Attendees at the scoping meetings were encouraged to watch a project overview video, which was available in English, Navajo and Hopi. Attendees were able to watch the introductory video at any time

throughout the scoping meeting as it was provided on several laptop computers with headphones. This provided a safe and private venue for attendees to become acquainted with the project. The project overview video was also made available in all three languages via DVD following the scoping meetings; the DVDs were mailed to government and tribal representatives who attended a scoping meeting and to the Tiis Tsoh Sikaad (Burnham) and Nenahnezad Chapter Houses.

At each scoping meeting a variety of posters were presented around the room. The information addressed the NEPA process, agency involvement, the proposed action and alternatives, and the environmental resource areas to be considered. The information clearly identified the time and manner in which the public was encouraged to directly participate, and this message was reiterated by the agency staff at the meeting. Subject matter experts were available at each poster to answer questions. While the posters were not translated into Hopi and Navajo, translators accompanied Navajo and Hopi speakers to each poster, as desired, to help understand the poster material and to assist tribal members to communicate with subject matter experts.

Comment collection stations were set up at each scoping meeting to facilitate the submission of written comments from the public. Translators were able to help tribal members prepare written comments, if desired. In addition, two court reporters were available at each scoping meeting to record oral comments, in recognition of the fact that Navajo and Hopi cultures have a strongly oral tradition. The court reporter option was used frequently by tribal members. At all of the scoping meetings held on Tribal Trust Lands, the majority of the comments received were oral as opposed to written. In addition, the translators helped facilitate 4 of the oral comments provided.

Based on comments received from tribal members during the initial scoping meetings, OSMRE filmed a video of the welcome table, the project description, and each of the posters, with narration provided by the subject matter experts. At the conclusion of the scoping meetings, the video was translated into Navajo and Hopi, and was distributed to select government and tribal representatives and the Tiis Tsoh Sikaad (Burnham) and Nenahnezad Chapter Houses. The purpose of the video was to enhance the outreach efforts to the affected Native American communities potentially affected by the Proposed Action.

Overall, the scoping meetings were very well attended by Tribal members. A total of 455 attendees participated in the nine scoping meetings, a large percentage of whom were tribal members. In addition, the scoping meetings were attended by Navajo Nation President Ben Shelly, and members of his staff. Several tribal council members attended the scoping meetings, as well as Navajo and Hopi elders. These tribal members had the opportunity to engage in discussion about their comments and concerns with knowledgeable team staff members, including the project managers and cooperating agency project leads.

Following the scoping meetings, public information repositories were established at 29 locations in the Four Corners region, including chapter houses, libraries, OSMRE offices, and BIA offices. Binders containing the notification advertisement and materials provided at the open house scoping meetings, copies of each poster, the fact sheet booklet and the comment form were provided at each information repository.

All of the actions described above help ensure that tribal members are informed and have the opportunity to meaningfully participate in the environmental review process, in accordance with the NEJAC recommendations.

Additional Public Outreach and Consultation

In addition to public participation during the scoping process, the Navajo, Hopi, and other tribes were consulted as part of the Section 106 consultation process, which aims to preserve important natural aspects of our national heritage as well as historical and cultural aspects though consultation and coordination between the federal government and affected tribes. As part of this process OSMRE reached out to approximately 40 tribes (See Section 5.1.3.2)

OSMRE formed a Section 106 Working Group that met through teleconference calls and in person to discuss the consultation process that includes: OSMRE and third-party consultant, BIA, Navajo Nation, Hopi Tribe, BLM, EPA Region 9, USACE, New Mexico Historic Preservation Division, Arizona State Parks/SHPO, PNM, BNCC and consultants, APS and consultants, and the Advisory Council on Historic Preservation. OSMRE has worked closely with the tribes throughout the consultation process, holding in person meeting to ensure that the tribes are fully engaged and that their traditions, policies and authorities are fully recognized, upheld, and protected.

OSM held additional in-person meetings at the Hopi and Navajo Nation Tribal Trust lands to help increase their understanding of the project and ensure that there was a genuine and meaningful exchange of information between federal agencies and the Hopi and Navajo people that would be affected by the project. Moreover, in response to comments related to cultural resources provided during the scoping period, additional site tours were conducted and a meeting was held at the Burnham Chapter house to ensure that concerns were understood and addressed.

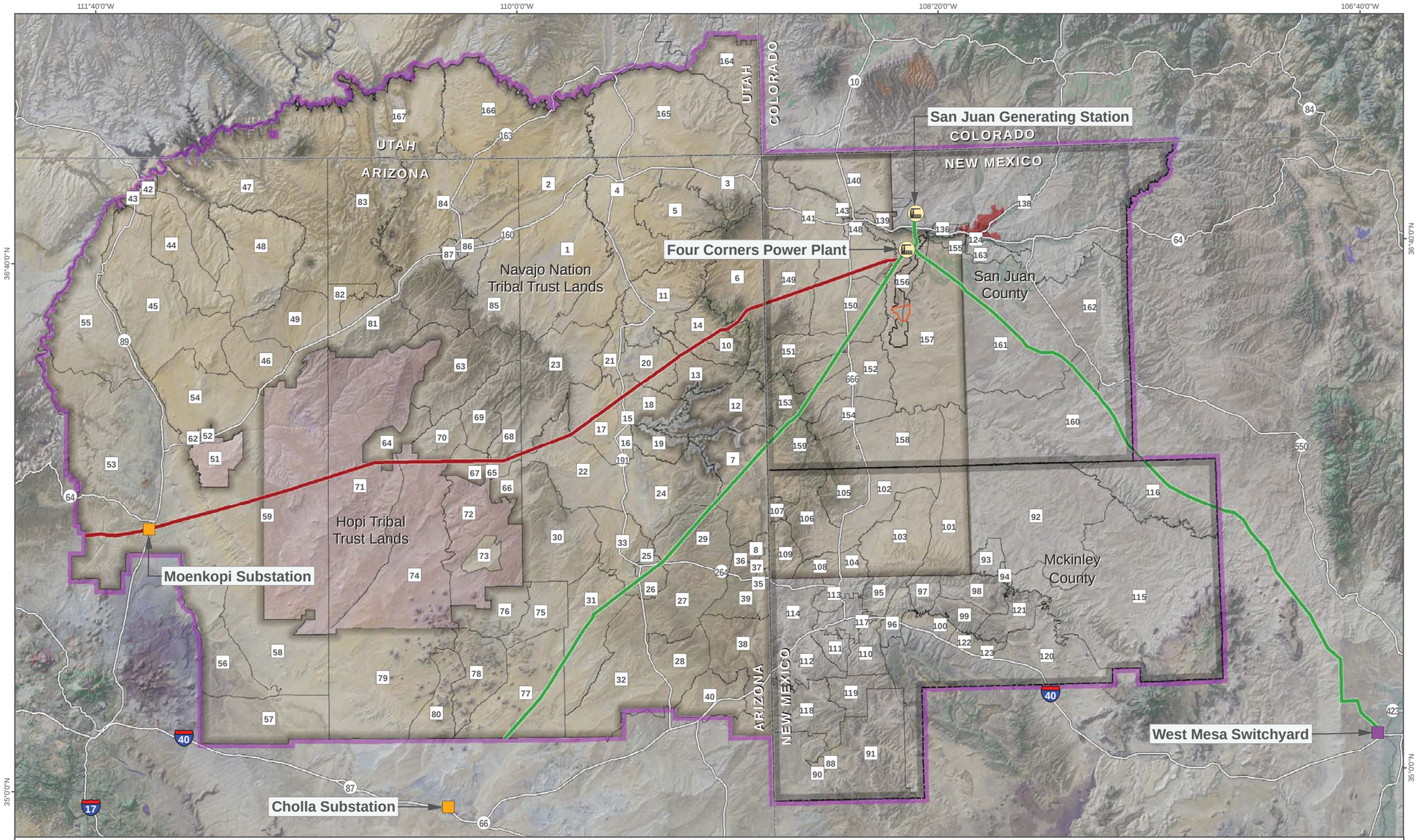
4.11.1 Affected Environment Pre-2014

4.11.1.1 Minority Population Areas

Figure 4.11-1 depicts all census block groups in the ROI and the counties in which they are located. The proportion of minority residents in each census block group is presented along with the proportion of minority residents in each county. The proportion in each census block group is compared to the proportion in the county (reference area) to determine whether particular census block groups are considered environmental justice minority population. Census block groups that are considered environmental justice minority population areas are highlighted in beige. Environmental justice minority population areas in the ROI make up the vast majority of the land area in the ROI. The only portions of the ROI that are not considered an environmental justice minority area are census block groups to the north and east of the FCPP, in northeast San Juan County.

4.11.1.2 Low-income Population Areas

Figure 4.11-2 lists all census block groups in the ROI and the counties in which they are located. The proportion of low-income residents in each census block group is presented along with the proportion of low-income residents in each county. The proportion in each census block group is compared to the proportion in the county (reference area) to determine whether particular census block groups are considered environmental justice low-income. Census block groups that are considered environmental justice low-income population areas are highlighted in pink. Environmental justice low-income population areas in the ROI make up the majority of the land area in the ROI.



Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group
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2	040019426002	18	040019442021	34	040019450011	50	040059449001	66	040179400102	82	040179423002	98	350319436004	114	350319439022	130	350450003024	146	350459428031	162	350459432014
3	040019427001	19	040019442022	35	040019450012	51	040059449002	67	040179400103	83	040179423003	99	350319436005	115	350319440001	131	350450004023	147	350459428032	163	350459432015
4	040019427002	20	040019443001	36	040019450013	52	040059449003	68	040179400111	84	040179424001	100	350319436006	116	350319440002	132	350450005031	148	350459428033	164	490379420001
5	040019427003	21	040019443002	37	040019450014	53	040059450001	69	040179400112	85	040179424002	101	350319437001	117	350319456004	133	350450005051	149	350459429001	165	490379420002
6	040019427004	22	040019443003	38	040019450021	54	040059450002	70	040179400113	86	040179425001	102	350319437002	118	350319457001	134	350450005053	150	350459429002	166	490379421001
7	040019440001	23	040019443004	39	040019450022	55	040059450003	71	040179400121	87	040179425002	103	350319437003	119	350319457002	135	350450005055	151	350459429003	167	490379421002
8	040019440002	24	040019443005	40	040019450023	56	040059451001	72	040179400131	88	350319403001	104	350319437004	120	350319460001	136	350450005056	152	350459429004		
9	040019440003	25	040019449011	41	040050021003	57	040059451002	73	040179400132	89	350319403002	105	350319438001	121	350319460002	137	350450006103	153	350459429005		
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13	040019441004	29	040019449015	45	040059422012	61	040059452002	77	040179400143	93	350319435002	109	350319438005	125	350450001004	141	350459428013	157	350459430003		
14	040019441005	30	040019449021	46	040059422013	62	040059452003	78	040179400151	94	350319435003	110	350319439011	126	350450002051	142	350459428021	158	350459431001		
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16	040019442012	32	040019449023	48	040059422022	64	040179400082	80	040179400153	96	350319436002	112	350319439013	128	350450002055	144	350459428023	160	350459432012		

Figure 4.11-1

Minority Population in the Region of Influence

PROJECT FACILITIES

- Four Corners Power Plant
- Substation
- Switchyard

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Proposed Pinabete Permit Boundary
- Region of Influence

TRANSMISSION LINES

- 345kV
- 500kV

CENCUS INFORMATION

- Minority Population Block Groups

OTHER FEATURES

- County Boundaries
- Hopi Tribal Trust Lands
- Navajo Nation Tribal Trust Lands

Note: Minority Population is defined as a Census Block Group where percentage of minority population is greater than the county in which it is located.

Source: U.S. Census Bureau (2012)

N

0 20 40
Scale in Miles

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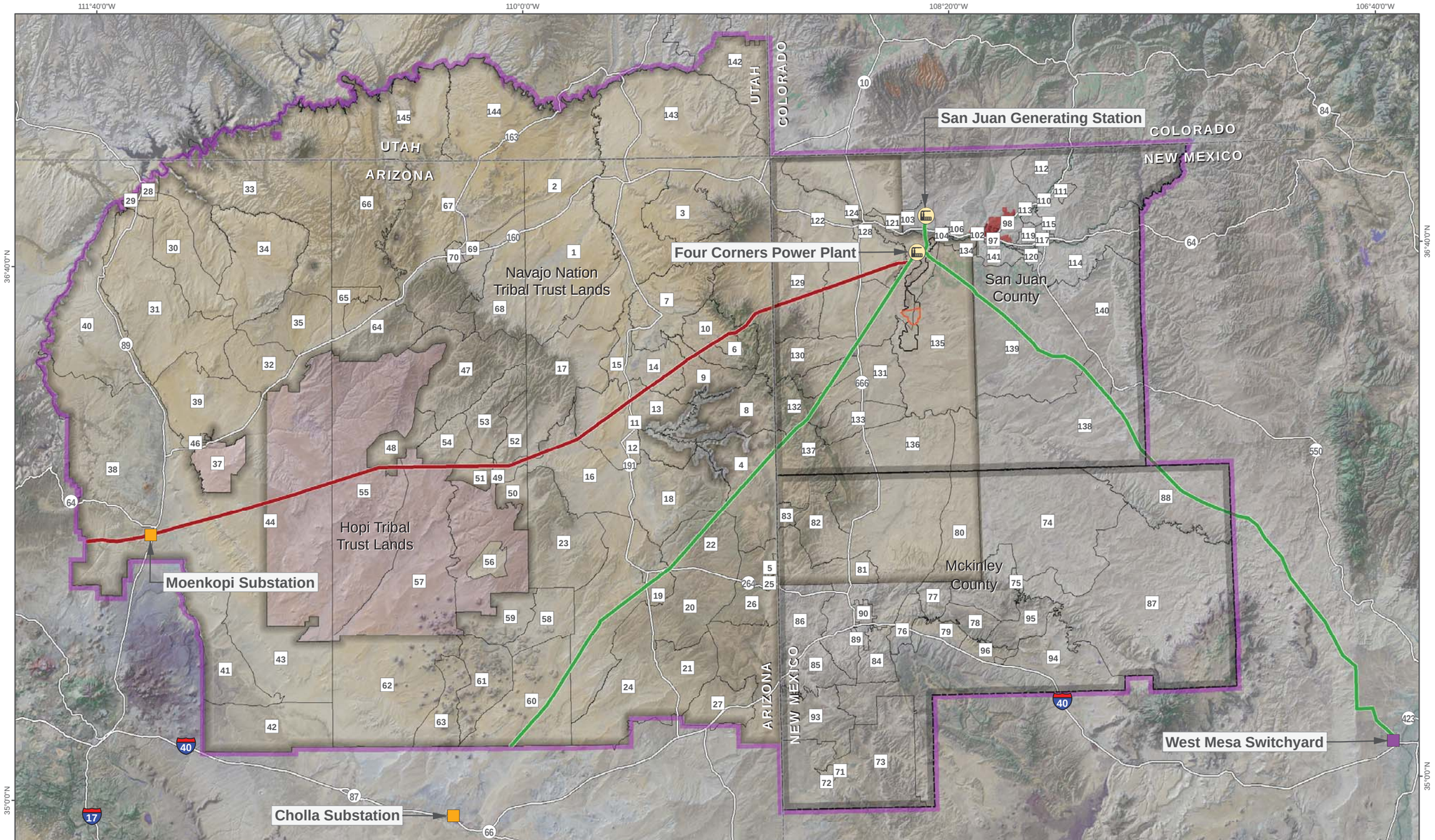
Figure 4.11-2

Low-income Population in the Region of Influence



Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group	Map Label	Block Group
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2	040019426002	18	040019443005	34	040059422022	50	040179400102	66	040179423003	82	350319438002	98	350450002042	114	350450007021	130	350459429003
3	040019427003	19	040019449012	35	040059422023	51	040179400103	67	040179424001	83	350319438003	99	350450002051	115	350450007051	131	350459429004
4	040019440001	20	040019449013	36	040059449001	52	040179400111	68	040179424002	84	350319439011	100	350450002053	116	350450007052	132	350459429005
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6	040019441001	22	040019449015	38	040059450001	54	040179400113	70	040179425002	86	350319439022	102	350450004013	118	350450007081	134	350459430001
7	040019441002	23	040019449021	39	040059450002	55	040179400121	71	350319403001	87	350319440001	103	350450005041	119	350450007082	135	350459430003
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10	040019441005	26	040019450022	42	040059451002	58	040179400141	74	350319435001	90	350319453001	106	350450005055	122	350459428013	138	350459432012
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16	040019443003	32	040059422013	48	040179400082	64	040179423001	80	350319437001	96	350319460003	112	350450006112	128	350459428033	144	490379421001
																145	490379421002

PROJECT FACILITIES

- Four Corners Power Plant
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- Switchyard

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Proposed Pinabete Permit Boundary
- Region of Influence

TRANSMISSION LINES

- 345kV
- 500kV

CENCUS INFORMATION

- Low-income Population Block Groups

OTHER FEATURES

- County Boundaries
- Hopi Tribal Trust Lands
- Navajo Nation Tribal Trust Lands

Note: Low-income Population is defined as a Census Block Group where percentage of people below poverty level is greater than the county in which it is located.

Source: U.S. Census Bureau (2012)

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0 20 40
Scale in Miles

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4.11.2 Changes to Environmental Justice Affected Environment Post-2014

Two completed federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions; and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared in the following Section. The relevance to environmental justice is described in the following paragraphs.

In August 2012, EPA published its source-specific FIP for BART to achieve emissions reductions required by the Clean Air Act at FCPP (40 CFR Part 49.5512). EPA has required FCPP to reduce emissions of NO_x. EPA has also set emission limits for PM, based on emission rates already achieved at FCPP, which contributes to visibility impairment in 16 mandatory Class I federal areas around FCPP. This action would allow for FCPP to continue operations in compliance with the FIP. Although an EIS or EA was not prepared for EPA's consideration of allowing the continued operations of FCPP, the CEQ guidance on environmental justice (CEQ 1997) recommends that "*agencies should augment their procedures as appropriate to ensure that the otherwise applicable process or procedure for a federal action addresses environmental justice concerns*."

In accordance with this guidance, the "EPA has determined that this final rule will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations because it increases the level of environmental protection for all affected populations without having any disproportionately high and adverse human health or environmental effects on any population, including any minority or low-income population. This rule requires emissions reductions of two pollutants from a single stationary source, Four Corners Power Plant" (40 CFR Part 49.5512).

On April 29, 2013, the Navajo Nation Council enacted legislation to form the NTEC, LLC. This legislation was signed into law by President Ben Shelly on April 30, 2013. As stated in the resolution, NTEC sought to purchase the Navajo Mine and control the lease, mineral rights and operations of Navajo Mine in order to:

> *"promote and develop the Navajo Nation's resources and new sources of energy, power, transmission, and attendant resources to develop the economic, financial, social and cultural well-being of the Navajo People and the Navajo Nation; and to promote the economic vitality of the Navajo Nation through the production of goods and services, to facilitate management of the Navajo Nation's interest in the development of its energy portfolio and market, to steer the Navajo Nation into a more efficient, productive, vital, and sustainable energy portfolio and market in the best interests of the future generations of the Navajo Nation."* (Navajo Nation Council Resolution CAP-20-13 as amended May 23, 2013).

Further, the legislation authorizing the formation of NTEC states that "The Navajo Nation's approval of the creation, formation, organization establishment and operation is for the protection and promotion of the Navajo People's and the Navajo Nation's economic and financial best interests, which are tied and related to mining operations and the energy industry within the Navajo Nation, as a means to ameliorate the economic financial and social conditions of the Navajo People and the Navajo Nation."

The CEQ guidance on environmental justice (CEQ 1997) states:

> *"Under NEPA, the identification of a disproportionately high and adverse human health or environmental effect on a low-income population, minority population, or Indian tribe does not preclude a proposed agency action from going forward, nor does it necessarily compel a conclusion that a proposed action is environmentally unsatisfactory. Rather, the identification of such an effect should heighten agency attention to alternatives (including alternative sites), mitigation strategies, monitoring needs, and preferences expressed by the affected community or population."*

The action of the Tribal Council is an expression by the affected community that investment in Navajo Mine by the Navajo Nation would meet its goals of controlling the mineral resource and providing stable employment for members.

OSMRE completed an EA evaluating the proposed action of the transfer of the SMCRA permit from BNCC to NTEC. The EA analyzed the environmental justice effects of this action. The analysis found that some programs formerly offered by BNCC, such as the employee coal distribution program at Navajo Mine, do not formally transfer to NTEC, and it is not clear whether NTEC will continue this program now that the permit has been transferred, or if NTEC will expand the program. Therefore, the potential indirect impacts associated with the assets and liabilities assumed by the Navajo Nation were found to not disproportionately impact the low-income, minority, and Tribal populations within the ROI.

4.11.3 Environmental Consequences

The concept of environmental justice is rooted in the Civil Rights Act of 1964, which prohibited discrimination in federally assisted programs, and in EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, issued February 11, 1994. EO 12898 was intended to ensure that Federal actions and policies do not result in disproportionately high adverse effects to minority or low-income populations. EO 12898 requires each Federal agency to incorporate environmental justice into its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects, including social or economic effects, of its programs, policies, and activities implemented both directly and indirectly (for which it provides permitting or funding), on minority populations and low-income populations of the US (CEQ 1997).

Additional guidance from the CEQ clarifies that environmental justice concerns may arise from effects to the natural and physical environment that produce human health or ecological outcomes, or from adverse social or economic changes. The CEQ's environmental justice guidance (CEQ 1997) states that the analysis should consider relevant data concerning the potential for multiple or cumulative exposures to human health or environmental hazards in the affected population. This analysis considers multimedia and cumulative effects, and references other Sections of the EIS for additional detail. Although the analysis is formally organized by individual resource category, cumulative and multiple effects are addressed in the most relevant resource category for those effects.

An environmental justice analysis consists of three steps:

1. Identify whether an alternative has potential adverse social, economic, or health effects.
2. Determine if potential adverse effects would disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities.
3. Determine if disproportionate adverse impacts are major.

As discussed in Section 4.11.1, the ROI is characterized by a disproportionately high population of minority residents (Native American) and low-income residents on Navajo lands. While minorities and low-income residents in the ROI reside in places other than Navajo lands (on Hopi lands or in the city of Farmington), this analysis focuses on Navajo populations because major impacts to the more distant Hopi tribal trust lands are not expected because there would be no change to operations. In addition, the city of Farmington is a mixture of minority/low-income populations. As such, impacts to residents of the city of Farmington would not disproportionately affect minorities or low-low income residents.

The remainder of this section focuses on identifying the presence and significance of adverse social, economic, or health effects of each alternative, and whether these disproportionately affect a minority or low-income populations. This analysis is based on the information presented in other resource sections in this EIS. Where other resource sections have identified adverse effects in comparison to the baseline condition, this section describes the potential associated effect to social, economic, or health impacts and

determines whether those impacts would disproportionately affect Navajo lands or populations, and if so, then assess whether the environmental justice impact is major.

The levels of significance of impacts are classified as major, moderate, minor, negligible or "no impact." An impact is considered major if it would result in a substantial adverse change to the environment. An impact is considered moderate or minor if it would not result in substantial adverse environmental effects but could still have some effect. In contrast to "no impact", a negligible impact could occur but at the lowest limits of detection of an effect. In cases where no impact would occur, this conclusion is noted. Quantitative thresholds are applied, where appropriate, to determine the level of significance (for example, quantitative thresholds are commonly used to determine impact levels in the areas of noise and air quality). Other issues are assessed qualitatively based on context and intensity.

4.11.3.1 Alternative A – Proposed Action

Under Alternative A, OSMRE would approve NTEC's Pinabete Permit Area SMCRA application and renew the existing permit at the Navajo Mine Permit Area. In addition, the BIA would approve Amendment #3 of the FCPP's lease with the Navajo Nation, as well as approve the grant of lease renewal for the four associated transmission lines.

Air Quality

This discussion of air quality considers the potential for multiple or cumulative exposure to human health or environmental hazards in the affected population. Although the primary focus is air quality, there are also considerations of public health.

Navajo Mine

Mobile source emissions from the Navajo Mine although quantifiable, are relatively small compared to future power plant emissions, about 6.8 percent of NO_X potential to emit and about 0.1 percent of SO_2 potential to emit and, generally, consistent with EPA limits of precision of -2 to +5 percent for fossil fuel combustion (EPA 2012b). Thus, any reasonable variations in mining-related mobile source estimates are negligible. Section 4.17, Health and Safety, also presents health risk assessments for fugitive dust and diesel particulate matter, which concludes that exposure levels would be within the range that is protective of human health. In both cases, the effects are minor and within regulatory target risk levels.

Four Corners Power Plant

Mercury and other contaminants may be deposited in the soil due to power plant operations, and humans may ingest these contaminants through consumption of farm products grown in these soils, or fish harvested from local waters. Even in the worst-case scenario, assuming high consumption of fish and local farm products, risk assessment indicates that exposure would be below thresholds protective of human health. The health risk assessment, following EPA guidance, considered consumption of beef, pork, chicken, eggs, and milk. Although sheep are not specifically quantified, the exposure factors for sheep are within those for the species considered, and therefore sheep consumption would be within the risk levels quantified in Section 4.17. Section 4.17 also considers health risks from inhalation of fugitive dust and finds that the levels are within the target regulatory risk level.

San Juan County's most recent Community Health Profile includes a comprehensive overview of health indicators including respiratory health (San Juan County 2010). This study found that San Juan County has a higher incidence of chronic lower respiratory disease comprised of chronic bronchitis, asthma, and emphysema compared to New Mexico or the rest of the United States. The study also points out that both teen and adult smoking is higher in San Juan County than all of New Mexico and the U.S. In addition, San Juan County's most recent Community Health Profile found that elevated levels of ozone in San Juan County were linked to incidence of asthma-related medical visits (NMDH 2007).

Another study, whose area of analysis included the Project Area, was undertaken to better understand the relationship between the perceived risk to respiratory health from ambient air quality and the risk presented by coal combustion inside of dwellings for cooking and heating. The study considered special exposures for vulnerable populations, and examined the relationship between coal combustion in homes in the Shiprock area and impacts on respiratory health. The study did not directly evaluate inhalation of coal dust from area mines or emissions from area power plants. The results from this study suggest that the risk of adverse effects from home burning of coal could be reduced by making relatively simple and inexpensive changes to methods of home heating (Bunnell et al. 2010).

The analysis in this EIS used a combination of ambient air monitoring, Project emissions modeling, adherence to NAAQS and Human Health Risk Assessments to evaluate both the Proposed Project's contribution of harmful contaminants in the ambient air and whether or not that contribution has a disproportionate impact on the local population.

The results of the human health risk assessment, the fugitive dust risk assessment, and the diesel particulate matter risk assessment (all found in Section 4.17, Health and Safety) indicated that continued operations of Navajo Mine and FCPP would be considered protective of sensitive subpopulations, such as children, the elderly, and the sick. Sensitive subpopulations such as the environmental justice community are protected by these values because the toxicity values used are considered by EPA to be protective of sensitive subpopulations.

Section 4.1 (Air Quality) presents the results of modeling the potential changes to NAAQS as a result of the Proposed Action. With respect to ozone, APS conducted photochemical modeling on a regional level to assess the effects of NO_X emissions from FCPP. The assessment was conducted by modeling FCPP emissions in combination with other regional sources and comparing the resulting ozone concentrations to the current 8-hour ozone NAAQS and also the former (1979-97) 1-hour ozone NAAQS. Ozone impacts were assessed near FCPP (maxima), in nearby PSD Class I and sensitive Class II areas, and at existing ozone monitoring sites (AECOM 2013b).

For consistency, APS utilized input data, configurations, and supporting information for the CAMx (Comprehensive Air Quality Model with eXtensions) modeling program, which was used for the Four Corners Air Quality Study (NMED 2009). As part of the modeling procedure, the Four Corners Air Quality Study regional emissions inventory was updated with current data for other sources in the 4-km domain, and APS provided updated emissions for FCPP consistent with the final BART rule. The modeling period spanned May through August because monitored ozone concentrations are highest during the summer months due to stronger sunlight, which drives photochemical reactions.

Future operation of would emit SO_2, NO_X, PM_{10} and $PM_{2.5}$ (also VOC and CO) and therefore contribute incrementally to ambient air quality deterioration, visibility impairment, and dry and wet deposition in the ROI. However, based on the findings of Section 4.1 (Air Quality), the Four Corners Region complies with the NAAQS, and as such the existing levels do not pose an adverse condition. For particulate matter (PM_{10} and $PM_{2.5}$) the EPA (2009) has noted that toxicity associated with exposure to airborne particulate matter can vary by particulate matter composition with the implication that the NAAQS for particulate matter may not be health protective in all cases. This concern is addressed in Section 4.17 (Health and Safety) as it pertains to fugitive coal dust emissions, and the risk analysis shows that the metals present in Navajo Mine coal and assumed to be present in fugitive dusts at the primary NAAQS for $PM_{2.5}$ of 12 $\mu g/m^3$ would not pose an unacceptable risk to public health.

Furthermore, boiler emissions from FCPP would decrease as a result of BART compliance, and would comprise about 17 percent of regional SO_2 emissions and about 5 percent of NO_X emissions from electric power generation beginning in 2019, when SCR would be fully operational on Units 4 and 5 and Units 1, 2 and 3 have been decommissioned. Thus, while NO_X emissions from FCPP would decrease about 87 percent compared to the historic plantwide baseline, the relative reduction when other regional plants are taken into account would be smaller, about 34 percent overall. Similarly, plantwide SO_2 emissions

from FCPP would decrease about 18 percent while the relative regional reduction would be about 4 percent. In general, such emissions decreases, attributable to BART compliance, would result in reduced pollutant levels in ambient air and provide a net clean air benefit. These conditions would be continued under the Proposed Action. Table 4.11-1 (also shown in Section 4.1, as Table 4.1-28) summarizes the reduced emissions as a result of compliance with the BART requirements.

Table 4.11-1 Summary of Air Emission Reductions from BART Compliance at FCPP

Criteria Pollutants, Greenhouse Gases and Target Metals	Historic Pre-2014 Baseline Emissions Units 1, 2, 3, 4, 5 tons/yr	Estimated Post-2014 Baseline Emissions Units 4 & 5 tons/yr	Pre-2014 vs Post-2014 Emissions Reduction percent
Sulfur Dioxide (SO_2)	11,971	9,800	18%
Nitrogen Oxides (NO_X)	41,121	5,420	87%
Carbon Monoxide (CO)	2,096	1,580	25%
Filterable Particulate (PM)	1,976	830	58%
Carbon Dioxide Equivalents (CO_2e)	15,439,236	11,396,710	26%
Arsenic (As)	1.78	0.06	96%
Lead (Pb)	1.82	0.07	96%
Mercury (Hg)	0.36	0.07	81%
Selenium (Se)	5.63	0.28	95%

Transmission Lines

No air quality impacts are associated with transmission lines.

Environmental Justice Considerations

- Step 1: Are potential adverse social, economic, or health effects associated with Alternative A?

  Yes. There are minor adverse impacts due to air quality for nearby residents.

- Step 2: Would potential adverse effects disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities?

  Yes. Impacts would primarily affect Navajo populations.

- Step 3: Are disproportionate adverse impacts major?

  No. Air quality, atmospheric deposition, and associated public health impacts are not considered major.

Earth Resources

Navajo Mine

As described in Section 4.3, Earth Resources, Alternative A would result in extensive adverse impacts to landforms and topography during mining. Following reclamation the land surface would be restored to the approximate original contour and impacts to landform and topography would be permanent but minor. Impacts associated with Burnham Road's realignment would be considered minor.

Impacts with regard to soil erosion would be considered minor, and post-reclamation activities within the permit area would have permanent positive impacts to soils. Impacts to soil from primary and ancillary road construction, maintenance, and deconstruction would be considered minor.

The level of impacts to geologic features from primary and ancillary road construction would be considered negligible, and no impacts to mineral resources would occur.

The Proposed Action includes a Paleontological Resources Management Plan designed to protect paleontological resources at the Navajo Mine and proposed Pinabete permit area. The condition addresses both known occurrences, as well as discovering previously unknown paleontological resources to occur within the permit area.

Four Corners Power Plant

Impacts to landform and topography would occur due to the construction of the DFADAs.. These alternations would substantially change the surface relief of the Lease Area. Potential impacts to soil erosion would be considered minor, as the five additional DFADAs would affect approximately 1,450 of the 1.7 million acres on the Navajo Nation. However, impacts to soil productivity would be major due to the disposal of CCR at the DFADAs. Impacts to geology and mineral resources are expected to be negligible. Alternative A within the FCPP Lease Area is unlikely to impact paleontological resources.

Transmission Lines

No impacts would occur to topography, soil, geology, mineral, or paleontological resources.

Environmental Justice Considerations

- Step 1: Are potential adverse social, economic, or health effects associated with Alternative A?

  Yes. Major impacts to soil productivity would occur, which would have the potential to detrimentally affect the ability of Native American populations to use land for agricultural purposes.

- Step 2: Would potential adverse effects disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities?

  Yes. The soil that would be impacted is on Navajo land and any future agricultural activity would primarily be undertaken by Navajo individuals or would primarily benefit Navajo residents through improved food supplies.

- Step 3: Are disproportionate adverse impacts major?

  No. While the impact to soil productivity is considered major and permanent at the FCPP, post-reclamation activities would have permanent beneficial impacts on the majority of soils in the Navajo Mine and Pinabete permit area, so overall impacts would be reduced to minor. As such, the anticipated impacts would have no major adverse effect on the overall sustainability of Navajo agricultural production and food supply.

Cultural Resources

All Project Components

In accordance with Section 106 of the NHPRA, and as outlined in 36 CFR Part 800.4(b)(2), OSMRE has developed two PAs for the proposed Project, one for the Navajo Mine Lease Area, and the other for the FCPP and the transmission lines. The PAs provide a process for compliance with NHPA pursuant to 36 CFR Part 800.14(b) in parallel with NEPA. Specifically, 36 CFP Part 800.4(b)(2), states that an agency may defer final identification and evaluation of historic properties if it is specifically provided for in a PA or documents used by an agency to comply with NEPA. Accordingly, the identification and evaluation of

historic properties within the APE will be completed as specific aspects are refined pursuant to 36 CFR Part 800.4(b)(1) and 36 CFR Part 800.4(c). The PAs provide procedures and responsibilities for the ongoing identification, evaluation, and mitigation of historic properties and procedures to minimize damage to historic properties. The PAs also include additional information including standards, guidelines, and unanticipated discovery protocols.

As potential impacts are identified, OSMRE will consult with THPO and SHPO and mitigation measures would be identified, and implemented, as specified in the PAs. Since potential impacts would be mitigated, no major impacts would occur (see Section 4.4, Cultural Resources, for additional information).

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.

Environmental Justice Considerations

- Step 1: Are potential adverse social, economic, or health effects associated with Alternative A?
  No. Potential significant impacts to cultural resources would be mitigated through the application of the PA. (Should this be yes? Or, TBD? Hard to have firm answer here since conclusions on cultural are still essentially TBD).
- Step 2: Would potential adverse effects disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities?
  Yes. If a cultural resource was destroyed or damaged due to project-related activities, members of the Navajo Nation would experience a disproportionate effect from losing a tribal resource.
- Step 3: Are disproportionate adverse impacts major?
  No. Major effects would be mitigated through the application of the PAs.

Water Resources/Hydrology

Navajo Mine

As described in Section 4.5, Water Resources/Hydrology, impacts to groundwater flow within the Navajo Mine Permit Area would be moderate due to the long rate of groundwater recovery.

Impacts to surface water quality would be minor due to erosion control measures and adherence to SMCRA regulations. Stock ponds located adjacent to active mining operations would be expected to experience minor impacts with respect to livestock use. Direct impacts related to peak flows and runoff volumes would be long term, yet negligible in severity. Minor changes in ephemeral flow may occur if some of the sediment and drainage control ponds were converted to permanent replacement livestock water ponds at the request of the Navajo Nation or the local water user.

Implementation of Alternative A would result in the loss of coal seam aquifers in the Fruitland Formation and a reduction in groundwater quantity as a result of mining operations. Impacts to the Fruitland Formation and groundwater quantity would be minor as mining operations would not affect the existing or future use of the Fruitland Formation, and current groundwater quality is already poor.

Reclamation activities would reduce overall TDS levels and aluminum loading.

Four Corners Power Plant

Continued operation and expansion of the DFADAs would have the potential to contaminate local groundwater and water quality in Chaco Wash, but this potential would be reduced through the operation of intercept trenches (see Section 4.5, Water Resources/Hydrology). Operations regarding uptake and discharge of water from Morgan Lake would not adversely affect surface water quality of water bodies in the plant's vicinity.

The operation of SCR devices on Units 4 and 5 would require the use of ammonia. Any potential spills of ammonia during transport, or on-site, could drain to nearby surface water features. In the unlikely event of a spill, actions identified in the SPCC Plan would be implemented to prevent and contain any adverse effects of the spilled material to the surrounding environment. No adverse effects would be expected occur to surface water quality from ammonia use.

No changes to water rights would occur under Alternative A, so Navajo Mine would maintain the right to draw as much water as rights allow for the Project life.

Stormwater discharge during the FCPP's continued operations would have no adverse effects to water quality. No adverse impacts would occur to nearby surface waters resulting from the presence of DFADAs, to waters of the US, or to surface water quantity.

Transmission Lines

Impacts to groundwater would be considered negligible as maintenance activities and normal operation would not involve any ground-disturbing activities.

Short-term impacts to surface water from the operation of the transmission lines would occur only during maintenance and repair to the lines.

Environmental Justice Considerations

- Step 1: Are potential adverse social, economic, or health effects associated with Alternative A?
  Yes. Stock ponds near the Project Area used to sustain livestock would be adversely impacted. Also, minor adverse impacts to surface water flows and water quality are expected in the Project Area; however, no known uses of this water would result in associated social, health, or economic effects.
- Step 2: Would potential adverse effects disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities?
  Yes. The water resources that would be affected are located on tribal lands and are primarily used by the Navajo.
- Step 3: Are disproportionate adverse impacts major?
  No. Impacts to surface water quality would be minor due to erosion control measures, impacts to stock ponds used for livestock sustenance would be minor, and impacts to peak water flows would be negligible.

Land Use and Transportation

Navajo Mine

Under Alternative A, mining activity in the Pinabete Permit Area would result in three direct, minor, adverse impacts to existing land use: (1) three dwellings would require permanent relocation according to the compensation agreements described in Section 2; (2) access to grazing areas in the Pinabete Permit Area and surrounding area would be permanently altered through the removal of some two-track roads; and (3) up to 5,568 acres of forage area and all grazing area within five CUAs would be removed to realign Burnham Road and mine within the Pinabete Permit Area. There are an additional three

residences located within 1 mile (1,600 meters) of the boundary of Area IV North and three more within 1 mile of Area III. The Proposed Action would require the permanent relocation of three dwellings located within the proposed Pinabete Permit Area of the Navajo Mine Lease. BNCC's agreement with the Navajo Nation for the Navajo Mine Lease requires compensation of families and individuals with land use rights within the lease area (BNCC 2012g). Through compliance with the lease provisions, this impact although permanent, is considered minor.

Burnham Road's realignment would result in short-term to permanent beneficial impacts resulting from improved road surface conditions and increased traffic safety compared to baseline conditions. Permanent changes to this portion of the transportation network would provide access for post-mining land use for livestock grazing. A minor increase in truck traffic would occur due to road construction, but is not expected to significantly increase traffic on any local roads. Temporary use restrictions would occur on some public roads and unimproved access routes to ensure public safety during active mining operations such as blasting, resulting in a minor short-term impact. Adequate signage and security would be provided to communicate timing of such activities to the public and minimize the short-term impact of mining activities.

Four Corners Power Plant

Under Alternative A, no residents would be directly impacted by the DFADA construction because no dwellings are located in this area. None of the proposed changes to the current FCPP footprint would impact current or future agricultural operations on the Navajo Nation. No grazing occurs the FCPP Lease Area; therefore, no impacts would occur.

Installation of SCR devices on Units 4 and 5 and the delivery of ammonia (either as aqueous ammonia, anhydrous ammonia, or urea) for SCR operation would result in additional truck traffic; however, this increase in truck traffic would be temporary and minor and long term and minor, respectively.

Transmission Lines

Under Alternative A, no changes to land use would be associated with the four existing transmission lines. Continued operation of the transmission lines would not impact existing or future farming or grazing operations because no new construction activities would occur.

Environmental Justice Considerations

- Step 1: Are potential adverse social, economic, or health effects associated with Alternative A?
  Yes. Navajo Nation members would be relocated and access to grazing areas on Navajo land would be restricted.
- Step 2: Would potential adverse effects disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities?
  Yes. Residents who would be relocated are all Navajo Nation members and grazing areas are used by Navajo more than any other ethnic group.
- Step 3: Are disproportionate adverse impacts major?
  No. Impacts related to relocation, increases in traffic, and restricted access to grazing areas would be considered minor.

Socioeconomics

The transfer of ownership of the Navajo Mine from BNCC to NTEC will result in changes to revenues, royalties, and taxes, as well as changes to employment levels. However, this is considered part of the baseline because it is associated with the completed federal action of OSMRE's approval of the SMCRA permit transfer from BNCC to NTEC. Therefore, under Alternative A, no changes are expected to the baseline conditions of population and demographics, economic background, indicators of social and

economic well-being, and Navajo public services. However, the use and transportation of ammonia for FCPP operations could impact public services if an accidental release occurred on tribal land. The accidental release would require responses from some of the already overburdened Navajo Nation public service agencies. OSMRE recommends the use of urea for the ammonia source, in part because its transportation does not entail these concerns.

Section 4.10, Socioeconomics, describes the primary social concerns and health status and risks in the Navajo Nation. Overall, as measured by common indicators, residents of the Navajo Nation are less well-off economically compared to San Juan County, the State of New Mexico, and the US overall. Compared to these other areas, the Navajo Nation has higher rates of poverty and unemployment as well as lower median household income. On several social measures, residents of the Navajo Nation also experience more adverse conditions than surrounding counties – the Navajo Nation has higher mortality and crime rates, lower graduation rates, and poorer health outcomes and housing conditions.

As of 2000, approximately 15.9 percent of occupants on the Navajo Nation had no vehicle available to them; this percentage was almost 3 times higher than that of the State of New Mexico overall (5.5 percent). A little more than one-fifth (21.3 percent) of occupied housing units on the Navajo Nation lacked complete plumbing facilities, 20 percent more than homes in New Mexico (1.2 percent) overall. Approximately one-third of occupied housing units on Navajo Nation tribal trust lands were heated with gas or electricity. McKinley County was the third location with the smallest percentage of occupied homes heated with gas or electricity (62.9 percent). Occupied housing units in San Juan County, the City of Farmington, and the State of New Mexico were more than 2 times as likely to be heated with gas or electricity (83.4, 97.3, and 92.3 percent, respectively) than homes on the Navajo Nation.

Navajo Nation public services are funded through tribal government tax revenues. The tax and royalty revenue received by the Navajo Nation from the operations of the FCPP and Navajo Mine is, in part, used to fund Navajo Nation public services.

As NTEC takes ownership of the Navajo Mine, the baseline fiscal contribution of the Navajo Mine to the Navajo Nation is expected to be higher than with BNCC ownership since the Navajo Nation would be getting more than just the royalties.. Because NTEC would be exempt from some local, state, and Federal taxes, their net revenues after taxes would be higher. Accordingly, more revenue would be available to the tribal government. NTEC remains responsible for continued royalty and tax payments to the Navajo Nation based on existing payment schedules. The Navajo Tribal Council has stated that a portion of the profits from NTEC operations would be directed to the investment in “research and development of renewable and alternative sources of energy, storage, and transmission technologies and facilities with priority given to the solar technologies and facilities with attendant storage and transmission capacity”. These could be applied in the area affected by the operation of the Navajo Mine and FCPP; however, that decision would be at the discretion of the Navajo Nation.

<u>Environmental Justice Considerations</u>

- Step 1: Are potential adverse social, economic, or health effects associated with Alternative A?
  Yes. If Navajo Nation public services use resources to respond to an ammonia spill, then the Navajo Nation government and tribal members who use Navajo Nation public services would be impacted through the additional cost borne. Under OSMRE’s recommended option of using urea for ammonia, there would be no spill risk.
- Step 2: Would potential adverse effects disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities?
  Yes. Navajo Nation public services are primarily used by the Navajo.
- Step 3: Are disproportionate adverse impacts major?
  No. While ammonia would be used on Navajo land and the likelihood would be disproportionate if an accidental spill would occur on Navajo land, responsibility for and

economic burden of cleaning a spill would be shared by FCPP and multiple agencies. Potential economic and social costs incurred to the Navajo Nation public services as a consequence of an accidental ammonia spill are not considered major. Under OSMRE's recommended option of using urea for ammonia, there would be no spill risk.

Visual Resources

Navajo Mine

As described in Section 4.13, Visual Resources, the overall impacts to scenic integrity and visual sensitivity from the issuance of a SMCRA permit for the Pinabete Permit Area and renewal of the SMCRA permit for the Navajo Mine Permit Area would be major and short-term during mining. However, interim reclamation would include backfilling of mine pits, re-contouring of the surface to its original surface elevations, and re-vegetation with the appropriate seed mixture to return the mined area to its original condition as closely as feasible. Reclamation would occur as soon as possible after the mining is complete and while mining would continue to occur in other portions of Pinabete Permit Area. The interim reclamation of those portions of the Pinabete Permit Area in which mining was complete would reduce impacts to minor levels. Moreover, these adverse effects to visual sensitivity by viewers, although permanent, would naturally decrease over time as viewers grow accustomed to the mining operations in the Pinabete portion of the lease and as reclamation would be implemented.

Four Corners Power Plant

As described in Section 4.1, Air Quality, the reduction in emissions from Units 4 and 5 and reduced visible plumes would marginally improve visual sensitivity. The overall impacts to visual resources from changes to the FCPP would be negligible, and the overall impacts from changes to the DFADAs would be moderately adverse. Therefore, the overall impacts to visual resources from implementation of the new lease agreement at the FCPP would be minor and low adverse.

Transmission Lines

No impact would occur to any of the landscape character units or to the visual sensitivity in any of the distance zones.

Environmental Justice Considerations

- Step 1: Are potential adverse social, economic, or health effects associated with Alternative A?
  Yes. Impacts to visual resources are located on tribal lands.
- Step 2: Would potential adverse effects disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities?
  Yes. Impacts to scenic integrity and visual sensitivity would be greater on tribal land than on nontribal land.
- Step 3: Are disproportionate adverse impacts major?
  No. Major temporary adverse impacts to scenic integrity would decrease over time and other adverse impacts are considered minor. Following re*clamation the land surface at the Navajo Mine would be restored to the approximate original contour and impacts to visual resources would be permanent but considered minor.*

Noise and Vibration

Navajo Mine

As described in Section 4.14, Noise and Vibration, the overall influence of blasting and mining activities to the overall noise environment would be short term. With the implementation of blasting activity controls, noise and ground-borne impacts from blasting operations would be minor. Noise from the mining activities would result in long-term, minor adverse impacts to the closest residence (approximately 2,745 feet southeast of the Pinabete Permit Area) for the duration of the mining activity in the nearby area.

No adverse noise impacts from coal transportation activities would occur, and impacts from ground-borne vibrations from the coal transportation activities would be minor. No major impacts would occur from noise or ground-borne vibrations from the construction of the Burnham Road realignment. Reclamation activities would result in adverse noise impacts to nearby residents for the duration of activity.

Four Corners Power Plant

Expanding the DFADA within the existing power plant boundaries would have no substantial effect on noise in the area. No major noise or vibration impacts would occur from power plant operation.

Transmission Lines

No adverse noise or vibration impacts would occur from continued operation and maintenance of the transmission lines.

Environmental Justice Considerations

- Step 1: Are potential adverse social, economic, or health effects associated with Alternative A?
  Yes. One residence would experience minor long-term adverse impacts from noise related to mining activities.
- Step 2: Would potential adverse effects disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities?
  Yes. The residence that would experience noise impacts is located on tribal lands.
- Step 3: Are disproportionate adverse impacts major?
  No. The noise impact, while long-term and adverse, is minor and would not harm the health or environment of nearby residents.

Hazardous and Solid Wastes

Navajo Mine

As described in Section 4.15, Hazardous and Solid Wastes, any impact from an accidental release or spill of hazardous materials would be negligible to minor.

Four Corners Power Plant

The three types of ammonia being considered by APS are anhydrous ammonia, aqueous ammonia (29 percent by weight), and solid urea. The option of solid urea carries negligible risk during transport, and is the option that OSMRE recommends. The impact of a potential alternative-case accidental release of anhydrous ammonia could impact 28 public receptors during on-site storage and could impact 1,654 receptors if a transportation accident were to occur within the city limits of Farmington. The impact of a potential alternative-case accidental release of aqueous ammonia would not impact public receptors during on-site storage, but could impact 146 receptors if a transportation accident were to occur within the city limits of Farmington. Urea is a solid, so risks during transportation and storage are greatly reduced. An accidental release of the amount of ammonia generated from urea would have negligible impacts. In contrast, the impacts of transport of anhydrous ammonia or aqueous ammonia would be moderate.

One of the potential impacts from the disposal of CCR is an accidental release of the ash disposal surface impoundments at the FCPP. Based on this assessment of the dam, impacts from the potential accidental release would be minor. APS would comply with all regulatory requirements and complete preparation of an EAP and an Ash Impound Dam Inspection and Maintenance Program. Further, implementation of location and design restrictions, recommended by OSMRE, would reduce the potential for such a breach.

Off-site contamination from historical CCR placement could occur as a result of seepage in groundwater. Previous studies conducted by APS found two primary areas of groundwater seepage beneath the ash disposal areas, the “north seep” and “south seepage area”. However, in 1977, APS constructed an open ditch system to collect seepage water from the ash disposal facilities as part of the NPDES permits for the FCPP. In 1993 and 2011 extraction wells were installed. These systems are designed to prevent contamination of the Chaco wash. In October 2011, APS constructed a north intercept trench excavated to the bottom of the shale formation. A review of groundwater level data and water quality data in three wells located downgradient of the trench show declines in all constituents and groundwater level. APS is currently in the process of installing a second south intercept trench to remediate groundwater. With the operation of the intercept trenches, continued operation and expansion of the ash disposal ponds would have less potential to contaminate local groundwater and water quality in Chaco Wash. Therefore, off-site impacts from placement of CCR would be minor.

Transmission Lines

Any impact from an accidental release or spill related to the hazardous materials in use for the transmission lines would be negligible to minor.

Environmental Justice Considerations

- Step 1: Are potential adverse social, economic, or health effects associated with Alternative A?
  Yes. The potential exists for impacts to tribal lands in the event of a breach of the CCR impoundments at FCPP or accidental spill of ammonia. Under OSMRE’s recommended option of using urea for ammonia, there would be no spill risk.
- Step 2: Would potential adverse effects disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities?
  Yes. Potential is greater for impacts to occur on tribal lands than on nontribal lands.
- Step 3: Are disproportionate adverse impacts major?
  No. The impoundment is rated satisfactory, and the potential for adverse human health impact associated with an accidental CCR release is minor.

Recreation

Navajo Mine

Under Alternative A, potential impacts to the recreational experience by affecting scenic beauty, hunting and/or fishing opportunities, and noise levels at recreation areas throughout the ROI would be similar to the existing conditions, and potential impacts to regional recreational resources would be negligible. Potential impacts to recreation by affecting the visual experience due to changes in site topography and vegetation would also be minor.

Public access restrictions would be long term (dispersed recreational opportunities would be restored following reclamation); however, opportunities for dispersed recreational opportunities would be available in adjacent publically accessible land areas. Alternative A would not alter long-term recreational uses and access within the ROI, and therefore, would not conflict with or be incompatible with recreation-related policies or objectives or the existing applicable management plans in the ROI.

Four Corners Power Plant

Implementation of Alternative A would not result in any impacts to access to recreation areas within the ROI. In addition, no adverse effects would occur to recreational opportunities and access associated with Morgan Lake, as these opportunities would remain the same as existing conditions.

Transmission Lines

Alternative A would not alter the recreational experience (including scenic beauty, hunting, and hiking) in the ROI because the transmission lines already exist and Alternative A would not alter existing conditions. Therefore, no impacts to recreational resources associated with the transmission lines would occur.

Environmental Justice Considerations

- Step 1: Are potential adverse social, economic, or health effects associated with Alternative A?
  Yes. The potential exists for impacts to recreation by affecting the visual experience due to changes in site topography and vegetation.
- Step 2: Would potential adverse effects disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities?
  Yes. Potential impacts would be to recreational resources on tribal lands and not on nontribal lands.
- Step 3: Are disproportionate adverse impacts major?
  No. Impacts to recreational resources would be considered minor.

Health and Safety

Because many of the potential health effects are related to air quality, the cumulative effects of air quality and other public health-related concerns are also discussed in the Air Quality subsection of Environmental Justice. This section includes worker health and safety.

Navajo Mine

As described in Section 4.17, Health and Safety, impacts to worker safety from Alternative A and continued operation of the Navajo Mine would be negligible. No substantial adverse public health consequences from criteria air pollutants would occur for Alternative A. Public health impacts from the operation of the mine have been and would continue to be minimal.

Four Corners Power Plant

Impacts to worker safety from Alternative A and the FCPP's continued operation would be negligible. Potential impacts to public health and safety from deposition of air emissions into soil and water would be minor. Comparison of soil samples to EPA Preliminary Remediation Goals for Residential Land Use, found that all concentrations of metals were below levels that would be cause for remediation.

Transmission Lines

No impacts would occur to worker safety or public safety from the continued use of the transmission lines.

Environmental Justice Considerations

- Step 1: Are potential adverse social, economic, or health effects associated with Alternative A?
  Yes. There are potential health effects associated with the Alternative.
- Step 2: Would potential adverse effects disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities?
  Yes. Adverse effects would disproportionally affect tribal lands.

- Step 3: Are disproportionate adverse impacts major?
  No. All adverse impacts would be negligible to minor.

Biological Resources

Navajo Mine

Under Alternative A, short-term impacts to habitat composition and wildlife would occur as a result of mining operations. Reclamation of mined areas would return the area to the original habitat type, although plant species and composition may be altered.

Four Corners Power Plant

Ecological risks associated with future emissions from the FCPP are associated with deposition of metal emissions on nearby terrestrial and aquatic habitats. The evaluation concluded that no major risks to terrestrial plants (habitat), invertebrates, birds or mammals are expected.

Operation of FCPP would result in the ongoing generation of noise throughout the ROI for the life of the FCPP. No increases in noise associated with operation of the FCPP are expected as FCPP operations for the Proposed Action would not create an increase above the current condition. Infrequent animal vehicle collisions with vehicles, noise, and avian collisions or electrocution associated with the power infrastructure would be expected to occur at levels commensurate with current operational activity. These low, ongoing impacts would persist for the life of the FCPP.

Construction of the expanded DFADA is expected to permanently remove up to 1,052 acres of wildlife habitat. However, the availability and quantity of identical habitat near the proposed facilities would reduce the overall impacts to this wildlife. Overall, impacts would be long-term but minor.

Transmission Lines

Renewal of the ROW leases would not remove or alter wildlife habitats within the transmission line ROWs. Vegetation Management within the ROWs is expected to result in the minor loss of woody debris and woody vegetation along the ROWs during tree trimming efforts that could result in direct impacts to nesting avian species within the ROW. The continued operation of electrical transmission towers and lines would increase the long-term potential for large bird or raptor collisions and electrocution from perching on or near tower conductors; however, continued implementation of the existing management plan would reduce potential impacts to minor levels.

Environmental Justice Considerations

- Step 1: Are potential adverse social, economic, or health effects associated with Alternative A?
  No. Potential adverse effects are not related to social, economic, or health concerns.
- Step 2: Would potential adverse effects disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities?
  No. Impacts would occur both on tribal and non-tribal lands.

4.11.3.2 Alternative B – Navajo Mine Extension Project Mine Plan

Air Quality

Impacts from Alternative B and the continued operation of the Navajo Mine, FCPP, and transmission lines would be the same as described for Alternative A.

Earth Resources

Navajo Mine

Impacts to topography, soil, geology, and mineral resources would be comparable to impacts discussed under Alternative A; however, under Alternative B, an additional 894.5 acres would be disturbed and an additional 7.4-mile primary road would be constructed as compared to Alternative A. Impacts associated with construction, maintenance, facilities removal, and reclamation would be considered negligible.

Four Corners Power Plant

Under Alternative B, impacts to topography and soils from DFADA construction would be comparable to Alternative A, and impacts to geologic features and mineral resources would be negligible. As such, impacts are considered moderate because topography would be permanently altered and soil resources lost due to wind and water erosion.

Transmission Lines

No impacts would occur to topography, soil, geology, mineral, or paleontological resources.

Environmental Justice Considerations

Similar to Alternative A, Alternative B would have major impacts to environmental justice. The impact to soil productivity would be considered major and permanent. While other agricultural lands might be used instead of this land, the overall permanent sustainability of Navajo agricultural production and food supply would be damaged.

Cultural Resources

As potential impacts are identified, OSMRE will consult with THPO and SHPO and mitigation measures will be identified. Since potential impacts will be mitigated, no impacts would occur (see Section 4.4, Cultural Resources, for additional information).

Water Resources/Hydrology

Navajo Mine

Impacts to groundwater quality and quantity during operation would be the same as described for Alternative A.

Permanent impacts to waters of the US would be greater than described for Alternative A. Impacts to surface water quality and channel morphology would be the same as described for Alternative A.

Four Corners Power Plant

Under Alternative B, impacts to both surface water and groundwater would be as described for Alternative A.

Transmission Lines

Under Alternative B, impacts to both surface water and groundwater would be as described for Alternative A.

Environmental Justice Considerations

Under Alternative B, impacts to environmental justice would be the same as under Alternative A; impacts would be disproportionate but minor. Impacts to surface water quality would be minor due to erosion control measure, impacts to stock ponds used for livestock sustenance would be minor, and impacts to peak water flows would be negligible.

Land Use and Transportation

Navajo Mine

Under Alternative B, three dwellings from within the Pinabete Permit Area would potentially have to be permanently relocated. Additionally, Alternative B would require the construction of more miles of primary and ancillary roads, transmission lines, and Burnham Road's realignment. Impacts during construction would be similar to Alternative A, but of a greater magnitude due to the additional road construction activity under Alternative B. Direct short-term to long-term beneficial impacts would be realized for Burnham Road's realignment, which would improve road surface conditions and safety compared to baseline conditions.

Four Corners Power Plant

Under Alternative B, the FCPP and all potential impacts would be the same as described under Alternative A.

Transmission Lines

Under Alternative B, the transmission line ROWs would be approved and they would continue to be operated and maintained as described under Alternative A.

Environmental Justice Considerations

Under Alternative B, impacts to environmental justice would be the same as Alternative A. Impacts related to relocation and restricted access to grazing areas would be considered minor.

Socioeconomics

Potential impacts to baseline conditions of population and demographics, economic background, indicators of social and economic well-being, and Navajo public services would be the same as described under Alternative A. Environmental justice impacts would be the same as well; no disproportionate adverse impacts would be related to socioeconomics (see Section 4.10, Socioeconomics, for more information).

Visual Resources

Navajo Mine

Under Alternative B, impacts to visual resources would be the same as under Alternative A, except with regard to intensity because of the increased miles of roads and transmission lines and the alterations to Pinabete Arroyo.

Four Corners Power Plant

Impacts would be the same as described for Alternative A.

Transmission Lines

No impact would occur to any of the landscape character units or to the visual sensitivity in any of the distance zones.

Environmental Justice Considerations

Impacts to environmental justice under Alternative B would be the same as under Alternative A. No major impacts would occur as highly adverse impacts to scenic integrity would decrease over time and other adverse impacts are considered moderate or low.

Noise and Vibration

Navajo Mine

Under Alternative B, impacts to sensitive receptors would remain the same as described for Alternative A for the mining and reclamation activities. However, adverse noise impacts would occur from coal transportation activities, as noise from the transportation of coal along the designated haul road would result in long-term adverse impacts at a nearby residence (located approximately 500 feet from the nearest haul road of the Area IV boundary) for the duration of mining activity in the nearby area.

Four Corners Power Plant

Noise-related impacts would be the same as described under Alternative A.

Transmission Lines

Noise-related impacts would be the same as described under Alternative A.

Environmental Justice Considerations

Impacts to environmental justice would be the same under Alternative B as Alternative A. Impacts from noise and vibration would be disproportionate but minor.

Hazardous and Solid Wastes

Navajo Mine

Under Alternative B, impacts from the on-site storage of hazardous materials and solid waste would be the same as described for Alternative A.

Four Corners Power Plant

Impacts for hazardous and solid wastes would be the same as Alternative A.

Transmission Lines

Impacts for hazardous and solid waste would be the same as Alternative A.

Environmental Justice Considerations

Impacts to environmental justice would be the same for Alternative B as Alternative A.

Recreation

Navajo Mine

Potential adverse impacts associated with mining operations and access restrictions would be comparable to Alternative A, though the alternate permit boundary would result in access restrictions in a slightly different location. The diversion of Pinabete Arroyo, under Alternative B, may indirectly impact dispersed recreation downstream by impacting wildlife along the arroyo. However, these impacts are expected to be negligible because Pinabete Arroyo is ephemeral and, as such, only intermittently supports wildlife and the associated hunting and fishing opportunities throughout the year.

Four Corners Power Plant

Under Alternative B, the FCPP would operate as described under Alternative A, with the same recreation-related impacts described above.

Transmission Lines

Under Alternative B, the transmission line ROWs would be approved, and they would continue to be operated and maintained as described under Alternative A, with the same potential recreation-related impacts as described above.

Environmental Justice Considerations

Impacts from Alternative B would be similar to Alternative A; impacts to environmental justice would be disproportionate but minor.

Health and Safety

Impacts to worker safety from Alternative B and the continued operation of the Navajo Mine, FCPP, and transmission lines would be the same as described for Alternative A.

Environmental Justice Considerations

Impacts to environmental justice from Alternative B would be the same as described for Alternative A.

Biological Resources

Navajo Mine

Impacts would be as described for Alternative A.

Four Corners Power Plant

Under Alternative B, the FCPP would operate as described under Alternative A, with the same biological resource-related impacts described above.

Transmission Lines

Under Alternative B, the transmission line ROWs would be approved, and they would continue to be operated and maintained as described under Alternative A, with the same potential biological resource-related impacts as described above.

Environmental Justice Considerations

Impacts from Alternative B would be similar to Alternative A; impacts to environmental justice would be disproportionate but not major.

4.11.3.3 Alternative C – Alternative Pinabete Mine Plan

Air Quality

Impacts from Alternative C and the continued operation of the Navajo Mine, FCPP, and transmission lines would be the same as described for Alternative A.

Earth Resources

Navajo Mine

Impacts to topography, soil, geology, and mineral resources would be comparable to Alternative A; however, under Alternative C, an additional 2,388.7 acres would be disturbed, and an additional 9.9 miles or primary roads would be constructed as compared to Alternative A.

Four Corners Power Plant

Under Alternative C, impacts to landforms and topography from DFADA construction would be comparable to Alternative A. However, impacts to topography and soils would be considered moderate because topography and soils would be permanently altered.

Transmission Lines

No impacts would occur to topography, soil, geology, mineral, or paleontological resources.

Environmental Justice Considerations

Similar to Alternative A, Alternative C would have major impacts to environmental justice. The impact to soil productivity is considered major and permanent. While other agricultural lands might be used instead of this land, the overall permanent sustainability of Navajo agricultural production and food supply would be damaged.

Cultural Resources

As potential impacts are identified, OSMRE will consult with THPO and SHPO and mitigation measures will be identified. Since potential impacts will be mitigated, no impacts would occur (see Section 4.4, Cultural Resources, for additional information).

Water Resources/Hydrology

Navajo Mine

The disturbance footprint under Alternative C would be greater than Alternative A; however, groundwater impacts of quantity and quality during operation would be as described for Alternative A.

Permanent impacts to waters of the US would be greater than described for Alternative A. Impacts to surface water quality, hydrology, and channel morphology would be as described for Alternative A.

Four Corners Power Plant

Impacts to both surface water and groundwater would be as described for Alternative A.

Transmission Lines

Under Alternative C, no impacts would occur to surface water resources or groundwater, as described for Alternative A.

Environmental Justice Considerations

Impacts to environmental justice from Alternative C would be the same as under Alternative A; impacts would be disproportionate but minor. Impacts to surface water quality would be minor due to erosion control measure, impacts to stock ponds used for livestock sustenance would be minor, and impacts to peak water flows would be negligible.

Land Use and Transportation

Navajo Mine

Under Alternative C, three dwellings from within the Pinabete Permit Area would have to be permanently relocated. Additionally, Alternative C would require the construction of more miles of primary and ancillary roads, transmission lines, and Burnham Road's realignment. Impacts during construction would be similar to Alternative A, but at a greater magnitude due to the additional road construction activity under Alternative C. Direct short-term to long-term beneficial impacts would be realized for Burnham Road's realignment, which would improve road surface conditions and safety compared to baseline conditions.

Four Corners Power Plant

Under Alternative C, the BIA would approve the lease amendment for the FCPP and the FCPP would operate as described under Alternative A.

Transmission Lines

Under Alternative C, the transmission line ROWs would be approved and they would continue to be operated and maintained as described under Alternative A.

Environmental Justice Considerations

Impacts to environmental justice would be the same under Alternative C as Alternative A. Impacts related to relocation and restricted access to grazing areas would be considered minor.

Socioeconomics

Potential impacts from Alternative C to baseline conditions of population and demographics, economic background, indicators of social and economic well-being, and Navajo public services would be the same as described under Alternative A. Environmental justice impacts would be the same as well; no disproportionate adverse impacts would be related to socioeconomics (see Section 4.10, Socioeconomics, for more information).

Visual Resources

Navajo Mine

Under Alternative C, impacts to visual resources would be the same as under Alternative A, except with regard to intensity because of the increased amount of disturbance acreage for the mine, increased length of Burnham Road's realignment, and the increased miles of roads and transmission lines to be constructed.

Four Corners Power Plant

Impacts would be the same as described for Alternative A.

Transmission Lines

No impact would occur to any of the landscape character units or on the visual sensitivity in any of the distance zones.

Environmental Justice Considerations

Impacts to environmental justice under Alternative C would be the same as under Alternative A. No major impacts would occur as highly adverse impacts to scenic integrity would decrease over time and other adverse impacts are considered moderate or minor.

Noise and Vibration

Navajo Mine

Under Alternative C, impacts to sensitive receptors would remain the same as described for Alternative A for the mining and reclamation activities.

Four Corners Power Plant

Noise-related impacts would be the same as described under Alternative A.

Transmission Lines

Noise-related impacts would be the same as described under Alternative A.

Environmental Justice Considerations

Impacts to environmental justice would be the same under Alternative C as Alternative A. Impacts from noise and vibration would be disproportionate but minor.

Hazardous and Solid Wastes

Navajo Mine

Impacts of Alternative C would be similar to impacts under Alternative A. Short-term impacts may be slightly higher due to potentially larger volumes of hazardous materials and waste generation during the construction of haul roads and ancillary roads.

Four Corners Power Plant

Impacts for hazardous and solid waste would be the same as Alternative A.

Transmission Lines

Impacts for hazardous and solid waste would be the same as Alternative A.

Environmental Justice Considerations

Impacts to environmental justice would be the same for Alternative C as Alternative A.

Recreation

Navajo Mine

All impacts associated with Alternative C would be the same as described for Alternative B.

Four Corners Power Plant

Under Alternative C, the FCPP would operate as described under Alternative A, with the same recreation-related impacts described above.

Transmission Lines

Under Alternative C, the transmission line ROWs would be approved and would continue to be operated and maintained as described under Alternative A, with the same potential recreation-related impacts as described above.

Environmental Justice Considerations

Impacts to environmental justice from Alternative C would be the same as described for Alternative B.

Health and Safety

Impacts to worker safety from Alternative C and the continued operation of the Navajo Mine, FCPP, and transmission lines would be the same as described for Alternative A.

Environmental Justice Considerations

Impacts to environmental justice from Alternative C would be the same as described for Alternative A.

Biological Resources

Navajo Mine

Impacts would be as described for Alternative A.

Four Corners Power Plant

Under Alternative B, the FCPP would operate as described under Alternative A, with the same biological resource-related impacts described above.

Transmission Lines

Under Alternative B, the transmission line ROWs would be approved, and they would continue to be operated and maintained as described under Alternative A, with the same potential biological resource-related impacts as described above.

Environmental Justice Considerations

Impacts from Alternative B would be similar to Alternative A; impacts to environmental justice would be disproportionate but minor.

4.11.3.4 Alternative D – Alternative Ash Disposal Area Configuration

Air Quality

Impacts from Alternative D and the continued operation of the Navajo Mine, FCPP, and transmission lines would be the same as described for Alternative A.

Earth Resources

Navajo Mine

Impacts to topography, soil, geology, and mineral resources would be the same as described for Alternative A

Four Corners Power Plant

Under Alternative D, impacts to topography and soils from DFADA construction would be comparable to Alternative A though less because Alternative D has a 10 percent reduction in disturbance area. Impacts to geologic features and mineral resources would be negligible. As such, impacts are considered moderate because topography would be permanently altered and soil resources lost due to wind and water erosion.

Transmission Lines

No impacts would occur to topography, soil, geology, mineral, or paleontological resources.

Environmental Justice Considerations

Alternative D would have similar impacts as though identified under Alternative A. The impact to soil productivity would be considered major and permanent. While other agricultural lands might be used instead of this land, the overall permanent sustainability of Navajo agricultural production and food supply would be damaged.

Cultural Resources

As potential impacts are identified, OSMRE will consult with THPO and SHPO and mitigation measures will be identified. Since potential impacts will be mitigated, no impacts would occur (see Section 4.4, Cultural Resources, for additional information).

Water Resources/Hydrology

Impacts from Alternative D and the continued operation of the Navajo Mine, FCPP, and transmission lines would be the same as described for Alternative A.

Land Use

Impacts from Alternative D and the continued operation of the Navajo Mine, FCPP, and transmission lines would be the same as described for Alternative A.

Socioeconomics

Potential impacts to baseline conditions of population and demographics, economic background, indicators of social and economic well-being, and Navajo public services would be the same as described under Alternative A. Environmental justice impacts would be the same as well; no disproportionate adverse impacts would be related to socioeconomics (see Section 4.10, Socioeconomics, for more information).

Visual Resources

Impacts from Alternative D and the continued operation of the Navajo Mine, FCPP, and transmission lines would be the same as described for Alternative A.

Noise and Vibration

Impacts from Alternative D and the continued operation of the Navajo Mine, FCPP, and transmission lines would be the same as described for Alternative A.

Hazardous and Solid Wastes

Impacts from Alternative D and the continued operation of the Navajo Mine, FCPP, and transmission lines would be the same as described for Alternative A.

Recreation

Impacts from Alternative D and the continued operation of the Navajo Mine, FCPP, and transmission lines would be the same as described for Alternative A.

Health and Safety

Impacts from Alternative D and the continued operation of the Navajo Mine, FCPP, and transmission lines would be the same as described for Alternative A.

Biological Resources

Navajo Mine

Impacts would be as described for Alternative A.

Four Corners Power Plant

Under Alternative D, the FCPP would operate as described under Alternative A, though the disturbance area for the DFADA would be approximately 10% less, with an associated reduction of impacts to the biological community. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

Impacts would be as described for Alternative A.

Environmental Justice Considerations

Impacts from Alternative D would be similar to Alternative A; impacts to environmental justice would be disproportionate but minor.

4.11.3.5 Alternative E – No Action Alternative

Air Quality

Navajo Mine

Under Alternative E, mobile emissions from the Navajo Mine would decrease beginning in 2015 and cease by 2021 upon the completion of reclamation activities.

Four Corners Power Plant

Under Alternative E, FCPP would continue to operate in 2014 and 2015 at which time, stationary source emissions would cease. Mobile source emissions would continue during the decommissioning of the power plant, however these tasks are undefined and not quantified.

Transmission Lines

Under Alternative E, mobile source emissions from transmission line maintenance would continue through 2015, at such time when they no longer carry power from FCPP it is unknown if the lines would be dismantled, therefore, emissions from this activity are not quantified.

Environmental Justice Considerations

Air impacts from Alternative E would be greatly reduced compared to those described for Alternative A; no environmental justice impacts are anticipated.

Earth Resources

Navajo Mine

No impacts to topography, soil, geology, or mineral resources within Areas IV North and South are anticipated from mining operations or road construction. However, a slight permanent alteration in topographic relief would occur compared to pre-mining conditions, which would be considered a minor impact.

Under Alternative E, two known significant paleontological resources would be impacted within Area III's pre-2016 striplines. The destruction of, or damage to, these significant localities would be considered a major impact to paleontological resources.

Four Corners Power Plant

No impacts to topography, soil, geology, or mineral resources are anticipated within the FCPP's area or from the dry fly ash ponds.

Transmission Lines

No impacts to topography, soil, geology, or mineral resources are anticipated within the current ROWs of the four transmission lines.

Environmental Justice Considerations

No impacts from noise and vibration would occur to soil productivity from Alternative E; therefore, no environmental justice impacts would occur.

Cultural Resources

Navajo Mine

The closure of the Navajo Mine would have no potential effect on cultural resources.

Four Corners Power Plant

The decommissioning and dismantling of the FCPP could impact historic properties. As potential impacts are identified, OSMRE will consult with THPO and SHPO and mitigation measures will be identified. Since potential impacts will be mitigated, no impacts would occur (see Section 4.4, Cultural Resources, for additional information).

Transmission Lines

If the transmission lines are left in place, there would be no impacts to cultural resources. If the transmission lines are dismantled, the ground disturbance activities could impact cultural resources. As potential impacts are identified, OSMRE will consult with THPO and SHPO and mitigation measures will be identified. Since potential impacts will be mitigated, no impacts would occur (see Section 4.4, Cultural Resources, for additional information).

Water Resources/Hydrology

Navajo Mine

During demolition activities associated with the Navajo Mine, short-term impacts to near-surface groundwater quality could occur. Impacts to subsurface hydrogeology would be beneficial, and reclamation of mined lands would potentially restore natural groundwater flow. Reclamation of mined lands would potentially restore natural groundwater flow, and surface water drainage and natural stormwater flow. Areas that had been previously mined or altered would be restored in accordance with the Reclamation Plan; therefore, impacts to groundwater and surface water would be beneficial. In addition, reclamation of mined lands would potentially restore natural groundwater flow.

Short-term impacts to surface water quality could occur; however, implementation of all applicable plans would minimize impacts to nearby waters of the US. Impacts to both surface water hydrology and water quality would be beneficial. The amount of water available to other users would not change.

Four Corners Power Plant

If APS chose to seek a lease directly from the Navajo Nation, impacts to both surface water and groundwater would be as described for the Proposed Action.

If APS decided to shut down and decommission the power plant, water quality in surface water bodies within the deposition area, particularly the San Juan River, would improve at lease incrementally, since deposition from FCPP was only one of the sources of deposition into these water bodies. Impacts to groundwater would be as described for the Proposed Action.

Transmission Lines

If APS chose to seek a lease directly from the Navajo Nation, no impacts to water resources would occur.

If APS decided to shut down and decommission the power plant, short-term impacts to surface water and groundwater quality during decommissioning could occur; however, by complying with all applicable plans and permits, impacts would be negligible.

Environmental Justice Considerations

Impacts to water resources/hydrology would be either minimal or beneficial; no major impacts to environmental justice would occur under Alternative E.

Land Use and Transportation

Navajo Mine

Under Alternative E, the three affected dwellings in the Pinabete Permit Area would not be relocated and grazing and CUAs would not change. Burnham Road would not be realigned; therefore, no additional noise, dust, and traffic would occur. However, the public benefits to transportation and safety would not be realized. Mine-related traffic would decrease as early as 2016 when Area III would no longer be mined.

Four Corners Power Plant

Under Alternative E, the FCPP would be dismantled slowly, which would result in an increase in traffic and associated dust, noise, and traffic of heavy machinery. Following the power plant's dismantlement and any associated remediation activities, additional land may be available for grazing, although it is uncertain at this time.

Transmission Lines

No environmental justice-related impacts would be associated with the transmission lines under Alternative E.

Environmental Justice Considerations

No impacts to environmental justice would be associated with Alternative E.

Socioeconomics

Population and Demographics

Under Alternative E, the shutdown of the Navajo Mine and FCPP may result in a population decline, as net immigration to the area may slow causing a reduction in population growth rates.

Economic Background

Unless and until other economic activities develop to replace the employment and income opportunities at the FCPP and the Navajo Mine, the ROI's economy would become weaker.

Indicators of Social and Economic Well-Being

Social and economic well-being would also be reduced because of the loss of jobs, which could also exacerbate health issues of Navajo Nation members.

The end of economic and fiscal contributions from the Navajo Mine and FCPP's operations could lead to reductions in education attainment, increased crime and recidivism, and a reduced ability to maintain or upgrade the housing stock. The ability of individuals to obtain healthcare would be negatively impacted as well.

Navajo Public Services

Under Alternative E, no more tax revenues from the operations and production would be associated with the Navajo Mine and FCPP. This reduction in revenues would negatively impact the quality and quantity of the public services offered on the Navajo Nation.

Environmental Justice Considerations

- Step 1: Are potential adverse social, economic, or health effects associated with Alternative E?
  Yes. Fewer employment opportunities for Navajo Nation members would exist. Social and economic well-being would be reduced leading to weaker overall social conditions. Taxes and royalties paid by the mine and power plant would cease likely leading to a reduction in the level of services provided to Navajo Nation members.
- Step 2: Would potential adverse effects disproportionately affect minority or low-income populations based on ROI population and participation in potentially affected activities?
  Yes. The loss of large fiscal contributions made by NTEC *and APS to the Navajo Nation government and the associated reduction in public services would disproportionately impact tribe members.*
- Step 3: Are disproportionate adverse impacts major?
  Yes. The decline in revenues to the Navajo Nation government would be expected to exceed $40.6 million.

Visual Resources

Navajo Mine

Under Alternative E, visual quality would be beneficially impacted through the removal of structures related to the Navajo Mine and the reclamation of the land; both of which would improve both the scenic quality and the integrity of the landscape.

Four Corners Power Plant

Under Alternative E, visual quality would be beneficially impacted by the FCPP's shutdown and the removal of all of the related buildings and facilities, which would improve both the scenic quality and integrity of the landscape.

Transmission Lines

Dismantling and removing the transmission lines would have a highly beneficial impact to the scenic integrity of the landscape character units they cross. Leaving the transmission lines in place would have no impact to the scenic integrity of the landscape units they cross.

Environmental Justice Considerations

Under Alternative E, no adverse impacts to environmental justice would be associated with visual resources.

Noise and Vibration

Navajo Mine

Under Alternative E, noise impacts would continue through 2012 until reclamation activities are completed. Following completion of reclamation, no noise impacts would result.

Four Corners Power Plant

Under Alternative E, upon plant closure no noise impacts would result. Noise impacts would result from the FCPP's dismantlement; however, these activities are undefined and therefore not quantified.

Transmission Lines

No noise impacts would occur under Alternative E.

Environmental Justice Concerns

No adverse impacts to environmental justice would be associated with noise and vibrations under Alternative E.

Hazardous and Solid Wastes

Navajo Mine

Short-term impacts would increase due to removal of ancillary buildings, facilities, and hazardous materials. After removal, impacts from hazardous materials would be reduced to no impact due to the lack of on-site storage of hazardous materials.

Potential impacts from historical placement of CCR would remain after Navajo Mine closure. Implementation of closure and post-closure management plans would decrease these potential impacts.

Four Corners Power Plant

Impacts to hazardous waste and solid waste would be short-term and predominately associated with disposal of demolition materials. Permanent hazards would be associated with the management of existing ash disposal units; however, these permanent hazards would be reduced through the implementation of a closure plan.

Transmission Lines

Any potential impacts for hazardous and solid waste would be associated with decommissioning and dismantling activities. These impacts would be expected to be minor to negligible and short term.

Environmental Justice Considerations

Impacts to environmental justice from hazardous wastes associated with Alternative E would not be major.

Recreation

Under Alternative E, mining would cease at the expiration of the SMCRA permit, the Navajo Mine would close, and the previously mined areas would be reclaimed.

Navajo Mine

The post-reclamation land use under Alternative E would be comparable to the post-reclamation land use under the Proposed Action, although it would occur sooner under Alternative E. No access restrictions would inhibit dispersed recreation within the Project Area, and indirect impacts to scenic beauty from designated recreation areas would not occur.

Four Corners Power Plant

If APS chose to seek a lease directly from the Navajo Nation, then the impacts to recreational resources as a result of FCPP operation would be comparable to the Proposed Action. If APS decided to shut down and decommission the power plant, the result would be a beneficial impact by improving the scenic beauty in the ROI. However, the potential elimination of water to Morgan Lake would have a major, permanent impact to recreational resources in the Project Area.

Transmission Lines

If transmission lines were left in place, the recreational setting would not change from the existing condition. If the transmission lines were dismantled, moderate beneficial impacts would occur from improving the scenic beauty in the ROI. Currently, no decommissioning plan exists.

Environmental Justice Considerations

No adverse impacts to environmental justice would be associated with recreation under Alternative E.

Health and Safety

Navajo Mine

Mining activities that require health and safety programs would no longer be performed after closing the mine, thereby contributing a negligible improvement of long-term public health and safety.

Four Corners Power Plant

If APS decided to shut down and decommission the power plant, short-term impacts to worker safety and public health during decommissioning would be the same as the Proposed Action. The potential long-term impact would be beneficial because operational activities that could contribute to worker safety or public health issues would occur.

If APS chose to seek a lease directly from the Navajo Nation, impacts to worker safety and public health would be the same as for the Proposed Action.

Transmission Lines

No impact would occur to worker safety or public health under Alternative E.

Environmental Justice Considerations

No adverse impacts to environmental justice would be associated with health and safety under Alternative E.

Biological Resources

Navajo Mine

Under Alternative E, existing mining areas would be reclaimed and no additional impacts to wildlife, habitat, or vegetation would occur.

Four Corners Power Plant

Under Alternative E, no impacts to wildlife, habitat, and vegetation would occur.

Transmission Lines

Impacts to wildlife would occur as described in Alternative A, until transmission lines are dismantled.

Environmental Justice Considerations

No adverse impacts to environmental justice would be associated with biological resources under Alternative E.

4.11.3.6 Summary of Environmental Justice Considerations Relative to Baseline Conditions

Table 4.11-2 summarizes the impacts to environmental justice that would arise from various resource areas analyzed in association with the action alternatives and the No Action Alternative. Impacts to environmental justice are essentially the same for each action alternative. Major adverse impacts to environmental justice were identified in relation to Hazardous and Solid Wastes under Alternative A and in relation to Socioeconomics under Alternative E.

Table 4.11-2 Summary of Environmental Justice Impacts

Resource Area	No Action	Action Alternatives			
		Alternative A	Alternative B	Alternative C	Alternative D
Air Quality	Minor impacts	Minor impacts	Minor impacts	Minor impacts	Minor impacts
Earth Resources	No Impact	Disproportionate impacts related to reduced soil productivity, which would be improved as a result of reclamation – not major	Similar impacts as identified under Alternative A	Similar impacts as identified under Alternative A	Similar impacts as identified under Alternative A
Cultural Resources	No Impact	No Impact	No Impact	No Impact	No Impact
Water Resources/ Hydrology	Minor impacts	Minor impacts to surface water quality and stock ponds	Similar impacts as identified under Alternative A	Similar impacts as identified under Alternative A	Similar impacts as identified under Alternative A
Land Use	No impacts	Minor impacts due to relocation, increases in traffic, and restricted grazing areas	Similar impacts as identified under Alternative A	Similar impacts as identified under Alternative A	Similar impacts as identified under Alternative A
Socioeconomics	Adverse, Major	No disproportionate impact	No disproportionate impact	No disproportionate impact	No disproportionate impact
Visual Resources	No adverse impacts	Major adverse impacts to scenic integrity that would be reduced to minor following reclamation	Similar impacts as identified under Alternative A	Similar impacts as identified under Alternative A	Similar impacts as identified under Alternative A
Noise and Vibration	No adverse impacts	Long-term and minor adverse impact, but no harm to health or environment of nearby residents	Similar impacts as identified under Alternative A	Similar impacts as identified under Alternative A	Similar impacts as identified under Alternative A
Hazardous and Solid Wastes	Minor impacts	Minor potential impacts on tribal land	Similar impacts as identified under Alternative A	Similar impacts as identified under Alternative A	Similar impacts as identified under Alternative A

Resource Area	No Action	Action Alternatives			
		Alternative A	Alternative B	Alternative C	Alternative D
Recreation	No adverse impacts	Minor impacts	Similar impacts as identified under Alternative A	Similar impacts as identified under Alternative B	Similar impacts as identified under Alternative A
Health and Safety	No adverse impacts	Minor impacts	Minor impacts	Minor impacts	Minor impacts
Biological Resources	No adverse impacts	Minor impacts	Minor impacts	Minor impacts	Minor

4.11.4 Environmental Justice Mitigation Measures

The Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects that would disproportionally affect low-income or minority populations. Therefore, no additional mitigation beyond that already recommended for identified adverse impacts in specific resource areas is recommended.

4.12 Indian Trust Assets

Indian Trust Assets (ITAs) are defined as *lands, natural resources, money or other assets held by the Federal Government in trust or that are restricted against alienation for Indian tribes and individual Indians* (BIA 303 DM 2.5.C). An ITA can be anything that is owned or has established rights of use (such as a lease) by a tribe or individual and that has a monetary value. Examples of ITAs may be underground minerals or energy resources, agricultural lands, fishing/hunting rights, and water rights. An ITA may be located on or off Indian trust lands or reservations. ITAs do not include anything in which a tribe or an individual does not have a legal interest; for example, anything for which a legal remedy for a property interest could not be obtained. ITAs cannot be sold or leased without prior approval by the Department of the Interior. The ROI for the ITA analysis consists of the entirety of the Navajo Nation and the Hopi tribal trust lands, although it is recognized that an ITA (i.e. water resources) can be located off tribal trust lands.

4.12.1 Regulatory Compliance Framework

The US has a trust responsibility to protect and maintain rights reserved by or granted to Indian tribes by treaty, statutes, and executive orders. As the Trustee, it is part of the Federal Government's fiduciary responsibility to ensure that a tribe receives fair compensation when ITAs are removed from the trust, as well as the responsibility to ensure that the use of an asset is in the best interest of the trustee. Both of these responsibilities are intended to ensure the preservation of ITA value for the tribes.

This trust relationship between Tribes and individual Indians applies to all agencies of the Federal Government, including OSMRE and BIA, and creates a responsibility for agencies to take all reasonably necessary actions to protect ITAs. The Secretary of the Interior is charged with acting as the trustee for ITAs and administers Federal trust management per the policies set forth in the American Indian Trust Fund Management Reform Act of 1994 (Public Law 103-412, October 25, 1994, 108 Stat. 4239).

While all US Department of the Interior agencies abide by the Secretary's trust policies, the BIA is the primary agency that administers trust actions and oversees ITAs. BIA's Office of Trust Services is tasked with overseeing all headquarter activities associated with management and protection of trust and restricted lands, natural resources, and real estate services. All activities must be performed in a way that considers the economy, environment, culture and best interest of the trustee. When a tribe or individual Indian approaches the BIA with a proposal to utilize an ITA, the BIA reviews the proposal to ensure appropriate management, development, and protection of that asset. All activities must be performed in a way that considers the economy, environment, and culture.

OSMRE administers specific trust management policies for mining projects occurring on Indian trust lands. These policies require that any ITAs that may be directly or indirectly affected by surface coal mining or reclamation operations are identified, conserved, and protected. It is OSMRE's policy to ensure that any direct or indirect anticipated effects to ITAs are considered in associated planning, decision, or operational documents.

4.12.2 Affected Environment

4.12.2.1 Minerals

The Indian Mineral Leasing Act of 1938 and the Indian Mineral Development Act of 1982 are the principal statutes governing the leasing of Indian coal assets for the benefit of a tribe. To obtain an American Indian Coal Lease, direct negotiation between the interested party and tribal authorities is necessary, where the Secretary of the Interior must review and approve the lease. As follows, 25 USC 396(a) describes the right by which coal reserves that are ITAs are leased, as well as the use of unallotted lands for mining purposes:

> *On or after May 11, 1938, unallotted lands within any Indian reservation or lands owned by any tribe, group, or band of Indians under Federal jurisdiction, except those specifically excepted from the provisions of Sections 396a and 396g of this title, may, with the approval of the Secretary of the Interior, be leased for mining purposes, by authority of the tribal council or other authorized spokesmen for such Indians, for terms not to exceed ten years and as long thereafter as minerals are produced in paying quantities.*

The Navajo Mine is located within the Navajo Nation's boundaries. The Navajo Nation holds both surface and mineral rights for the land occupied by the Navajo Mine. All of the coal produced from the Navajo Mine and used at the FCPP is considered an ITA. The coal is produced subject to a lease between the Navajo Mine and the Navajo Nation. The original lease (Lease No. 14-20-603-2505) was approved by the Navajo Nation Tribal Council, executed by the Navajo Nation, and approved by the Secretary of the Interior in 1957. After numerous amendments to the lease, the Navajo Mine spans a total of 32,619 acres. NTEC holds a SMCRA permit through OSMRE (OSMRE Permit No. NM-0003F) to mine the leased area.

The proposed Pinabete Permit Area is also located on trust lands where the Navajo Nation holds both surface and mineral rights. The area would include 5,569 acres and would be composed of parts of the current Navajo Mine Permit Area, as well as portions of Area IV North and Area IV South. The land would be used for mining, to haul coal, and to otherwise enable the Navajo Mine's coal sale obligations through 2041.

4.12.2.2 Land

The Navajo Nation has over 17 million acres of trust land and the Hopi Reservation has approximately 1.5 million acres. Infrastructure for the existing FCPP and Navajo Mine also occupies Navajo Nation trust land. The Navajo Mine holds a lease with the Navajo Nation for the approximately 32,619-acre parcel occupied by the mine; while APS holds a lease with the Navajo Nation for the approximately 2,460-acre parcel occupied by the power plant and ancillary facilities. Infrastructure for the FCPP on Navajo Nation trust land consists of coal processing facilities, steam generators, turbines, water pumping and distribution equipment, pollution control equipment, storage tanks for required chemicals, potable and wastewater treatment facilities, office buildings, switchyards, and maintenance facilities. Infrastructure and associated activities related to the Navajo Mine on Navajo Nation trust land include surface coal mining, reclamation activities, access roads, haul roads, a 6.3-mile transmission line, a 15-mile railroad, and coal handling facilities. Other ROWs and easements exist on Navajo Nation and Hopi trust land for four transmission lines, all of which originate at the FCPP.

4.12.2.3 Water

The 1908 Supreme Court decision in *Winters v. United States*, known as the Winters Doctrine, decreed that the establishment of an Indian reservation also required that a sufficient amount of water be reserved for the tribe's present and future use. The Winters Doctrine allows for a legal process as determined by a judge or arbitrator for settling water rights between the U.S. and Indian Tribes are not clearly defined. According to the Winters Doctrine, nonuse of reserved water will not result in forfeiture of the reserved water rights. The Navajo Nation's and Hopi Tribe's surface and groundwater rights are ITAs. The Navajo Nation and the State of New Mexico settled their water rights on the San Juan River Basin in 2005. The District Court signed the Supplemental Partial Final and Partial Final Decree on November 1, 2013 that approved the Navajo Nation's allocation of the San Juan River. This water right partially quantified water from the San Juan Basin based on historic use and reserved water rights. In addition, the 1984 Navajo Water Code declares the purpose of and asserts authority over all actions that affect the use of water on Navajo Nation tribal trust lands as follows:

> *In order to provide for a permanent homeland for the Navajo People; to protect the health, the welfare and the economic security of the citizens of the Navajo Nation; to develop, manage, and preserve the water resources of the Navajo Nation; to secure a*

> *just and equitable distribution of the use of water within the Navajo Nation through a uniform and coherent system of regulation; and to provide for the exercise of the inherent sovereign powers of self-government by the Navajo Nation, the Navajo Nation hereby asserts its sovereign authority over all actions taken within the territorial jurisdiction of the Navajo Nation which affect the use of water within the Navajo Nation*
> (Navajo Nation Council 1984).

BBNMC holds a water right for the use of surface and groundwater of the San Juan Basin (New Mexico Office of the State Engineer Permit No. 2838). The mine uses this right to supply water for the FCPP and the Navajo Mine. All of the water for the FCPP and Navajo Mine is obtained from the San Juan River; the water is pumped into Morgan Lake and then pumped from the lake for use in mining and power plant operations. In addition, the FCPP has an agreement with the Jicarilla Apache Water Authority for supplemental water use, as needed. Water is used at the FCPP for a variety of purposes, including SO_2 scrubbing, steam condensers, cooling water, dust control, washwater for vehicles and facilities, and domestic purposes. Water used for Navajo Mine operations is for reclamation purposes and dust suppression. Water for the proposed Pinabete Permit Area would also be obtained from the San Juan River via Morgan Lake, and would be used in mining operations, including dust suppression and reclamation purposes. The proposed Project does not utilize any water from the Hopi Tribe.

Future water development within the basin is anticipated to occur and has the potential to affect species dependent on the flow regime of the San Juan River. Most of these future water depletions were accounted for in the consultation for Navajo Dam Operations (USFWS 2006), and are therefore considered in meeting the San Juan River Flow Recommendations. There are irrigation ditches and canals below Navajo Dam that could entrain pikeminnow and razorback sucker: Citizens, Hammond, Fruitland, San Juan Generating Station, Jewett Ditch, and Hogback. Increased urban and suburban use of water, including municipal and private uses will increase demands for water. Further use of surface water from the San Juan River will reduce river flow and decrease available habitat for the razorback sucker and pikeminnow and may affect habitat for riparian dependent species such as southwestern willow flycatcher and yellow-billed cuckoo. Livestock grazing may adversely impact these species by removal of water for drinking and the reduction in soil water holding capacity in the floodplain, and resulting reduction in base flows.

4.12.2.4 Cultural Resources

Indian cultural sites, cultural items, and even Native American human remains may be considered ITAs if they are associated with land status, a treaty, or some other statute. Cultural resources, including sacred sites and those protected by NAGPRA are discussed in Section 4.4 (Cultural Resources).

4.12.2.5 Grazing, Hunting, and Gathering Resources

The BIA Navajo Region established CUAs throughout the Navajo Reservation that grant grazing privileges for individual Navajo Nation tribal members. A CUA is not a title of ownership, but rather defines an individual's personal area for grazing use. The Navajo Mine Lease Area intersects 27 CUAs, and the proposed Pinabete Permit Area would intersect 5 CUAs. The Navajo Nation and Hopi Tribe have the right to continue hunting, gathering, grazing livestock, and their traditional uses on the Hopi and Navajo Reservations. Hunting and gathering, and grazing are also discussed in Section 4.4 (Cultural Resources) and Section 4.9 (Land Use).

4.12.2.6 Paleontological Resources

Per 59 IAM 7 (April 2012), paleontological resources are considered ITAs and should be protected and managed accordingly. BIA classifies "any remains, impressions or traces of organism preserved in or on the earth's crust" as an ITA. However, human remains are considered "cultural items" and not treated as an ITA. Human remains and related burial relics are regulated under the Native American Graves

Protection and Repatriation Act of 1990 (25 USC 3001). The intention of BIA's policy is to ensure that paleontological resources, which can be highly valued, are not poached or trafficked, which would devoid the tribe or individual of an asset.

As discussed in Section 4.3, the San Juan Basin contains a rich and diverse paleontological record. As of 2007, the New Mexico Museum of Natural History and Science database indicated that more than 10,000 fossil specimens had been collected from San Juan County. However, only a small number are from Navajo Nation tribal trust lands (DOI and BIA 2007).

4.12.3 Changes to Indian Trust Assets Affected Environment Post-2014

Two completed federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions; and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared in the following Section. Neither of these completed federal actions would change the affected environment for ITAs.

4.12.4 Environmental Consequences

This section discusses the ITAs that could be affected under the alternatives described in Section 3.2. ITAs with monetary and intrinsic values that could be affected by the alternatives include minerals, land, water, cultural resources, and grazing, hunting, and gathering resources. Impacts are described in comparison to the baseline condition.

ITA impact assessment is based on changes in asset values attributable to the Proposed Action and alternatives. The value of ITAs to the tribe is largely based on their quantity and quality; any change in quality or quantity without fair market compensation represents a potential change in value to the tribe. Value is also based on the ability to access the ITAs. The analysis in this section, thus, assesses potential impacts to the value of ITAs by analyzing whether the access to or quantity/quality of ITAs would be modified by the alternatives; as such, this section often draws on impact analyses completed in other resource sections. Assessment of the magnitude of an impact is described where possible. Assessment of the significance of impacts is based on the conclusions from other resource sections.

4.12.4.1 Alternative A – Proposed Action

Navajo Mine

Minerals

Coal is the dominant mineral resource in the Pinabete Permit Area and the only mineral trust asset that would be extracted during the mining operations. The Pinabete Permit Area would be mined in the same manner described for the current Navajo Mine operations, using surface coal mining methods adapted for multiple coal seam mining. Under Alternative A, the coal would be mined subject to proposed Lease Amendment #3 between the Navajo Mine and the Navajo Nation. The Secretary of the Interior must ensure that Lease Amendment #3 meets the objectives of established Federal trust management policies so that the action is in the best interest of the Navajo Nation and Federal Government (25 CFR 211.3).

The annual total tonnage that would be mined from the Pinabete Permit Area would depend on the demand for coal and availability of mining equipment. Table 3-4 presents the expected coal extraction from the Pinabete Permit Area from 2017 to 2041. Over the 25-year lease period, 134 million tons of coal would be extracted and used at the FCPP (an average of 5.4 million tons per year over the entire permit period). If NTEC's existing SMCRA permit is renewed, the expected amount of coal that would be extracted from the existing Navajo Mine area, not including the proposed Pinabete Permit Area, from 2013 to 2024 is 91.8 million tons of coal (an average of 7.7 million tons per year). The total amount of coal

that would be extracted under Alternative A, including coal from the new Pinabete Permit Area and the existing Navajo Mine, is 226 million tons over the 29-year period from 2013 to 2041 (an average of 7.8 million tons per year). The heaviest period of extraction would occur in the years 2022 through 2026 (an average of 9.2 million tons per year).

To identify if the Navajo Nation is receiving fair compensation for its coal, this analysis identifies the probable market value of Navajo Mine coal based on prices received elsewhere. As of April 12, 2013, prices of coal (delivered to market) ranged from $10.06 per ton (for coal from the Powder River Basin) to $58.10 per ton for coal from the Central Appalachian region (U.S. Energy Information Administration 2012). The wide range in price is partly due to extraction location (and associated costs to transport the coal to end users) and the variation in the amount of energy inherent in a unit of coal, as measured by Btu. Coal from the Powder River Basin (southeastern Montana/northeastern Wyoming) has an average rating of 8,600 Btu per pound while coal from the Central Appalachian region has an average rating of 12,500 Btu per pound (John T. Boyd Company 2011; McIlmoil and Hansen 2010). Coal from the Navajo Mine has a relatively low average rating of 9,500 Btu per pound (BNCC 2006), which indicates that its market value may be at the mid- to low-end of the national price range.

In 2011, the average price of coal produced in New Mexico was $34.22 per ton (US Energy Information Administration 2012). This amount is the price of coal produced and delivered to market; the value of coal in the ground is much lower because of the substantial costs associated with extraction. Assuming a similar Btu rating for average New Mexico coal and the Navajo Mine coal, this analysis estimates a market value of $34.22 per ton for coal from the Navajo Mine. Table 4.12-1 shows that coal valued at approximately $7.7 billion (based on the 2011 New Mexico price) would be extracted during the permit period; however, the future price of coal produced at the Navajo Mine may change as a result of the transfer of ownership of the mine to the NTEC.

Table 4.12-1 Coal Mined and Value of Coal, by Permit Area, Totals Over the Permit Period

Mine Area	Total Coal Mined	Assumed Price Per Ton*	Value of Coal Over the Permit Period
Pinabete Area	134,439,000	$34.22	$4,600,502,580
Navajo Mine	91,771,000	$34.22	$3,140,403,620
Total	**226,210,000**	**$34.22**	**$7,740,906,200**

*Assumed price per ton based on 2011 average New Mexico price.

A small percentage of the coal resources (between 8 and 10 percent) would be unrecoverable ‘wedges’ and ‘ribs’ at the top and bottom of coal seams. This unrecoverable coal is not included in Table 4.12-1, so an additional 18 million (8 percent of 226 million) to 22.6 million (10 percent of 226 million) valued at $774 million (assuming $34.22 per ton) would be lost as wedges and ribs.

As compensation for the coal, it is estimated that the tribe would receive $40.2 million per year royalties (Brown 2006). At $40.2 million per year, over 29 years, the tribe would be compensated a total of $1.2 billion. Thus, the tribe would be expected to receive payments valued at approximately 15.1 percent of the gross value of the coal produced, or 13.7 percent of the gross value of all coal lost to future use (produced coal plus unrecoverable coal). Following ownership of the mine transfer to the NTEC, the royalty payments would continue under the current payment schedule (OSMRE 2013).

The royalty rate paid to Federal agencies leasing mineral rights provides a point of comparison to whether the tribe is being fairly compensated. The royalty rate for Federal coal mined by surface methods, established by law, is 12.5 percent of the gross value of the coal produced. However, Federal agencies may also have other income from coal leasing. For example, BLM receives three types of revenues from coal leasing: a bonus paid at the time it issues a lease, a rental fee of $3 per acre (or fraction thereof), and production royalties of 12.5 percent of the gross value of the coal produced (BLM 2012a). Unless the bonus

paid at time of leasing is quite large, it appears that the royalties received by the tribe (at 13.7 to 15.1 percent) would exceed those paid to the BLM for coal rights. Although not determinable with certainty based on the Federal royalty rate, it appears that the tribe would be fairly compensated for its mineral resources.

Land

Under the Proposed Action, all mining activity would be on acreage already leased for mining purposes, with no change in the lease or ownership status of trust lands.

Proposed surface mining of overburden (material that lies above the target formation) and subsurface coal resources would disturb approximately 4,104 acres of rocks and soil and modify land topography. Most soils in the permit area do not currently meet the SMCRA definition of topsoil; therefore, top-dressing substitute material from within the permit area would be used during reclamation (as described in Section 4.3, Earth Resources). As required by the SMCRA permit, following reclamation, the site would support vegetative cover, which would decrease soil erosion. Short-term uses of the land would be impacted by coal mining operation in the Pinabete Permit Area; however, long-term uses would be expected to return to conditions that are equivalent to or better than the baseline.

Compared to baseline conditions, the increase in soil quality after reclamation may enhance the suitability of these lands for other future uses, such as grazing or other agricultural purposes. Thus, under Alternative A, no adverse impacts to the value of trust land would be expected at the Project site.

During Project operations, potential adverse effects to the value of adjacent lands held in trust could occur, due to any Project-induced changes in the area's aesthetics, air quality, or groundwater quality. As presented in Section 4.9, Land Use, land uses adjacent to the Project Area are primarily dispersed housing, grazing, agriculture (including dispersed family farm plots and commercial farming), mining, oil and gas extraction, electricity production, and recreation with a variety of roads (from paved to dirt) traversing the land (Figure 1-1, General Project Location Map). Of these uses, the value of housing and recreational land uses may be most sensitive to the Project. However, due to the existing industrial nature of the area, Project impacts on adjacent land value, even housing or recreation, would be limited (see Section 4.10, Socioeconomics, for further discussion).

Water

Implementation of Alternative A would result in the loss of coal seam aquifers in the Fruitland Formation and a reduction in groundwater quantity as a result of mining operations (see Section 4.5, Water Resources/Hydrology). However, the impacts to the Fruitland Formation and groundwater quantity would be limited as mining operations would not affect the existing or future use of water from the Fruitland Formation, and current groundwater quality is poor due to high salinity. No major adverse impacts on groundwater resources held in trust would occur.

BBNMC would retain the allocated water right for FCPP and Navajo Mine operations after NTEC takes ownership of Navajo Mine, and the water right would not become the property of the Navajo Nation or NTEC. This water right is provided under Permit 2838 and entitles NTEC to divert 39,000 acre-feet per year (afy) from the San Juan River for consumptive and 51,600 afy for diversion. Navajo Mine's usage is approximately 1,000 afy. FCPP usage is approximately 25,000 afy. The mine and FCPP will continue to be supplied with water from Permit 2838. The sale of NMCC, LLC's equity to NTEC will not change the source or amount of water available to the mine. According to BNCC, prior to sale of NMCC, LLC's equity to NTEC, BNCC, the current owner of Permit 2838, will transfer its ownership interest in Permit 2838 to BBNMC and BBNMC will honor all existing contractual commitments for water deliveries (BNCC/NTEC/APS 2013).

Compared to the baseline conditions, impacts to surface water quality would be limited due to erosion control measures and adherence to SMCRA regulations. It is worth noting that there have been past surface impoundment violations and there are currently a limited number of impoundments meeting NNEPA surface

water quality standards. OSMRE is charged with enforcing, and if necessary issuing fines, for impoundments not meeting NNEPA water quality standards. Although TDS and aluminum levels fluctuate with changes in precipitation patterns, reclamation activities would reduce overall TDS levels and aluminum loading from current levels, which would result in beneficial impacts to surface water resources held in trust (see Section 4.5). Project activities, therefore, are not expected to adversely affect the surface water quality of the San Juan River and consequently not result in an adverse impact to this ITA.

As identified in Section 4.5, direct surface water quantity impacts related to peak flows and runoff volumes would be long term, yet negligible in severity. Changes in ephemeral flow may occur if some of the sediment and drainage control ponds are converted to permanent replacement livestock water ponds at the request of the Navajo Nation or the local water user. These impoundments would only be considered permanent if water quality conditions meet NNEPA standards. The impact of the mine on geometry, morphology, or location of the natural stream patterns would be negligible. Stock ponds located adjacent to active mining operations would not experience major water quality or quantity impacts with respect to livestock use. No major impacts on surface water resources held in trust would occur.

Cultural Resources

Due to additional ground disturbances from the development of the permitted areas and the construction of new roads, implementation of Alternative A could impact the integrity of prehistoric resources, historic resources, and/or TCPs. Under Section 106 of the National Historic Preservation Act, OSMRE is consulting with THPO and SHPO to identify mitigation measures to reduce potential impacts (see Section 4.4, Cultural Resources). Since potential impacts would be mitigated, any unavoidable impacts to ITAs would be considered minor.

Grazing, Hunting, and Gathering Resources

Under Alternative A, mining and construction activities would occur within the Pinabete Permit Area and the Navajo Mine Permit Area (permit areas), requiring public access restrictions for safety purposes for the duration of mining operations and reclamation. Additional access restrictions within five CUAs would occur due to the realignment of Burnham Road. Restricted access would reduce the availability and value to the Navajo Nation of grazing and hunting and gathering resources present within the proposed restricted access areas. NTEC would compensate for the reduced access to designated grazing areas by negotiating with the Navajo Nation and land user(s). The land would be restored to conditions suitable for grazing after the Project. No compensation would be provided for restricted access to hunting and gathering resources. However, abundant other hunting and gathering trust resources are nearby, so the loss of access to a relatively small area to hunting and gathering would result in negligible impacts.

Paleontological Resources

The development of Pinabete Mine and the DFADAs would likely have an adverse impact on paleontological resources. However, an inadvertent discoveries plan would be prepared as a condition of the SMCRA permit. The inadvertent discoveries plan would seek to minimize the potential damage or destruction of paleontological resources by putting in place protocols for pre-surveying and monitoring activities, procedures for evaluating the significance of a discovery, and stipulate the level of training that personnel must have in order to conduct identification, collection, and curation activities. While ground-disturbing activities associated with the Project may damage or destroy paleontological resources, these protocols would ensure that the Navajo Nation is not deprived of the opportunity to realize benefits from these ITAs. Therefore, minor effects are expected to occur as result of the development of the Pinabete Permit Area.

Four Corners Power Plant

Minerals

Currently, no mineral extraction is conducted at the FCPP, and none is planned; therefore, approval of Amendment #3 would not impact mineral trust assets.

Land

Under Alternative A, APS would construct five additional DFADAs within the FCPP's existing boundaries (the size of the leased acreage and the footprint of the FCPP facilities would not change). As discussed in Section 4.5, Water Resources/Hydrology, berms would be constructed around the areas to restrict any storm water runoff containing CCR that could impact surrounding soils. While it is possible that impacts to soils at the DFADAs could occur if berms and embankments were to fail, such failure is unlikely. DFADA construction and use is not expected to result in any adverse impacts to surrounding land areas.

Placement of CCR would permanently reduce soil productivity and prevent vegetation growth on this portion of the lease area (see Section 4.3, Earth Resources, for more information). The loss of soil productivity would permanently diminish the ability of the tribe to use these trust lands for productive purposes following the decommissioning and dismantlement of the FCPP at the end of the lease period. However, under the FCPP lease between APS and the Navajo Nation, the tribe is compensated for use of lands. Therefore, the potential loss of productivity on the portion of the FCPP Lease Area occupied by the DFADAs, following closure of the FCPP in 2041, is not considered a major impact to the value of land ITAs.

Water

Under Alternative A, the FCPP's operation would not affect groundwater quantity. The potential does exist for continued operation and expansion of the DFADAs to adversely affect groundwater quality and surface water quality in Chaco Wash through ongoing seepage, but this potential would be reduced through the operation of intercept trenches (see Section 4.5, Water Hydrology/Resources). No major impacts to groundwater trust assets would occur.

In terms of surface water resources, the water used at the FCPP is cycled from Morgan Lake through the power plant condenser for cooling and then discharged back into the lake. Under Alternative A, the FCPP would continue to operate in accordance with the existing NPDES permit and the SWPPP, in addition to using berms around the proposed DFADAs. Operation of selective catalytic reduction devices on Units 4 and 5 would require the use of ammonia. Any potential spills of ammonia during transport could drain to nearby surface water features. In the unlikely event of a spill, a SPCC Plan would be implemented to prevent and contain any adverse effects of the spilled material to the surrounding environment. As described in Section 4.5, Water Resources/Hydrology, it is expected that surface water quality would not be affected by the continued operation of Units 4 and 5 at the FCPP and the DFADAs.

Construction of the new DFADAs would result in the permanent filling of three ephemeral drainages that discharge into the Chaco River. Based on a review of the delineation of wetlands and waters of the US conducted at the FCPP and the Project plans, removal of nonjurisdictional segments of these drainages would alter historic storm flows and hydrology in the Pinabete Permit Area. However, the application of mitigation measures and BMPs would prevent these impacts from adversely affecting surface water quantity or quality (see Section 4.5, Surface Water Quality for more information).

In addition to direct impacts to surface water quality from spills, operation of the power plant would also result in the deposition of mercury, selenium, and other materials into the San Juan River and adjacent waterbodies through atmospheric deposition from FCPP emissions. As discussed in Section 4.5, this deposition area would occur on almost entirely Navajo lands; however, based on the modeling that was

conducted, the amount of minerals deposited are considered limited and would not result in a major impact to surface water quality (AECOM 2013c).

BBNMC currently holds the water rights for this water use (New Mexico Office of State Engineer Permit No. 2838). The final disposition of the water rights is still pending and will be resolved between BBNMC and NTEC. No changes to water rights would occur under Alternative A; therefore, the Navajo Mine would maintain the right to draw as much water as the rights allow for the Project life.

Cultural Resources

Due to additional ground disturbances from the construction of the new DFADAs, implementation of Alternative A could impact the integrity of cultural resources, historical resources, and/or TCPs. As potential impacts are identified, OSM will consult with THPO and SHPO and mitigation measures will be identified. Since potential impacts will be mitigated, it is expected that any impacts on cultural resource ITAs would be minor (see Section 4.4, Cultural Resources, for additional information).

Grazing, Hunting, and Gathering Resources

No major impacts to grazing, hunting, and gathering resources would occur as a result of Alternative A. The quantity and quality of, and access to, grazing, hunting, and gathering resources and other natural resources would not change from baseline conditions under Alternative A. At the end of the lease, current access restrictions would be removed and the land reclaimed. As abundant other hunting and gathering trust resources are nearby in the area, access restrictions under Alternative A would be expected to result in negligible impacts.

Paleontological Resources

The development of the DFADAs could destroy or damage paleontological resources if encountered during ground-disturbing activities. However, as discussed in Section 4.3.4.1, the potential to encounter intact paleontological resources in these areas is considered low. An inadvertent discoveries plan would be implemented for development of the DFADAs. The inadvertent discoveries plan will seek to minimize the potential damage or destruction of paleontological resources by putting in place protocols for pre-surveying and monitoring activities, procedures for evaluating the significance of a discovery, and stipulate the level of training that personnel must have in order to conduct identification, collection, and curation activities. While ground-disturbing activities associated with the Project may damage or destroy paleontological resources, these protocols would ensure that the Navajo Nation is not deprived of the opportunity to realize benefits from these ITAs. Therefore, minor effects are expected to occur as result of the development of the DFADAs.

Transmission Lines

Minerals

Currently, no mineral extraction is conducted along the transmission lines, and none is planned; therefore, the renewal of the current ROWs associated with the transmission lines would not impact mineral trust assets.

Land

The renewal of the current ROWs associated with the transmission lines would not result in any changes to use of the land associated with the four existing transmission lines. Baseline conditions and existing land uses would continue. At the end of the lease, the transmission lines would either be decommissioned and dismantled or left in place.

Water

Under Alternative A, potential impacts on groundwater would be considered negligible as maintenance activities and normal operation would not involve any ground-disturbing activities.

As described in Section 4.5, Water Resources/Hydrology, the existing transmission lines and associated ROWs traverse numerous surface water features. Baseline conditions and current maintenance practices would continue. General maintenance activities to transmission lines and associated ROWs could indirectly affect surface water resources by increased stormwater runoff from the site carrying sediment and contamination loads into surface water, and by contamination from construction equipment and activities infiltrating area surface waters. Site clearing and grading activities could result in soil exposure, rutting, and compacting, which have the potential to increase water yields from the site, concentrate and channelize sheetflow, increase erosion rates, and increase sediment delivery to nearby water bodies. To protect the water quality of area surface waters during construction and maintenance activities, any and all of the BMPs required by the appropriate authorities will be implemented and maintained. Such mitigation measures are expected to limit any adverse effects to surface water ITAs to minor impacts.

Cultural Resources

Due to continued maintenance in ROW areas, implementation of Alternative A could impact the integrity of cultural resources, historical resources, and/or TCPs. As potential impacts are identified, OSM will consult with THPO and SHPO and mitigation measures will be identified. Since potential impacts will be mitigated, it is expected that any impacts to cultural resource ITAs would be minor (see Section 4.4, Cultural Resources, for additional information).

Grazing, Hunting and Gathering Resources

Few impacts to grazing, hunting, and gathering resources would be associated with the transmission lines under Alternative A. The quantity and quality of the grazing, hunting, and gathering resources would not change under Alternative A, and access to current grazing, hunting, and gathering lands and grazing areas would remain similar to baseline conditions.

Paleontological Resources

While vegetation management activities would occur within the ROW, no new ground-disturbing activities are proposed. This would significantly reduce the potential to damage or destroy an intact paleontological resource; therefore, the renewal of the ROW for the transmission lines would not impact paleontological resources.

4.12.4.2 Alternative B – Navajo Mine Extension Project Mine Plan

Navajo Mine

Minerals

Under Alternative B, Area IV South would be mined in the same manner described for the current Navajo Mine operations, using surface coal mining methods adapted for multiple coal seam mining. The same amount of coal would be expected to be extracted from Area IV South as detailed under Alternative A. All associated impacts to mineral trust assets would be the same as described in Section 4.12.4.1.

Land

Under Alternative B, the mining activity would be located on acreage already leased to the Navajo Mine, with no change in the lease or ownership status of trust lands.

Surface mining operations and new construction would disturb approximately 4,999 acres of rocks and soil. This disturbance area is larger than that under Alternative A (4,104 acres). Impacts to land trust

assets would be similar to those described in Section 4.12.4.1, despite the larger footprint of the mining operations.

Compared to baseline conditions, the increased soil quality after reclamation may enhance the suitability of these lands for other uses, such as grazing or other agricultural purposes. Thus, under Alternative B, no adverse impacts to the value of trust land would occur at the Project site.

Water

Under Alternative B, impacts to groundwater, surface water, and channel morphology would be as described for Alternative A.

Based on the delineation of waters of the US conducted in April 2012, approximately 33 acres of waters of the US would be impacted under Alternative B. If an USACE permit is granted, it would require mitigation to offset impacts to the waters of the US, such as payment to an established mitigation bank or restoration of an agreed-upon acreage. As a result of implementation of mitigation, no major impacts would occur to water resources held as ITAs.

Cultural Resources

Due to additional ground disturbances in Area IV South and the construction of the new roads and transmission lines, Alternative B could impact the integrity of cultural resources, historical resources, and/or TCPs. As potential impacts are identified, OSM will consult with THPO and SHPO and mitigation measures will be identified. Since potential impacts will be mitigated, it is expected that any impacts to cultural resource ITAs would be minor (see Section 4.4, Cultural Resources, for additional information).

Grazing, Hunting, and Gathering Resources

Under Alternative B, the mining operations would be comparable to those described under Alternative A, but would occur in a slightly different part of the Navajo Mine Lease Area and would encompass a slightly larger footprint.

Mining and construction activities would occur within Pinabete Arroyo and require diversion of flows from the arroyo around mining activities. Diversion of Pinabete Arroyo may indirectly impact wildlife, which could impact hunting resources. The effect of displaced wildlife on hunting resources would be uncompensated; however, an abundance of other hunting areas are held in trust, so this displacement would result in negligible impacts.

Paleontological Resources

Under Alternative B, impacts to paleontological resources would be as described for Alternative A.

Four Corners Power Plant

Under Alternative B, the BIA would approve the lease amendment for the FCPP, and the FCPP would operate as described under Alternative A. All potential impacts to minerals, land, water, cultural resources, paleontological resources, and grazing, hunting, and gathering trust assets would be the same as described in Section 4.12.4.1.

Transmission Lines

Under Alternative B, existing transmission line ROW renewal would be approved as described under Alternative A. All potential impacts to minerals, land, water, cultural resources, paleontological resources, and grazing, hunting, and gathering trust assets would be the same as described in Section 4.12.4.1.

4.12.4.3 Alternative C – Alternative Pinabete Mine Plan

Navajo Mine

Minerals

Under Alternative C, Area IV North and Area IV South would be mined in the same manner described for the current Navajo Mine operations, using surface coal mining methods adapted for multiple coal seam mining. The same amount of coal would be extracted from Area IV North and Area IV South as detailed under Alternative A. All associated impacts to the mineral trust assets would be the same as described in Section 4.12.4.1.

Land

Under Alternative C, the mining activity would be located on acreage already leased to the Navajo Mine, with no change in the lease or ownership status of trust lands. Surface mining operations and new construction would disturb approximately 6,492acres of rocks and soil, and modify land topography. This disturbance area is larger than under Alternative A (4,104 acres). Impacts to land trust assets would be similar to those described for the Proposed Action, despite the larger footprint of the mining operations.

Water

Under Alternative C, impacts to groundwater, surface water, and channel morphology would be as described for Alternative A.

Based on the delineation of waters of the US conducted in April 2012; approximately 6.6 acres of waters of the US would be impacted. If an USACE permit is granted, it would require mitigation to offset impacts to the waters of the US, such as payment to an established mitigation bank or restoration of an agreed-upon acreage. As a result of implementation of mitigation measures, no major impacts would occur to water resources held as ITAs (see Section 4.5, Water Resources/Hydrology, for additional information).

Cultural Resources

Due to additional ground disturbances from the development of the lease areas and the construction of the new roads and transmission lines, Alternative C could impact the integrity of prehistoric resources, historic resources, and/or Traditional Cultural Properties. As potential impacts are identified, OSM will consult with THPO and SHPO and mitigation measures will be identified. Since potential impacts will be mitigated, it is expected that any impacts to cultural resource ITAs would be minor (see Section 4.4, Cultural Resources, for additional information).

Grazing, Hunting, and Gathering Resources

Under Alternative C, the mining operations would occur in a slightly different part of the Navajo Mine Lease Area, but would be comparable to those described under Alternative A.

Paleontological Resources

Under Alternative C, impacts to paleontological resources would be as described for Alternative A.

Four Corners Power Plant

Under Alternative C, the BIA would approve the lease amendment for the FCPP, and the FCPP would operate as described under Alternative A. All potential impacts to minerals, land, water, cultural resources, paleontological resources, and grazing, hunting, and gathering trust assets would be the same as described in Section 4.12.4.1.

Transmission Lines

Under Alternative C, existing transmission line ROW renewal would be approved as described under Alternative A. All potential impacts to minerals, land, water, cultural resources, paleontological resources, and grazing, hunting, and gathering trust assets would be the same as described in Section 4.12.4.1.

4.12.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action. All potential impacts to minerals, land, water, cultural resources, paleontological resources, and grazing, hunting, and gathering trust assets would be the same as described for the Proposed Action

Four Corners Power Plant

Under this alternative, BIA would approve the amended lease for the FCPP, and the plant would continue to operate as described under the Proposed Action. However, instead of constructing seven DFADAs, APS would construct a single “super cell” DFADA. Under this alternative, the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The types of direct and indirect effects on Indian Trust Assets under this alternative would be the same as described for the Proposed Action, but would result less potential impacts due to the 10% reduction in surface area of the DFADAs. Potential impacts to minerals, land, water, and grazing, hunting and gathering resources would be the same under this alternative as described under the proposed action. Due to the reduced disturbance area there is less potential for unanticipated impacts to cultural and paleontological resources. . All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

Under Alternative C, existing transmission line ROW renewal would be approved as described under Alternative A. All potential impacts to minerals, land, water, cultural resources, paleontological resources, and grazing, hunting, and gathering trust assets would be the same as described for the Proposed Action.

4.12.4.5 Alternative E– No Action Alternative

Navajo Mine

Minerals

Under the No Action Alternative, no coal would be mined after the ROD is issued in 2015. No associated adverse impacts would occur to the quantity or quality of mineral trust assets, but an adverse impact to the economic value of mineral trust assets would. Current royalties associated with the operation of the Navajo Mine would be eliminated.

Land

No adverse impacts to land trust assets would result from mine closure and reclamation under the No Action Alternative. No changes in land use would occur for the Pinabete Permit Area. Upon permit expiration, the Navajo Mine would conduct reclamation activities in Area III and Area IV North. All ancillary buildings and facilities would be removed, and the land would be reclaimed according to OSM guidelines. As reclamation would be required to return the land to equivalent or better state than pre-mining and land areas would no longer be restricted from public access, impacts to land trust assets would potentially be beneficial. The net impact to the value of land trust assets would depend on the value of other land uses after reclamation.

Water

Under the No Action Alternative, demolition activities associated with the Navajo Mine could result in short-term impacts to near-surface groundwater and surface water quality; however, potential impacts would be minimized through permit requirements and BMPs. Reclamation of mined lands would potentially restore natural groundwater flow, and surface water drainage and natural stormwater flow. Areas that had been previously mined or altered would be restored in accordance with the Reclamation Plan; therefore, impacts to groundwater and surface water would be beneficial. In addition, reclamation of mined lands would potentially restore natural groundwater flow, resulting in potential benefits to federally reserved waters held in trust. Thus, overall, impacts to trust water resources would be limited, but beneficial, under the No Action Alternative.

Cultural Resources

The closure of the Navajo Mine would have no effect on historic properties. However, reclamation activities could impact historic properties. OSMRE is consulting with the Navajo Nation THPO for determinations of Project effects on these historic properties within the APE.

Grazing, Hunting, and Gathering Resources

Following reclamation, any existing access restrictions would be removed, thereby increasing the availability and potential value of hunting and gathering resources to the tribe. Therefore, impacts to grazing, hunting, and gathering resources would be beneficial.

Paleontological Resources

The closure of the Navajo Mine would reduce the likelihood that paleontological resources would be damaged or destroyed. Therefore, there are no major effects to paleontological resources as ITAs expected to occur as part of the No Action alternative. However, there are two know paleontological resources occurring in the pre-2016 dragline areas. These sites would be protected and managed in accordance with the protocols of an inadvertent discoveries plan presented in Alternative A, which would mitigate any potentially major adverse effects to these ITA resources.

Four Corners Power Plant

Minerals

Under the No Action Alternative, no additional coal would be mined after 2016. Impacts associated with mineral use and the FCPP would be indirect. Current royalties associated with the FCPP operation would be eliminated, but potential royalties would remain, including the FCPP's conversion to another type of energy producing plant.

Land

No adverse impacts to land trust assets would result under the No Action Alternative. Under the No Action Alternative, the FCPP would be decommissioned and the units, switchyards, and facilities may eventually be dismantled. The land would be reclaimed, which may render lands suitable and available for other uses, such as grazing or other agricultural purposes, although uncertain at this time. Land lease revenues from the FCPP would be eliminated. The net impact to the value of land trust assets would depend on the value of these other land uses, compared to the land lease revenues received from FCPP (adverse impacts to the value of the trust land would result if the leases are more valuable than rents from other land uses).

Water

Under the No Action Alternative, the FCPP would shut down and remain in place until such time that a decommissioning plan is approved and implemented. Under the No Action Alternative, APS would cease drawing water from the San Juan River to operate the plant and would also cease discharges into Morgan

Lake. Water from Morgan Lake would remain in place until such time that it naturally evaporates. In addition, deposition of mercury, selenium, and other pollutants from the FCPP would cease. As a result, water quality in surface water bodies within the deposition area, particularly the San Juan River, would improve at least incrementally (see Section 4.5, Water Resources/Hydrology, for more information). This reduction in contaminant deposition would improve San Juan River water quality, with potential benefits to the quality of federally reserved waters held in trust.

Cultural Resources

The decommissioning and dismantling of the FCPP could impact historic properties. OSMRE is consulting with the Navajo Nation THPO on determinations of Project effects for unevaluated archaeological resources within the APE.

Grazing, Hunting, and Gathering Resources

Under the No Action Alternative, the FCPP would cease operations and any existing access restrictions would be removed. Unrestricted access would increase the availability and potential value of grazing, hunting, and gathering trust resources to the tribe. No adverse impacts to grazing, hunting, and gathering resources would result under the No Action Alternative.

Paleontological Resources

The closure of FCPP would not result in any ground-disturbing activities and therefore minimize the potential for the impairment of paleontological resources. Therefore, there are no major effects to paleontological resources as ITAs expected to occur as part of the No Action alternative.

Transmission Lines

Minerals

Under the No Action Alternative, the transmission line ROWs would not be approved and the transmission lines would be decommissioned, dismantled, or left in place. These actions would not directly impact mineral trust assets, but could indirectly affect the value of the mineral trust assets by reducing the feasibility of potential future use of the mineral assets if the transmission lines are decommissioned and dismantled. However, the potential value of the mineral trust assets would remain.

Land

The transmission lines would either be decommissioned and dismantled or left in place. Any subsequent impacts to trust assets would depend on the new land use. If the transmission lines were removed, all related actions would be addressed under their own set of permits and approvals.

Water

Under the No Action Alternative, the ROWs for the transmission lines would not be approved. The transmission lines may be decommissioned and dismantled or left in place. Dismantling of transmission lines has the potential to result in short-term impacts to surface water and groundwater quality; however, APS and PNM would be required to comply with all environmental laws and obtain necessary permits. Erosion from transmission line deconstruction and possible leaks from construction equipment could adversely impact water quality in the area (see Section 4.5, Water Resources/Hydrology, for more information).

If the transmission lines are left in place, little to no impacts to surface water quality and to trust assets would occur.

Cultural Resources

The decommissioning of the transmission lines could impact archaeological resources that are currently unevaluated for the NRHP and two archaeological resources that are determined eligible for the NRHP. OSMRE is consulting with THPO and SHPO on determinations of Project effects for unevaluated archaeological resources within the APE.

Grazing, Hunting, and Gathering Resources

Under the No Action Alternative, the ROWs for the transmission lines would not be approved. The transmission lines may be decommissioned and dismantled or left in place. Little to no impacts would occur to grazing, hunting, and gathering resources held as trust assets from either decommissioning or dismantling the transmission lines.

Paleontological Resources

Under the No Action alternative, no new ground-disturbing activities would occur. There are no known paleontological resources within the transmission line ROWs due to prior disturbance, and therefore, little to no impacts would occur to paleontological resources from either decommissioning or dismantling the transmission lines.

4.12.5 Indian Trust Assets Mitigation Measures

The Project Applicants must comply with protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section for each resource category. Where the environmental analysis in this EIS recommends additional protective measures, over and above the regulatory protections, they are listed below as specific mitigation measures.

The Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects to Indian Trust Assets. Therefore, no additional mitigation is recommended.

4.13 Visual Resources

Visual resources consist of the natural and cultural features that make up the visible landscape, including land, water, vegetation, buildings, structures, and cultural features within an observer's visual environment. The management of visual resources on public lands generally includes an inventory of the present landscape within its administrative boundaries and an assignment of management classes to define landscape units.

Federal agencies have developed various systems, or methodologies, for describing, analyzing, and managing visual resources on public lands. For example, BLM uses the Visual Resource Management System and the US Forest Service (USFS) uses the Scenery Management System. On nonpublic lands, variations of both systems and other methodologies are used. The Navajo Nation, BIA, and OSMRE currently do not have established methodologies for the inventory of visual resources on tribal trust lands; therefore, have not assigned visual resource management classes to the tribal lands they administer. Past visual resource analyses in the Project Area used a combination of the USFS Scenery Management System, the BLM Visual Resource Management System, and a hybrid system called the Visual Sensitivity-Visual Contrast System. Aspects of all three analysis systems were used in this evaluation of the visual landscape of the FCPP and Navajo Mine Lease Areas.

The visual environment of the Project Area is comprised of the natural and cultural elements of the Project components (the Navajo Mine and FCPP Lease Areas and the PNM and APS transmission line ROWs). The Visual Resources ROI is defined as those areas within the visual landscape of these project components that are visible from key observation points.

4.13.1 Regulatory Compliance Framework

OSMRE and BIA have trust responsibilities for the management of the lands and resources within the Navajo Nation Indian Reservation. Regulatory requirements applicable to regional haze and visibility are addressed in Section 4.1, Air Quality, and are not addressed in this section. Air quality is regulated under the Clean Air Act, which addresses emissions of criteria pollutants, including those that can cause visibility issues. The only Federal regulation applicable to the visual resources analysis is the Indian Lands Program of SMCRA, which states that the application package will contain "an evaluation of [impacts to] the scenic and aesthetic resources, due to the proposed surface mining and reclamation operation." No New Mexico or Arizona State, Navajo Nation or Hopi Tribe, or county or municipal visual resources requirements are considered applicable to the project.

4.13.2 Affected Environment Pre-2014

The Project Area is located within the Colorado Plateau physiographic region, the major distinguishing features of which are landforms that have been sculpted by wind and water, ranging from mesas to badlands. These landforms and the wet and dry waterways that shaped them largely define the visual environment of the region.

4.13.2.1 Regional Landscape

The natural environment around the ROI consists of broad, open natural desert areas, intermingled with agricultural areas, residential areas, coal mines, and power plants. Viewing distances are greater than 50 miles. The natural terrain consists of broad, gently undulating mesas cut by numerous shallow arroyos. Scattered residences and agricultural areas are located on the mesas. Isolated buttes and hogbacks (a ridge with a sharp summit and steep slopes of nearly equal inclination on both flanks) rise abruptly out of the landscape in stark contrast to the mesas. Shiprock, the Chuska Mountains, the Lukachukai Mountains, the Carrizo Mountains, Sleeping Ute Mountain, and the La Plata Mountains are visible in the distance to the west, northwest, and northeast from many locations within the Navajo Mine Lease Area. Within the ROI, the

Hogback (Hogback Mountain) is the prominent landform, extending roughly north to south along the western side of the Navajo Mine Lease Area. Figure 4.13-1 shows regional landscape features.

The San Juan River extends east to west and creates a riparian corridor through the landscape. The relatively dense vegetation along the river contrasts sharply with the sparse desert vegetation on the mesas that surround it. Smaller water courses in the ROI also have patches of denser vegetation, including the Chaco River in the northern portion of the Navajo Mine Lease Area and Cottonwood Wash in the southern portion of the Navajo Mine Lease Area.

Agricultural and residential areas are concentrated along the San Juan River. Industrial developments related to power plants are located on the San Juan River mesas, with the San Juan Generating Station to the north and FCPP to the south. The FCPP is adjacent to Morgan Lake; a man-made lake used both for industrial and recreational purposes. A network of transmission lines traverse the landscape extending outward in all directions from the FCPP and the San Juan Generating Station. The Navajo Mine Lease Area has been mined historically and is now in various stages of active mining and mine reclamation.

4.13.2.2 Project Area

Paved and improved roads in and around the Navajo Mine Lease Area provide the principal views of the project components to the greatest number of viewers. Visible project components are the FCPP and associated facilities, Navajo Mine Lease Area, and transmission lines. The a DFADAs along the Chaco River are only visible to FCPP employees from a few locations along two-track roads in Navajo Mine Resource Area I. Burnham Road is an improved road that extends north to south through the eastern and central portions of Area IV North, Area IV South, and Area V. Navajo Nation Highway 3005 extends north to south, east of Area I and Area II. BIA Road N-5 extends along the southern border of the Navajo Mine Lease Area, and BIA Highway N-36 extends along its northern border. US Highway (US) 64 is located to the north of the lease area. US 491 is located to the west of the lease area and New Mexico State Highway (NM) 371 is located to the east of the lease area.

4.13.2.3 Visual Resources Inventory

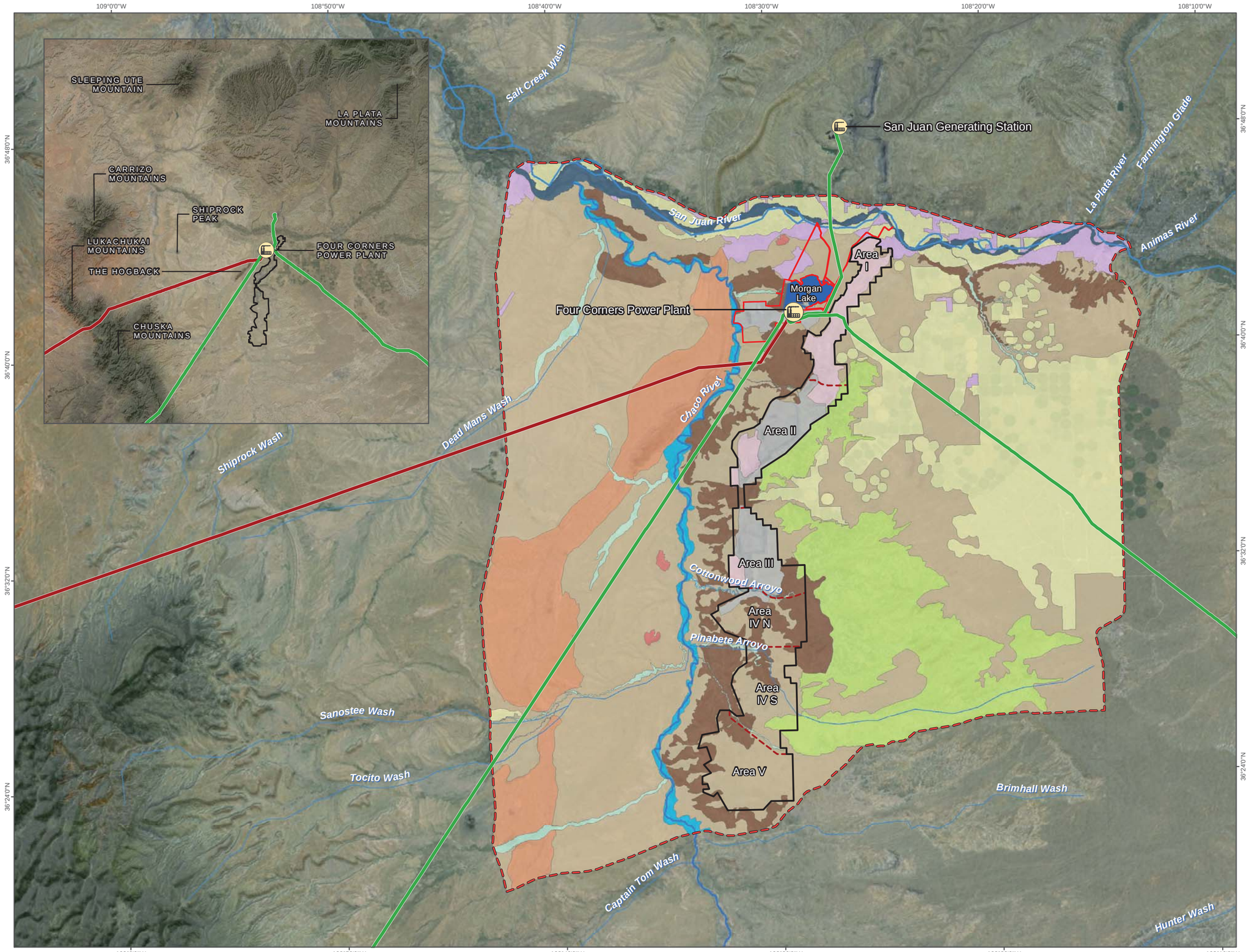
Visual resources inventories describe the existing visual environment through analysis of a number of variables. Two inventories were used in the description of the affected environment.

Desert Rock Draft EIS

A visual resources study was undertaken in connection with development of the draft EIS for the proposed Desert Rock coal-fired power plant and associated transmission lines (DOI and BIA 2007). The proposed Desert Rock project was adjacent to and west of the Navajo Mine and the FCPP Lease Area. A visual resources inventory was completed for the Desert Rock proposed action and alternatives using aspects of the USFS Scenery Management System (USFS 1997) and the BLM Visual Resource Management System (BLM 1986). The inventory describes the landscape character, visibility and viewer sensitivity, and the scenic integrity of the natural landscape. The Visual Resources ROI was a 6-mile wide corridor that extended north to south through the western side of the Navajo Mine Lease Area from a point northwest of the San Juan Generating Station to the community of Burnham on Highway 5.

Figure 4.13-1

Visual Resources Inventory



PROJECT FACILITIES

- Power Plant

PROJECT BOUNDARIES

- Navajo Mine Lease Areas
- Navajo Mine Resource Areas
- Four Corners Power Plant Lease Area

TRANSMISSION LINES

- 345kV
- 500kV

VISUAL RESOURCES INVENTORY

- Survey Area
- Agricultural Lands
- Badlands
- Chaco River Basin
- Desert Plains
- Dry Wash
- Eroding Escarpment
- Hogback
- Industrial Desert Plains
- Mesa
- Mixed Development
- Morgan Lake
- Reclaimed Mining Lands
- San Juan River

N

0 1.5 3 6
Scale in Miles

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It included the FCPP Lease Area and a majority of the Navajo Mine Lease Area (portions of Resource Areas I and II are Landscape character types were defined for all lands within the Visual Resources ROI and further subdivided into subtypes and units. Landscape character type was defined as “the visual and cultural image of a geographic area, and consists of a combination of physical, biological, and cultural attributes that make each landscape unique or identifiable” (DOI and BIA 2007:3-119). The landscape character type for the Navajo Mine Lease Area was designated the Navajo Landscape Character Type, described as, “an area of young plateaus with broad, open valleys; horizontal sandstone beds, eroded tablelands, cuestas, rock terraces, receding escarpments, shallow canyons, rolling desert plains, dry washes, and riparian corridors; and sparse vegetation consisting of desert plains, grasslands, salt bush, and sagebrush” (DOI and BIA 2007:3-119).

Landscape character subtypes were defined as regional areas with common distinguishing physical and visual characteristics (DOI and BIA 2007: 3-119). Three landscape character subtypes were designated for the Navajo landscape character types: High Plateau Tablelands, San Juan River Lands, and Navajo Modified Lands. Landscape character subtypes were further subdivided into landscape character units with distinguishing physical and visual attributes and different visual characteristics, as follows:

- The High Plateau Tablelands were subdivided into six landscape character units (Hogback, Playa, Weathered Badlands, Eroding Escarpment, Mesa, and Desert Plains).
- The San Juan River Lands were subdivided into four units (San Juan River, Chaco Wash, Dry Wash, and Morgan Lake).
- The Navajo Modified Lands were subdivided into four units (Industrial Desert Plains, Rural Desert Plain, Agricultural Lands, and Reclaimed Mine Lands.

These units were all defined in the study, with the exception of Rural Desert Plains, which did not occur within the project’s visual resources ROI.

The Desert Rock study also evaluated scenic integrity of the landscape character units. Scenic integrity is defined as, “the degree of intactness or wholesomeness of the landscape character” (USFS 1997). The level of scenic integrity was evaluated as generally high over most of the ROI. A landscape character with a high degree of scenic integrity is defined as a landscape that “has a sense of wholeness, intactness or being complete. Its scenic condition is near-perfect with no evident discordant elements or deviation from the existing character valued for its aesthetic appeal” (USFS 1997).

FCPP and Navajo Mine Energy Project

A new visual resources inventory of the landscape was conducted for the FCPP and Navajo Mine Energy Project to refine the previous landscape character study and incorporate Project Area changes that occurred in the past 5 years. The landscape character analysis was conducted using topographic maps, aerial photography, soil maps, the USGS National Gap Analysis Program, and National Hydrologic Data. The landscape character units derived were field verified during a site visit in October 2012. The area analyzed encompassed a larger area than that analyzed in the previous study to incorporate landscapes directly adjacent to the FCPP and Navajo Mine Lease Area. The ROI is depicted in Figure 4.13-2, comprised of a roughly square-shaped area surrounding the FCPP and the Navajo Mine Lease Area that is bounded by the primary travel routes (US 491, US 64, NM 371, and Navajo Nation Road 5).

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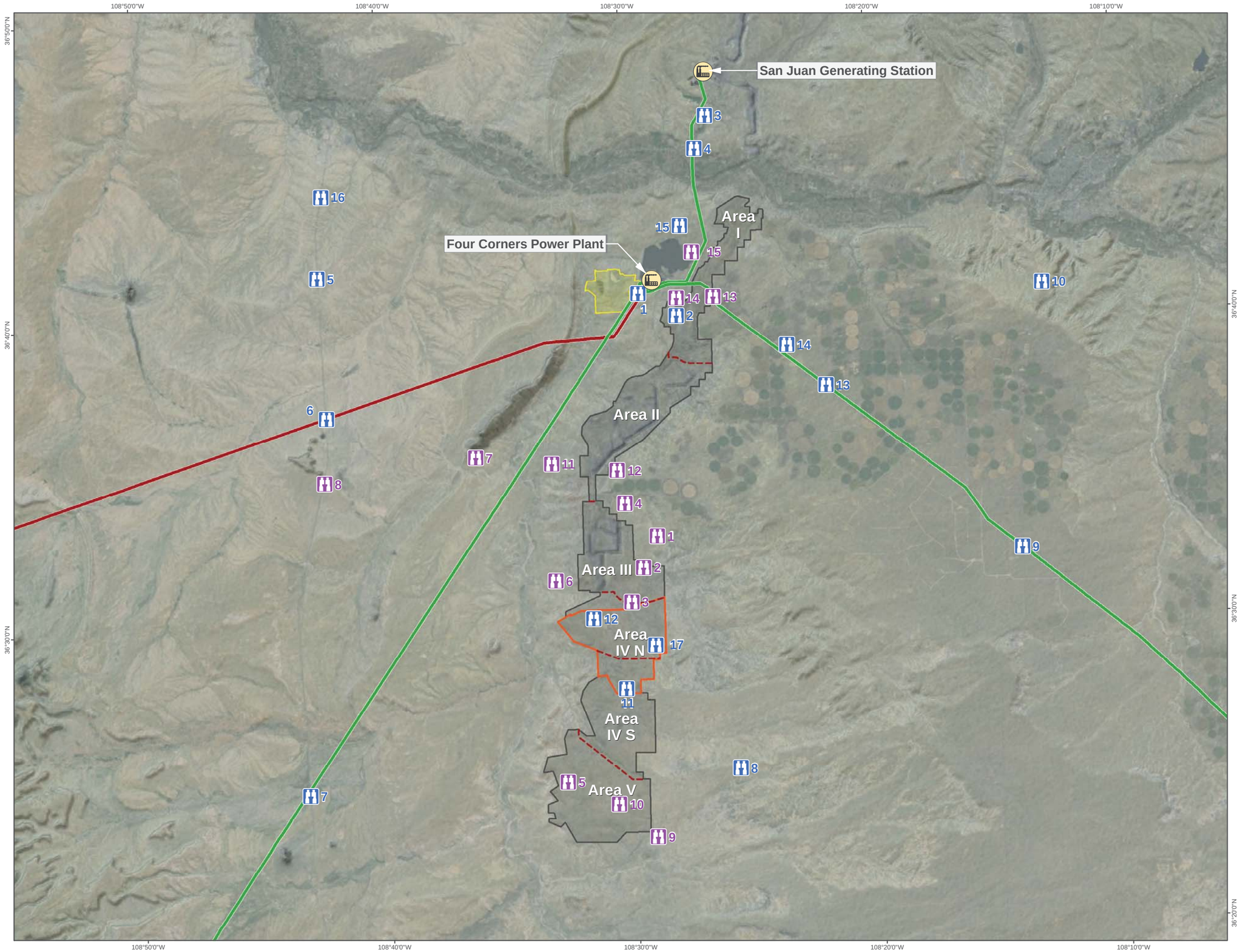

Figure 4.13-2

Key Observation Points
May 2012 and October 2012

PROJECT FACILITIES

- Four Corners Power Plant
- Future Ash Disturbance Area

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Navajo Mine Resource Areas
- Proposed Pinabete Permit Boundary

TRANSMISSION LINES

- 345kV
- 500kV

KEY OBSERVATION POINTS

- Survey - October 2012
- Survey - May 2012

N

0 1.75 3.5 7
Scale in Miles

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Similar to the study performed in the Desert Rock Draft EIS, the defined landscape character types were based on like physiographic characteristics (texture, color, variety, man-made features, similar visual patterns, and topographic features). The landscape character units derived were similar to those derived in the previous study with some minor variations (Table 4.13-1). All three previously defined landscape character subtypes (High Plateau, San Juan River, and Navajo Modified Lands) were expanded over the current ROI. Most of the previously defined landscape character units were used. The Playa landscape character unit was dropped because it was not found to occur within the ROI. The Desert Plain landscape character unit was expanded over the western portion of the current ROI, and the Agricultural Plains were expanded over the eastern portion of the ROI. The Badlands character type was expanded to encompass additional areas at the southern end of the Navajo Mine Lease Area. A new landscape character unit was defined for areas of residential development that were not present on the landscape in 2007. The DFADAs within the FCPP Lease Area were included as an element in the Industrial Desert Plains unit (Figure 4.13-2).

Scenic integrity was evaluated for each landscape character unit identified in the ROI (Table 4.13-1). Scenic integrity follows definitions used in the Scenery Management System (USFS 1997). It varies from very high to very low. Scenic integrity was found to be high in a majority of the landscape character units.

Table 4.13-1 Landscape Character Types, Subtypes, and Units

Type	Subtype	Unit	Description
Navajo Landscape	High Plateau Tablelands	Hogback	High ridge that varies in both width and elevation; typified by cross-bedded sandstone rock strata; vegetation varies from bare rock to sparse desert scrub; most dominant landform in the ROI. The scenic integrity of this unit is moderate with some development visible, but not dominant, within it (transmission lines, radio towers).
		Badlands	Distinctive sandstone layering on escarpments; stratified color variation; ranges from flat beaches and bars to rolling hills and cross-bedded escarpments. The scenic integrity of this unit is high with very little development visible within it.
		Eroding Escarpment	Encompasses broken and weathered geologic uplifts, cuestas, buttes, spires, volcanic dikes, steep-sloped windblown sand dunes, sandstone outcroppings defined by erosion, geologic deposits, tilted fault-block mountains, and retreating cliffs and bluffs; landforms ranges from jagged edged, steep-sloped escarpments with bare rock ridges to gently dipping slopes of sand dunes; bare rock landforms provide texture to the dominant Desert Plains landscape; color and striations provide a high degree of visual contrast. The scenic integrity of this unit is high to moderate with little in the way of development within it.
		Mesa	Large, dominant, high plateaus with eroded edges and cliffs; vegetation ranges from bare rock to grasslands. The scenic integrity of this unit is very low because of the heavy alteration from agriculture and the Navajo Mine within it.
		Desert Plains	Ranges from barren Desert Pavement to relatively dense low-lying desert shrub vegetation; sedimentary rock provides texture and color variation; homogenous topography varying from flat to rolling hills; dominant landforms and cultural modifications are highly visible and noticeable. The scenic integrity of this unit is high to moderate with some development visible, but not dominant, within it (primarily transmission lines).

Type	Subtype	Unit	Description
Navajo Landscape	San Juan River Lands	San Juan River	East/west-flowing river corridor; visually distinctive with cut banks, rocky streambed, flowing water, and dense vegetation that lines the corridor. The scenic integrity of this unit is low to very low because of the heavy residential and industrial development.
		Chaco Wash	Ephemeral water feature with highly varied width and depth; corridor has cutbanks replete with a sandy channel bed; dense vegetation within channel that varies from desert grasses to mature paloverde and mesquite trees. The scenic integrity of this unit is moderate to low because of transmission lines and the FCPP DFADAs along it.
		Dry Wash	Many dry washes dissect the landscape; flow only seasonally; erode to varying widths and depths; sparse vegetation along banks and on channel bars; visually evident but not dominant. The scenic integrity of this unit is high to very high.
		Morgan Lake	Man-made lake that is a dominant feature on the landscape. The scenic integrity of this unit is high to very high.
		Mixed Development	Lands with concentrated housing developments and scattered commercial development, creating distinctive visual patterns with agricultural lands mixed in. The scenic integrity of this unit is moderate to low.
	Navajo Modified Lands	Industrial Desert Plains	Industrial development areas that include active and inactive mining areas, Four Corners Power Plant, transmission lines, and the DFADAs. The scenic integrity of this unit is high.
		Agricultural Plains	Includes residences, agricultural outbuildings, ranches, fields and other associated facilities; visually distinctive because of color contrast during growing season, circular pattern of irrigated fields, and greater density of vegetation. The integrity of this character unit is high.
		Reclaimed Mining Lands	Lands that have been mined in the past and are currently in various stages of reclamation. The integrity of this character unit is low because of the patchwork of reclamation that has occurred.

Source: Modified from DOI and BIA 2007

4.13.2.4 Visual Sensitivity Analysis

Visual sensitivity is the degree of change a given landscape can accommodate without having major impacts on the visual resources. Landscapes with a high degree of visual sensitivity cannot accommodate a great amount of change without having a major impact on the visual resources of an area, and landscapes with a low degree of visual sensitivity can accommodate a greater amount of change without a major impact on the visual resources of an area (Ecosphere 2012d). Two sensitivity analysis studies were used in the description of the affected environment.

May 2012 Study

A visual sensitivity analysis was performed as part of the visual resources baseline assessment of the Navajo Mine Lease Area, conducted in May 2012 (Ecosphere 2012d). The visual sensitivity analysis of the landscape was based on three factors:

(1) Viewer sensitivity, defined as the level of concern for change in the visual character of the landscape by the viewing population.

(2) Visual quality, defined as the appeal of a given view to the viewing population.

(3) Viewer exposure, defined as the summation of overall visibility of the project, distance from the project, number of viewers of the project, and duration of the view of the project.

The Navajo Mine's visibility to a viewer was defined in terms of distance zones (Foreground, Middleground, Background, Seldom Seen), which follow definitions used in the BLM Visual Resource Management Manual (BLM 1986). Distance zones were based on the visibility of project activities from observation points and the variable dominance of four design elements (form, line, texture, and color). The distance zones and their definitions used are presented below (Table 4.13-2). Ultimately, all three factors (viewer sensitivity, visual quality, viewer exposure) are based on the individual analyst's judgment and interpretation.

Table 4.13-2 Visual Distance Zone Definitions (adapted from Ecosphere 2012d)

Distance Zone	Distance (in miles)	Definition
Foreground	0 to 1	Existing infrastructure is readily visible.
Middleground	1 to 5	Existing coal mining activities are visible. Outer boundary of distance zone is defined as point where texture and form of individual floristic items in the vegetative environment are no longer apparent on the landscape.
Background	5 to 15	Existing coal mining activities and vegetation are visible as patterns of light and dark.
Seldom Seen	15+	Resource areas are faintly visible under excellent atmospheric conditions.

In the study, visual sensitivity analysis was conducted from 15 viewpoints, referred to as Key Observation Points (KOPs). The viewpoints are shown in Figure 4.13-2, and included, "residences within 2 miles of the mine lease area, significant features on the landscape (i.e., Hogback geologic feature), travel corridors (i.e., highways), scenic viewpoints, recreation areas, residential areas, and representative views of the typical landscape" (Ecosphere 2012d). The study analyzed viewer sensitivity, visual quality, and viewer exposure to arrive at an overall visual sensitivity. The results of the visual sensitivity analysis indicated a low to moderate overall visual sensitivity (Table 4.13-3).

Table 4.13-3 May 2012 Visual Sensitivity Analysis

KOP #	Viewer Sensitivity	Visual Quality	Overall Viewer Exposure	Overall Visual Sensitivity
KOP 1	Low	Low to Moderate	Low to Moderate	Low to Moderate
KOP 2	Low	Low to Moderate	Low to Moderate	Low to Moderate
KOP 3	Low	Low to Moderate	Low to Moderate	Low to Moderate
KOP 4	Low	Low to Moderate	Low to Moderate	Low to Moderate
KOP 5	Low	Low to Moderate	Low to Moderate	Low to Moderate
KOP 6	Low	Low to Moderate	Moderate	Low to Moderate
KOP 7	Low	Moderate	Moderate	Moderate
KOP 8	Low	Moderate to High	Low to Moderate	Low to Moderate
KOP 9	Low to Moderate	Moderate	Moderate	Moderate
KOP 10	Low	Low to Moderate	Low to Moderate	Low to Moderate
KOP 11	Low to Moderate	Low to Moderate	Low to Moderate	Low to Moderate
KOP 12	Low to Moderate	Low	Moderate	Low to Moderate
KOP 13	Low to Moderate	Low	Low to Moderate	Low to Moderate
KOP 14	Moderate	Low to Moderate	Moderate	Moderate
KOP 15	Moderate	Low to Moderate	Moderate to High	Moderate

Source: Ecosphere 2012d

October 2012 Study

An additional visual sensitivity analysis study was conducted from 17 KOPs during a ROI field reconnaissance in October 2012 (Figure 4.13-2). The analysis was conducted to augment the May 2012 study baseline assessment (Ecosphere 2012d), which was considered to have these deficiencies with respect to utility for this EIS:

- The study was not conducted within the context of a specific proposed action, but rather as a broad visual resources study of the entire Navajo Mine Lease Area.
- KOPs used in the previous analysis did not take into consideration views of the FCPP component of the current Project Area, including the addition of a new DFADAs, nor did it take into consideration the continued operation and maintenance of the four existing transmission lines.
- KOPs used in the previous study were biased towards active residences, three of which would not be occupied once mining commences within the Pinabete Permit Area.

The KOPs selected for analysis in the October 2012 study include locations where the various elements of the Project Area would be visible to the viewing public. The KOPs include elevated locations overlooking the various elements of the Project Area, locations along primary and secondary roads where the FCPP or proposed mining areas would be visible, and the locations along primary and secondary roads where they are crossed by the four transmission lines that are part of the Project Area.

The visual sensitivity analysis was based on an assessment of viewer sensitivity, visual quality, and viewer exposure, as follows:

(1) Viewer sensitivity was primarily the analyst's judgment of public concern for the view as demonstrated by current land use and public comments received during scoping. The previous analysis from nearby KOPs, the type of viewer, and the current land use were taken into consideration in the current analysis.

(2) Visual quality was analyzed based on seven inventory factors used by the BLM (1986) for evaluating scenic quality on public lands: the landforms present in the landscape, the type and density of the vegetation present, the presence or absence of water, the colors that are present, quality of the adjacent scenery, scarcity of the view, and the cultural modifications that are present.

(3) Viewer exposure was analyzed based on a number of the factors used in the previous study, including visibility, distance zone, number of viewers, and the duration of the view.

The results of the October 2012 visual sensitivity analysis at the 17 KOPs are presented in Table 4.13-4 and representative, annotated photographs showing the view from each KOP are provided in Appendix D.

Table 4.13-4 October 2012 Visual Sensitivity Analysis

KOP #	Viewer Sensitivity	Visual Quality	Overall Viewer Exposure	Overall Visual Sensitivity
KOP 1	NA	NA	NA	NA
KOP 2	Low	Moderate	Low	Low to Moderate
KOP 3	Low	Moderate	Moderate	Low to Moderate
KOP 4	Low to Moderate	Low	High	Low to Moderate
KOP 5	Low to Moderate	Moderate	Low	Low to Moderate
KOP 6	Low to Moderate	Moderate	High	Moderate
KOP 7	Low to Moderate	Moderate	High	Moderate

KOP #	Viewer Sensitivity	Visual Quality	Overall Viewer Exposure	Overall Visual Sensitivity
KOP 8	Moderate	Moderate	Low	Moderate
KOP 9	Low to Moderate	Low	High	Low to Moderate
KOP 10	Low to Moderate	Moderate	Low	Low to Moderate
KOP 11	Moderate	Moderate	Moderate	Moderate
KOP 12	Moderate	Low	Moderate	Moderate
KOP 13	Low to Moderate	Low	Moderate	Low to Moderate
KOP 14	Low to Moderate	Moderate	Moderate	Low to Moderate
KOP 15	Low to Moderate	Moderate	High	Moderate
KOP 16	Low to Moderate	Moderate	Low	Low to Moderate
KOP 17	Low to Moderate	Moderate	Moderate	Low to Moderate

4.13.2.5 Visual Analysis of Project Components

The results of the visual analysis are presented below for each major project component. Refer to Figure 4.13-1 for the regional landscape context.

Four Corners Power Plant

The FCPP is located on the flat top of a mesa within the Industrial Desert Plain landscape character unit (see Table 4.13-1). Morgan Lake is located directly north of the FCPP, and extensive reclaimed mine areas of Area I in the Navajo Mine Lease Area bound it on the east. A large escarpment at the edge of the mesa on which it lies is located beyond Morgan Lake approximately 3 miles to the north, and the prominent Hogback geologic feature is located approximately 3 miles to the west. The landscape has a very industrial appearance because it has been extensively modified by construction of the FCPP facilities, an electrical substation, and multiple transmission lines.

The FCPP is visible from a limited number of locations along US 491 and from the mesa north of US 64 near the San Juan Generating Station. From along NM 371, it is seen from only one location in the far distance. The FCPP facilities are prominent from secondary highways BIA Highway N-36 and Navajo Nation 3005. The plumes from the stacks and the brown haze from the plant emissions are visible for short periods of time from US 491 and US 64 and from a limited number of locations along NM 371. The stacks and plumes are very prominent from secondary highways BIA Highway N-36 and Navajo Nation 3005.

KOP 14 from the May 2012 study (see Figure 4.13-2) included views of the FCPP from active residences located south of the plant in the foreground distance zone. From KOP 14, the visual quality was rated as low to moderate (see Table 4.13-3). The viewer sensitivity, overall viewer exposure, and overall viewer sensitivity were rated as moderate. A visual sensitivity analysis of the FCPP was conducted in October 2012 from KOPs 2, 3, 10, 14, and 15 (see Figure 4.13-2) in the middleground, background, and seldom seen distance zones. Viewer sensitivity ranged from low to moderate. Visual quality was rated as moderate from all five KOPs. Overall viewer exposure ranged from low to high, and overall visual sensitivity ranged from low to moderate (see Table 4.13-4).

The DFADA is located approximately 3 miles west of the FCPP between Chaco Wash and the escarpment at the western edge of the mesa upon which the FCPP sits. The Hogback geologic feature is very prominent directly to the west and dominates the landscape. TheDFADA is located within the Industrial Desert Plain landscape character unit as defined above (see Table 4.13-1). The DFADAs are not visible from surrounding primary and secondary roads within the Navajo Mine Lease Area to the east.

They are visible from the primary FCPP access road, the escarpment above them to the east, and from the scattered residences on the terraces on the western side of Chaco Wash. Viewers of the ash pits are primarily FCPP employees; there are few locations from which the public can view them. Because of the type of viewers and the limited views available to the public of the DFADAs, the visual sensitivity analysis was not conducted.

Navajo Mine

The Navajo Mine Lease Area consists of five Resource Areas (Areas I through V). Areas I and II are located at the northern end of the Navajo Mine Lease Area, and Area III is approximately in the center of the Lease Area. All three Areas have been mined historically and are now in various stages of reclamation. The area proposed for mine expansion is known as the Pinabete Permit Area and consists of portions of Area IV North and Area IV South at the southern end of the Navajo Mine Lease Area. Area V is at the south end of the Navajo Mine Lease Area. The Eroding Escarpment, Desert Plain, Badland, and Dry Wash landscape character units are all present in the Pinabete Permit Area. The landscape is in a predominantly natural state with little development visible, except for the transmission lines that cross the area and a few scattered residences.

The topography of Areas IV and V is characterized by a highly eroded plain with numerous small, dry washes with little to no vegetative cover. The Hogback geologic feature is prominent to the northwest in the background, and the Chuska Mountains are visible beyond it. Mesas are prominent to the north in the background with the La Plata Mountains visible in the distance. Highly weathered badlands and isolated buttes are visible in the foreground to the south and east. Cottonwood Arroyo is located along the northern border of Area IV North, and Pinabete Arroyo flows through the northwestern corner of Area IV South. Areas IV and V are visible from high points on the eastern end of BIA Road N-5 and from a few locations along NM 371. Both areas are highly visible from Burnham Road, which crosses roughly north to south through them.

KOPs 3 and 4 (see Figure 4.13-2) from the May 2012 visual resources study examined Area IV North from the middleground distance zones. KOP 3 was from the intersection of Burnham Road and a public road along Cottonwood Wash, and KOP 4 was from an active residence along Burnham Road. The viewer sensitivity was rated as low at both KOPs. The visual quality was rated as low to moderate at both, as was overall viewer exposure. Overall visual sensitivity was also rated as low to moderate (see Table 4.13-3).

KOPs 5, 9, and 10 (see Figure 4.13-2) from the May 2012 visual resources study examined Area IV South from the middleground distance zone. KOP 5 was from an active residence west of Burnham Road, KOP 9 was from the BIA Highway 5 near Burnham, and KOP 10 was from along Burnham Road. The viewer sensitivity at the three KOPs varied from low to moderate. The visual quality was rated as low to moderate at all three KOPs. The overall viewer exposure to Area IV South at all three locations was rated as low to moderate. The overall visual sensitivity was also rated as low to moderate at all three (see Table 4.13-3).

KOPs 8, 11, 12, and 17 (see Figure 4.13-2) from the October 2012 visual resources study also examined Area IV North and Area IV South from the foreground and background distance zones. KOP 8 was from BIA Road No. 5, which overlooks both Area IV North and Area IV South. KOP 11 was located along Burnham Road at the southern edge of Area IV South at the southern end of the proposed realignment of Burnham Road. KOP 12 was from an abandoned Navajo residence with overlooks of Area IV North. KOP 17 was located along the present Burnham Road realignment (Phase I) at the intersection with the planned Phase II realignment. The viewer sensitivity and visual quality ranged from low to moderate. Viewer exposure at KOPs 11, 12, and 17 was moderate, and low at KOP 8. The overall visual sensitivity ranged from low to moderate (see Table 4.13-4).

Transmission Lines

The four existing transmission lines connected with FCPP are highly visible from all of the primary highways in the area (US 491, US 64, and NM 371) as well as secondary highways (BIA Road No. 5, BIA Highway N-36, Navajo Nation 3005) and local mine access roads (Burnham Road). The APS Moenkopi 500-kV and Cholla 345-kV transmission lines cross US 491 and are highly visible for extended periods of time along the highway. The PNM 345-kV transmission line to the San Juan Generating Station crosses US 64 and BIA Highway N-36. It is highly visible along extensive lengths of these highways and from along Navajo Nation 3005. The PNM 345-kV West Mesa transmission lines cross NM 371 and Navajo Nation 3005. They are visible for extensive lengths along both highways. The landscape along the entire lengths of transmission lines was not inventoried because it would not be affected by the Proposed Action or alternatives (see Section 4.13.4). However, short portions of all four transmission lines lying within the landscape ROI were analyzed in this EIS. In addition, there is the potential for visual impacts to Traditional Cultural Properties located along the transmission Line ROWs.

The APS 500-kV Moenkopi transmission line crosses portions of the Hogback, Eroding Escarpment, Desert Plains, and Chaco Wash units. The APS 345-kV Cholla transmission line crosses the Eroding Escarpment, Desert Plains, and Chaco Wash units. The PNM 345-kV transmission line to the San Juan Generating Station lies partially within the landscape that was inventoried during the October 2012 study. Nearby landscape units suggests it crosses the Eroding Escarpment, Desert Plain, San Juan River, and Agricultural Lands units. Similar to the PNM 345-kV transmission line to the San Juan Generating Station, the PNM 345-kV West Mesa transmission line crosses lands that were not evaluated. Projecting nearby landscape units onto it suggests it crosses the Desert Plain, Agricultural Lands, and Reclaimed Mine Lands units.

KOP 7 (see Figure 4.13-2) from the May 2012 study was used in assessing visual sensitivity for the Cholla 345-kV transmission line in the middleground distance zone. The KOP was located along the access road to a radio tower. From this KOP, the viewer sensitivity was rated as low while visual quality, overall viewer exposure, and overall visual sensitivity were rated as moderate (see Table 4.13-3). Visual sensitivity analysis was conducted from the three KOPs along primary roads (KOPs 4 and 6) and a secondary road (KOP 14) in the October 2012 study. Viewer sensitivity ranged from low to moderate and visual quality was rated as moderate at all four KOPs. Viewer exposure was rated as high at KOPs along the primary roads (KOPs 4, 6, and 7), but moderate at the KOP along secondary roads (KOP 14). Overall visual sensitivity ranged from low to moderate with higher ratings along US 491 than US 64 and the secondary road (see Table 4.13-4).

4.13.3 Changes to Visual Resources Affected Environment Post-2014

Two completed Federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions; and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed Federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared in the following Section. Neither of these completed Federal actions would change the affected environment for Visual Resources.

4.13.4 Environmental Consequences

Visual impacts are caused by changes to the existing features in the environment. Changes include adding new features, colors, or textures to the environment that are uncharacteristic to the locality or region. Changes also occur when aesthetic features of the landscape are made less visible.

Impacts of the Proposed Action and the alternatives were evaluated according to the level of change they would cause to the existing landscape character. The assessment of impacts takes into consideration a number of factors, including scenic integrity, viewer sensitivity, visual quality, viewer exposure, and overall visual sensitivity.

Viewer sensitivity, visual quality, viewer exposure, and overall visual sensitivity were previously evaluated for the Navajo Mine Lease Area (Ecosphere 2012d). The same variables were evaluated for the current Project Area, which includes the FCPP Lease Area, the Pinabete Permit Area, the Burnham Road realignment, and the portions of the four transmission lines lying within the landscape character ROI.

The definitions of impact severity from a previous landscape study (DOI and BIA 2007) were applied in this visual resources impacts analysis. Significance of impacts of the Proposed Action and alternatives on the character of the landscape and its scenic integrity was evaluated according to the following definitions:

- *High Impact.* Proposed Action or alternatives would cause a substantial long-term effect on the landscape character/scenic quality of the existing visual environment of a sensitive viewer.
- *Moderate Impact.* Proposed Action or alternatives would cause a noticeable, but not substantial, change in the landscape character/scenic quality, or would cause a noticeable, but not substantial, change to the visual environment of a sensitive viewer.
- *Low Impact.* Proposed Action or alternatives would cause negligible or no change in the landscape character/scenic quality or the visual environment of a sensitive viewer.

4.13.4.1 Alternative A – Proposed Action

Impacts of the Proposed Action from implementation of each of the primary project components are summarized in Table 4.13-5. The overall impact on visual resources from the Proposed Action would be moderately adverse.

Table 4.13-5 Visual Resources Impacts from the Proposed Action

Impact Variables	Navajo Mine	FCPP	Transmission Lines
Scenic Integrity	High (adverse)	Moderate (adverse)	None
Visual Sensitivity	Moderate (adverse)	Negligible	None
Overall	High to Moderate (adverse)	Low (adverse)	None

Navajo Mine

Under Alternative A, a new permit area (Pinabete Permit Area) would be strip mined and reclaimed. The Pinabete Permit Area would include portions of the current Navajo Mine Permit Area, portions of Area IV North, and all of Area IV South (see Table 3-10). The landscapes of Area IV North and Area IV South are in a predominately natural state with little development visible. The landscape character units within Area IV North consist of Eroding Escarpment, Desert Plain, and Dry Wash (Cottonwood Arroyo). Landscape character units within Area IV South consist of Eroding Escarpment, Desert Plain, Badland, and Dry Wash (Pinabete Arroyo). All landscape types in the Pinabete Permit Area have a very high to moderate degree of scenic integrity. The mean scenic integrity of all these landscape units is high. The evaluations of viewer sensitivity, visual quality, viewer exposure, and overall visual sensitivity from the applicable KOPs ranged from low to moderate in both Area IV North and Area IV South in the foreground, middleground, and background distance zones. The low to moderate visual sensitivity in the three distance zones suggests the landscape can accommodate a fairly high degree of adverse visual change.

The strip mining in the Pinabete Permit Area would have a high adverse impact on the scenic integrity of three of the landscape units within it (Eroding Escarpment, Desert Plain, and Badland). The removal of the vegetation and topsoil from the surface, excavation of the pits, placement of topsoil and coal stockpiles in Area IV South, and development of the necessary infrastructure (roads and powerlines) would have a high degree of contrast with the existing natural landscape, which currently has little development. The high impacts would be long-term, lasting for the duration of the mining period and until

reclamation reestablishes compatible landform contours, drainage patterns, and vegetation. Viewer sensitivity would not change under the Proposed Action, but it would decrease the visual quality to low and increase the viewer exposure to high in the foreground and middleground distance zones. The mean impact on the overall visual sensitivity in these zones would be moderately adverse.

Because the overall impacts on scenic integrity would be highly adverse and the overall impacts on visual sensitivity would be moderately adverse, the overall impacts from the issuance of a SMCRA permit for the Pinabete Mine Area would be highly to moderately adverse. There are no measures to reduce the impacts to scenic integrity during mining operations themselves; however implementation of reclamation activities as soon as possible after mining operations are complete, as proposed by NTEC, would reduce the duration of effects. The interim reclamation of exhausted mine pits while mining operations continue at other pits would also reduce visual impacts through backfilling of pits, topsoil replacement, landscape contouring, and revegetation. Further, adverse effects to visual sensitivity by viewers will naturally decrease over time as viewers grow accustomed to the mining operations in the Pinabete portion of the lease.

Four Corners Power Plant

Under Alternative A, the FCPP would continue to operate under a new lease agreement. The FCPP and its associated facilities are located wholly within the Industrial Desert Plains landscape character unit. The character unit is defined by the presence of the FCPP and the associated facilities. The character unit currently has a very industrial appearance with a high degree of scenic integrity. Evaluations of viewer sensitivity ranged from low to moderate at KOPs from the foreground, middleground, background, and seldom seen distance zones along primary and secondary roads. Visual quality was rated as moderate at a majority of the KOPs. Overall viewer exposure ranged from low to high at a majority of the KOPs, and overall visual sensitivity ranged from low to moderate. The low to moderate visual sensitivity suggests the landscape can accommodate a fairly high degree of adverse visual change.

The implementation of the new lease agreement for the FCPP would have a negligible impact on the scenic integrity of the Industrial Desert Plain landscape unit. The Proposed Action would not impact the current industrial appearance of this character unit. The proposed changes to the FCPP would largely be undetectable to sensitive viewers in any of the distance zones. The reduction in the emissions from Units 4 and 5 would reduce the visibility of the FCPP to sensitive viewers, particularly in the background and seldom-seen distance zones, thereby reducing the viewer exposure. The Proposed Action would result in a negligible decrease in the overall visual sensitivity.

The DFADA is also located within the Industrial Desert Plain landscape character unit. The character unit currently has a very industrial appearance with a high degree of scenic integrity. The addition of more material to the existing DFADAs would not change the industrial appearance of the landscape unit. The continued use of existing DFADAs 1 and 2 would have a negligible impact on the scenic integrity of the Industrial Desert Plain landscape character unit.

The proposed new DFADAs would extend into the adjacent Desert Plain landscape character unit. This character unit has a moderate degree of scenic integrity because of the active and reclaimed mining lands within it and the numerous transmission lines that crisscross it. The construction of new DFADAs in the Desert Plain landscape character unit would have a moderately adverse impact on the scenic integrity of the landscape unit. Visual sensitivity analysis was not conducted for the DFADAs because the only viewers are FCPP employees with few opportunities for the public to view them.

The overall impacts from changes to the FCPP would be negligible, and the overall impacts from changes to the DFADAs would be moderately adverse. Therefore, the overall impacts from implementation of the new lease agreement at the FCPP would be low adverse.

Transmission Lines

The ROW renewal for the four transmission lines would have no impact on any of the landscape character units they currently cross, as there is not change to the existing transmission line structures. They also would have no impact on the visual sensitivity in any of the distance zones.

4.13.4.2 Alternative B – Navajo Mine Extension Project

Impacts of Alternative B from implementation of each of the primary elements are summarized in Table 4.13-6. The overall impact on visual resources from Alternative B would be moderately adverse.

Table 4.13-6 Visual Resources Impacts from Alternative B

Impact Variables	Navajo Mine	FCPP	Transmission Lines
Scenic Integrity	High (adverse)	Moderate (adverse)	None
Visual Sensitivity	Moderate (adverse)	Negligible	None
Overall	High (adverse)	Low (adverse)	None

Navajo Mine

The Navajo Mine Extension Project Mine Plan would be followed under Alternative B. Only Area IV South would be mined, resulting in the area of disturbance shown in Table 3-10. The landscape of Area IV South is in a predominately natural state with little development visible. Landscape character units within Area IV South consist of Eroding Escarpment, Desert Plain, Badland, and Dry Wash (Pinabete Arroyo). All four landscape character types possess a moderate to very high degree of scenic integrity. The mean scenic integrity of these landscape units is high. The evaluations of viewer sensitivity, visual quality, viewer exposure, and overall visual sensitivity ranged from low to moderate in Area IV South in the foreground, middleground, and background distance zones. The low to moderate visual sensitivity suggests the landscape can accommodate a fairly high degree of adverse visual change.

Alternative B would have a high adverse impact on the scenic integrity of four landscape units. The removal of the vegetation and topsoil from the surface, excavation of the pits, placement of coal stockpiles along the boundary of the permit area, and development of the necessary infrastructure (roads and powerlines) would have a high degree of contrast with the existing natural landscape, which currently has little development. The high impacts would be long-term, lasting for the duration of mining until reclamation reestablished compatible landform contours, drainage patterns, and vegetation. Plan implementation would decrease the visual quality to low and increase the viewer exposure to high in the foreground and middleground distance zones. The overall impact on the visual sensitivity in these zones would be moderate. The impacts on visual resources from Alternative B would be higher than they would be for Proposed Action due to the increased miles of roads and powerlines and the alterations to Pinabete Arroyo. The overall impacts would be highly adverse.

Four Corners Power Plant

Under Alternative B, the FCPP would continue to operate under the same lease amendment as in the Proposed Action. Impacts would be the same as described for the Proposed Action (see Section 4.13.4.1).

Transmission Lines

The ROW renewal for the four transmission lines would have no impact on any of the landscape character units they currently cross and also would have no impact on the visual sensitivity in any of the distance zones.

4.13.4.3 Alternative C – Alternative Pinabete Mine Plan

Impacts of Alternative C from implementation of each of the primary elements are summarized in Table 4.13-7. The overall impact on visual resources from Alternative C would be moderately adverse.

Table 4.13-7 Visual Resources Impacts from Alternative C

Impact Variables	Navajo Mine	FCPP	Transmission Lines
Scenic Integrity	High (adverse)	Moderate (adverse)	None
Visual Sensitivity	Moderate (adverse)	Negligible	None
Overall	High (adverse)	Low (adverse)	None

Navajo Mine

Under Alternative C, NTEC would implement an alternative Pinabete Mine Plan. The proposed mining activity would be located in both Area IV North and Area IV South in two separate pits with disturbance as shown in Table 3-10. The landscapes of Area IV North and Area IV South are in a predominantly natural state with little development visible. The landscape character units within Area IV North consist of Eroding Escarpment and Desert Plain. Landscape character units within Area IV South consist of Eroding Escarpment, Desert Plain, Badland, and Dry Wash (Pinabete Arroyo). All four landscape types have a very high to moderate degree of scenic integrity. The mean scenic integrity for these units is high. The evaluations of viewer sensitivity, visual quality, viewer exposure, and overall visual sensitivity ranged from low to moderate in both Area IV North and Area IV South in the foreground, middleground, and background distance zones. The low to moderate visual sensitivity suggests the landscape can accommodate a fairly high degree of adverse visual change.

Alternative C would have a high adverse impact on the scenic integrity of four landscape units (Table 4.13-7). The removal of the vegetation and topsoil from the surface, excavation of the pits, placement of coal stockpiles within the Pinabete Permit Area, and development of the necessary infrastructure (roads and powerlines) would have a high degree of contrast with the existing natural landscape, which has little development present currently. The high adverse impacts would be long-term lasting for the duration of mining until reclamation reestablishes compatible landform contours, drainage patterns, and vegetation. It would decrease the visual quality to low and increase the viewer exposure to high in the foreground and middleground distance zones. The impact on the overall visual sensitivity in these zones would be moderate. Overall, the impacts on visual resources from Alternative C would be higher than they would be for the Proposed Action due to the increased amount of disturbance acreage for the mine, increased length of the Burnham Road realignment, and the increased miles of roads and powerlines to be constructed.

Four Corners Power Plant

Under Alternative C, the FCPP would continue to operate under the same lease amendment as in the Proposed Action. Impacts would be the same as described for the Proposed Action (see Section 4.13.4.1).

Transmission Lines

The ROW renewal for the four transmission lines would have no impact on any of the landscape character units they currently cross and also would have no impact on the visual sensitivity in any of the distance zones.

4.13.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Impacts of Alternative D from implementation of each of the primary elements are summarized in Table 4.13-8. The overall impact on visual resources from Alternative D would be moderately adverse.

Table 4.13-8 Visual Resources Impacts from Alternative D

Impact Variables	Navajo Mine	FCPP	Transmission Lines
Scenic Integrity	High (adverse)	Moderate (adverse)	None
Visual Sensitivity	Moderate (adverse)	Negligible	None
Overall	High to Moderate (adverse)	Low (adverse)	None

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action. Impacts would be the same as described for the Proposed Action.

Four Corners Power Plant

Under this alternative, the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The 10% reduction in surface area of the DFADAs would result in the same visual impacts as described for the Proposed Action. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

Under this alternative, the transmission line ROWs would be approved and they would continue to be operated and maintained as described for the Proposed Action. The ROW renewal for the four transmission lines would have no impact on any of the landscape character units they currently cross and also would have no impact on the visual sensitivity in any of the distance zones. Impact would be the same as those described for the Proposed Action.

4.13.4.5 Alternative E – No Action Alternative

Impacts of Alternative E from implementation of each of the primary elements are summarized in Table 4.13-9. The overall impact on visual resources from Alternative E would be low.

Table 4.13-9 Visual Resources Impacts from Alternative E

Impact Variables	Navajo Mine	FCPP	Transmission Lines
Scenic Integrity	High (beneficial)	High (beneficial)	Unknown
Visual Sensitivity	High (beneficial)	High (beneficial)	Unknown
Overall	High (beneficial)	High (beneficial)	Unknown

Navajo Mine

Under the No Action Alternative, the Navajo Mine would close. The Pinabete Permit Area (Areas IV North and South) would not be mined. Burnham Road would not be realigned. Mining in the Navajo Mine Permit Area (Areas III and IV North) would continue until the current SMCRA permit expires. Areas I and II, which are also part of the Navajo Mine Permit Area, have already been reclaimed, and no new mining would occur in these areas. Upon permit expiration, NTEC would begin reclamation activities in Areas III and IV North. Reclamation activities would continue until OSMRE approval, indicating that all requirements have been

met. It is expected that all reclamation would be completed by June 2021. All ancillary buildings and facilities (e.g., communication lines, railroad) would be removed, and the land would be reclaimed.

Alternative E would have a high beneficial (as opposed to adverse) impact on scenic integrity and overall visual sensitivity. The scenic integrity of the Reclaimed Mine Lands is currently evaluated as low. The reclamation of Areas III and Area IV North and removal of the ancillary buildings and facilities would add substantially to the overall scenic integrity of this landscape character unit. Impacts on the visual sensitivity from Alternative E would also be high. Visual quality would be increased substantially with the removal of the cultural modifications from the landscape. Viewer sensitivity and overall viewer exposure would not be affected. The overall impact on the landscape from Alternative E would, thus, be highly beneficial.

Four Corners Power Plant

Under the No Action Alternative, Units 4 and 5 would be shut down when the current lease expires in 2016. The plant facilities would be decommissioned and dismantled. The impacts on the scenic integrity of the Industrial Desert Plains landscape character type would be negligible. Visual quality would be increased substantially with the removal of the cultural modifications from the landscape. Viewer sensitivity and overall viewer exposure would not be affected. The overall impact on the landscape would be highly beneficial.

Transmission Lines

Under the No Action Alternative, the ROWs for the four subject transmission lines would not be approved. The lines would either be decommissioned and dismantled or left in place. Dismantling would have a highly beneficial impact on the scenic integrity of the landscape character units they cross. Leaving them in place would have no impact on the scenic integrity of the landscape units they cross.

Dismantling the transmission lines would increase visual quality and decrease viewer exposure. The net effect on overall visual sensitivity would be highly beneficial. Leaving the transmission lines in place would have no impact on visual quality, viewer exposure, or overall visual sensitivity.

4.13.5 Visual Resources Mitigation Measures

The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific mitigating measures for certain environmental impacts, standard operating procedures that reduce or avoid environmental impacts, and best management practices for specific activities. These are described in Section 3.2.6.13. These measures are part of their application materials and are enforceable through permit or lease conditions. In addition, the Project Applicants must comply with additional protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section for each resource category. Where the environmental analysis in this EIS recommends additional protective measures, over and above the applicant proposed measures and regulatory compliance, they are listed below as specific mitigation measures.

The Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, would result in short-term adverse impacts to the scenic integrity of multiple landscape character units through the introduction of elements that are uncharacteristic to the existing visual environment. The introduction of uncharacteristic elements results in a reduction in the scenic integrity of the landscape character unit. The contrasts between the characteristic elements and non-characteristic elements are noticeable to the casual viewer and result in an adverse impact to visual resources. Short-term impacts from the excavation of mine pits, construction of access road, and stockpiling of top soil and overburden within the Pinabete Permit Area would create adverse visual impacts as these elements are uncharacteristic to the existing visual environment and create a high degree of visual contrast highly noticeable to the casual observer. However, interim reclamation would include backfilling of mine pits, re-contouring of the surface to its original surface elevations, and re-vegetation with the appropriate seed

mixture to return the mined area to its original condition as closely as feasible. Reclamation would occur as soon as possible after the mining is complete and while mining would continue to occur in other portions of Pinabete Permit Area. The interim reclamation of those portions of the Pinabete Permit Area in which mining was complete would reduce the strong contrasts and reduce them to minor levels. No additional mitigation measures would be necessary.

4.14 Noise and Vibration

This section describes the existing sound levels and ground-borne vibration associated with current operations at the Navajo Mine, FCPP, and of the subject transmission lines and evaluates the potential impacts of the Proposed Action and alternatives to this baseline. The following provides definitions of noise and vibration and describes the measurements associated with each.

Fundamentals of Acoustics

Sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. When sound becomes excessive or unwanted, it is referred to as noise. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise, the perceived importance of the noise and its appropriateness in the setting, the time of day and the type of activity during which the noise occurs, and the sensitivity of the individual.

Sound (noise) levels are measured and quantified with several metrics. All of them use the logarithmic decibel (dB) scale with 0 dB roughly equal to the threshold of human hearing. A property of the decibel scale is that the sound pressure levels of two separate sounds are not directly additive. For example, if a 50-dB sound is added to another 50-dB sound, the total is only a 3-dB increase (to 53 dB). Thus, every 3-dB change in sound levels represents a doubling or halving of sound energy. Related to this is the fact that a less-than-3-dB change in sound levels is imperceptible to the human ear.

The frequency of sound is a measure of the pressure fluctuations per second, measured in Hertz (Hz). Most sounds do not consist of a single frequency, but consist of a broad band of frequencies differing in level. The characterization of sound level magnitude with respect to frequency is the sound spectrum. Many rating methods exist to analyze sound of different spectra. One rating method is called A-weighting (there are also B- and C-weighting filters). The A-weighted scale (dBA) most closely approximates how the human ear responds to sound at various frequencies by progressively deemphasizing frequency components below 1,000 Hz and above 6,300 Hz and reflects the relative decreased sensitivity of humans to both low and extremely high frequencies (FHWA 2006). Table 4.14-1 lists typical sound levels from representative sources.

Table 4.14-1 Typical Noise Levels (measured at distance a person would typically be from the source)

Typical Noise Source	Sound Level (dBA)
Grand Canyon at Night (no roads, birds, wind)	10
Computer	37-45
Refrigerator	40-43
Typical Living Room	40
Forced Hot Air Heating System	42-52
Microwave	55-59
Normal Conversation	55-65
Clothes Dryer	56-58
Dishwasher	63-66
Clothes Washer	65-70
Phone	66-75

Typical Noise Source	Sound Level (dBA)
Push Reel Mower	68-72
Hairdryer	80-95
Vacuum Cleaner	84-89
Leaf Blower	95-105
Circular Saw	100-104
Maximum Output of a Stereo	100-110
Jet Fly-over at 1,000 Feet	110

Source: Noise Pollution Clearinghouse 2012.

The duration of noise and the time period at which it occurs are important factors in determining the impact of noise on sensitive receptors. Several methods are used for describing variable sounds including the equivalent level (L_{eq}), the maximum level (L_{max}), and the percent-exceeded levels. These metrics are derived from a large number of moment-to-moment A-weighted sound level measurements. Some common metrics reported in community noise monitoring studies are described below:

- L_{eq}, the equivalent level, can describe any series of noise events of arbitrary duration, although the most common averaging period is hourly. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events and L_{eq} is the common energy-equivalent sound/noise descriptor.
- L_{max} is the maximum sound level during a given time. L_{max} is typically due to discrete, identifiable events such as an airplane overflight, car or truck passing by, or a dog barking.
- L_{90} is the sound level in dBA exceeded 90 percent of the time during the measurement period. L_{90} is close to the lowest sound level observed. It is essentially the same as the residual sound level, which is the sound level observed when no obvious nearby intermittent noise sources occur.
- L_{50} is the median sound level in dBA exceeded 50 percent of the time during the measurement period.
- L_{10} is the sound level in dBA exceeded only 10 percent of the time. It is close to the maximum level observed during the measurement period. L_{10} is sometimes called the intrusive sound level because it is caused by occasional louder noises like those from passing motor vehicles.

In determining the daily measure of community noise, it is important to account for the difference in human response to daytime and nighttime noise. Noise is more disturbing at night than during the day, and noise indices have been developed to account for the varying duration of noise events over time as well as community response to them. The Day-Night Average Level (L_{dn}) is such an index. L_{dn} represents the 24-hour A-weighted equivalent sound level with a 10-dB penalty added to the “nighttime” hourly noise levels between 10:00 pm and 7:00 am. Because of the time-of-day penalties associated with the L_{dn} index, the L_{eq} for a continuously operating sound source during a 24-hour period will be numerically less. Noise is also more disturbing the closer a receptor is to the source; noise levels decrease by 6 dB as the distance from its source doubles (FHWA 2011).

Fundamentals of Vibration

Ground-borne vibration consists of waves transmitted through solid material. Several types of wave motions exist in solids, unlike air, including compressional, shear, torsional, and bending. The solid medium can be excited by forces, moments, or pressure fields. Ground-borne vibration propagates from the source through the ground to adjacent buildings by surface waves. Vibration may be composed of a single pulse, a series of pulses, or a continuous oscillatory motion. The frequency of a vibrating object describes how rapidly it is oscillating, measured in Hz. Most environmental vibrations consist of a composite, or “spectrum” of many frequencies, and are generally classified as broadband or random vibrations. The normal frequency range of most ground-borne vibration that can be felt generally starts from a low frequency of less than 1 Hz to a high of about 200 Hz.

Ambient and source vibration information for this study are expressed in terms of the peak particle velocity (PPV) in inches per second (in/sec). PPV is used to measure vibration through a solid surface. When a vibration is measured, the point at which the measurement takes place can be considered to have a particle velocity. This particle vibration will take place in three dimensions (x, y, and z) and will usually end up back where it started. The PPV is the maximum velocity that is recorded during a particular event.

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

Construction and mining activities can cause vibration that varies in intensity depending on several factors. The use of pile driving, vibratory compaction equipment, and blasting typically generates the highest construction- and mining-related ground-borne vibration levels. Because of the impulsive nature of such activities, the use of PPV has been routinely used to measure and assess ground-borne vibration from construction and mining activities (Jones and Stokes 2004). Specifically, OSMRE uses the PPV descriptor because it correlates well with damage or complaints (OSMRE 1986).

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

Vibration damage to buildings can be classified as cosmetic only, such as minor cracking of building elements, or may increase to the level of structural damage, which could threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary whether the vibrations are short-duration single events, such as from blasting, or continuous or repeated vibration events, such as from railroads or rail transit. The safe vibration limit from blasting is typically in the range of 2 in/sec, while the safe limit from continuous vibrations is typically 0.2 in/sec to prevent architectural damage to buildings (Jones and Stokes 2004). Construction-induced vibration that can be detrimental to a building is very rare and has only been observed in instances where the structure is in a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

The reaction of humans and effects on buildings from continuous levels of vibration is shown in Table 4.14-2. However, annoyance is a subjective measure, and vibrations may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying.

Table 4.14-2 Reaction of People and Damage to Buildings Resources from Continuous Vibration Levels

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

Source: Jones and Stokes 2004

Noise and air-borne vibration perceived during blasting is the result of an air blast. An air blast is a pressure disturbance that travels through the air like any other sound, and it is quantified in the same manner as any noise event. Because of the impulsive nature of the blast, it is commonly referred to as an “overpressure” (a temporary increase in air pressure over the standard atmospheric pressure). Generally, air blasts are of short duration, usually 2 to 10 seconds. Because the air blast contains mostly low frequencies (typically less than 250 Hz), it is often felt rather than heard. The overpressure (and resultant noise) is a function of the source strength (charge weight), weather conditions, and distance to the receiver. Factors that affect ground vibration transmission include explosive composition, charge weight and delays, distance, depth of burial of the charge, and geologic formations. Air overpressure transmission is also affected by intensity, terrain features (e.g., trees, foliage, and other screening), orientation of the blast face, atmospheric conditions, temperature gradients, and wind direction and velocity.

4.14.1 Regulatory Compliance Framework

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

4.14.1.1 Federal Regulations

Noise Control Act of 1972

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

U.S. Department of Housing and Urban Development

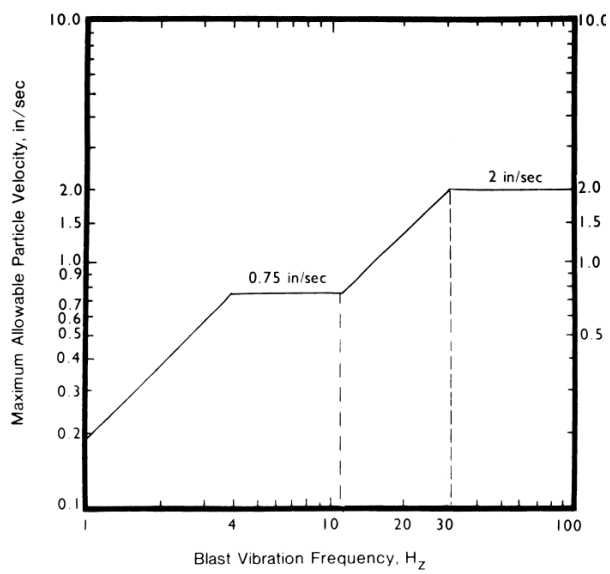
The US Department of Housing and Urban Development (HUD) has also established guidelines for acceptable noise levels for sensitive receivers such as residential areas, schools, and hospitals (24 CFR 51). HUD's noise levels include a two-pronged guidance, one for the desirable noise level and the other for the maximum acceptable noise level. The desirable noise level established by HUD conforms to the EPA guidance of 55-dBA L_{dn} for outdoor use areas of residential land uses and 45-dBA L_{dn} for indoor areas of residential land uses. The secondary HUD standard establishes a maximum acceptable noise level of 65-dBA L_{dn} for outdoor use areas of residential areas.

Mine Safety and Health Administration

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

Applicable Vibration Regulations

The OSMRE regulates ground-borne vibrations and air blasts from blasting activities at mining operations (30 CFR 816.67), including requirements for seismographic recording during each blast. Maximum allowable air blasts and ground-borne vibrations are specified for nearby vibration-sensitive buildings, including dwellings, public buildings, schools, churches, community buildings, and institutional buildings. Allowable air blasts are limited to a maximum of 129 flat-response or linear decibels (dBL) at 6 Hz or lower and 133 dBL at 2 Hz or lower. Allowable ground-borne vibration levels are weighted based on distance from the blasting site, with maximum PPV of 1.25 in/sec PPV_{max} at distances of 0 to 300 feet, 1.00 in/sec PPV_{max} at distances of 301 to 5,000 feet, and 0.75 in/sec PPV_{max} at distances of 5,001 feet and beyond. An alternative blasting level criterion (Blasting Level Chart) uses the ground-vibration limits to determine maximum allowable ground vibration if seismograph records include both particle velocity and vibration-frequency levels (Figure 4.14-1).



Source: 30 CFR 816.67

Figure 4.14-1 OSMRE Alternative Blasting Level Criteria

4.14.1.2 Navajo Tribal Regulations

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

4.14.1.3 New Mexico State Regulations

The State of New Mexico does not have jurisdiction on the Navajo Nation, so any statewide noise or vibration regulations would not apply to the Project components within those boundaries. There are no New Mexico State noise or vibration regulations applicable to the transmission line portion of the Project.

4.14.1.4 Local Regulations

San Juan County, Apache County, Navajo County, and Coconino County do not have any noise regulations or ordinances that would be applicable to noise or vibration generated by the Project.

4.14.2 Affected Environment Pre-2014

4.14.2.1 Navajo Mine

Ambient Noise Levels

A series of noise measurements was conducted on February 23 and 24, 2011, with additional measurements conducted from January 17 to 21, 2012, to characterize typical noise levels generated by various mining activities, as well as to document ambient noise levels in and around the various areas of the mine. Noise circulation can be influenced by wind, temperature, cloud cover, fog, topography, and man-made barriers such as buildings and other structures. Generally, noise levels decrease as the distance increases between a source and a receiver. However, the direction in which the sound waves travel can be altered by weather conditions, which may result in varying noise levels at the same location at different times. For example, cloud cover tends to bend sound waves downward toward the ground, which can increase the sound heard by a receiver. Inversions, which occur when the air temperature increases as altitude increases, slow the atmospheric adsorption of the noise waves and may cause a noise to sound louder. Wind is another factor that generally causes sound waves to bend in the direction it flows and increase noise levels. These differing conditions provide an example of how weather may alter the circulation of sound waves such that the same noise sources may be perceived differently at a receptor depending on the weather at the time. Accordingly, the noise measurements collected around the various areas of the mine serve to represent noise levels that may be perceived under typical weather conditions rather than the full range of noise that may be perceived under more extreme weather environments.

Noise measurements were conducted in accordance with ANSI S12.91993 (R2008), the standard for environmental noise measurements. A total of 14 separate noise measurements were collected in February 2011, ranging in duration from 10 to 70 minutes, with 14 additional measurements collected in January 2012, ranging in duration from 10 minutes to 9 hours. Tables 4.14-3 and 4.14-4 present the results of the noise measurements. Noise measurement locations are shown graphically on Figure 4.14-2.

Table 4.14-3 Ambient Noise Measurements in Project Area from February 2011

ID Number	Description of Location and Predominant Noise Source	Approximate Distance to Noise Source (feet)	Average Noise Level (dBA L_{eq})	Peak Noise Level (dBA L_{max})
1	Area IV South – Residence (peak noise is vehicle passby)	14,000	46	72
2	Area III - Dozers on coal stockpile	350	46	56
3	Area III - Lowe Ramp 1 - water trucks, haul trucks, and bottom dump trucks	100	66	77
4	Area III - Dragline #1 with D11 dozer in distance	770	56	63
5	Area III - Scrapers, water trucks on stockpile	45	69	74
6	Area III - Dixon Ramp 2 - D11 dozers (2)	370	66	74
7	Area III - In Dixon Pit – dragline with D11 dozer	730	62	69
8	Area III - Prestrip 63 – East – haul trucks – empty	75	67	79
	Area III - Prestrip 63 – East – haul trucks – fully loaded	200	67	80
9	Prestrip 63 – West – haul trucks – fully loaded	75	72	84
	Area III - Prestrip 63 – West – haul trucks – empty	200	72	77
10	Area I - Coal plant with power plant in distance	300	61	64
11	East of Area III - Near residence (peak noise is mining vehicle passby)	8,000	44	65
12	Area III - High wall by Lower Pit – dozers and dragline	770	62	72
13	Northwest of Area IV North - Near residence – no audible noise sources	4,500	33	36
14	Area III - Near blasting area in Lower Pit, Strip 59 – warning sirens	300	54	67
	Area III - Near blasting area in Lower Pit, Strip 59 – blast	300	66	94

Source: HDR Engineering 2012

Table 4.14-4 Ambient Noise Measurements in Project Area from January 2012

ID Number	Description of Location and Predominant Noise Source	Approximate Distance to Noise Source (feet)	Average Noise Level (dBA L_{eq})	Peak Noise Level (dBA L_{max})
ST-1	Area IV South – ambient	NA	35	50
ST-2	Area V – ambient	NA	34	55
ST-3	Area II – Yazzie Overlook – coal shot	250	74	109
ST-4	Area III – Dixon Pit – overburden drilling	250	71	87
ST-5	Area III – Dixon Pit – overburden blast	300	73	113
ST-6	Area II – Shop complex ready line – drill truck and crane truck	40	65	81
ST-7	Area II – Along rail line – passing coal train	50	65	88
ST-8	Area III – Top soil removal – dozer, end dumps	300	62	79
ST-9	Area III – Dixon Pit - dragline	500	61	81
ST-10	Area III – Lowe Stockpile – dozers and loaders	150	62	71
ST-11	Area III – Low Ramp 2 – occasional haul trucks	75	35	55
ST-12	Area III – Dixon Pit – coal shot	400	47	76
LT-1	Area I – Coal plant near power plant	700	54	78
LT-2	Area III – Large cast shot in Lowe Pit	700	49	81

NA – not applicable

Source: HDR Engineering 2012

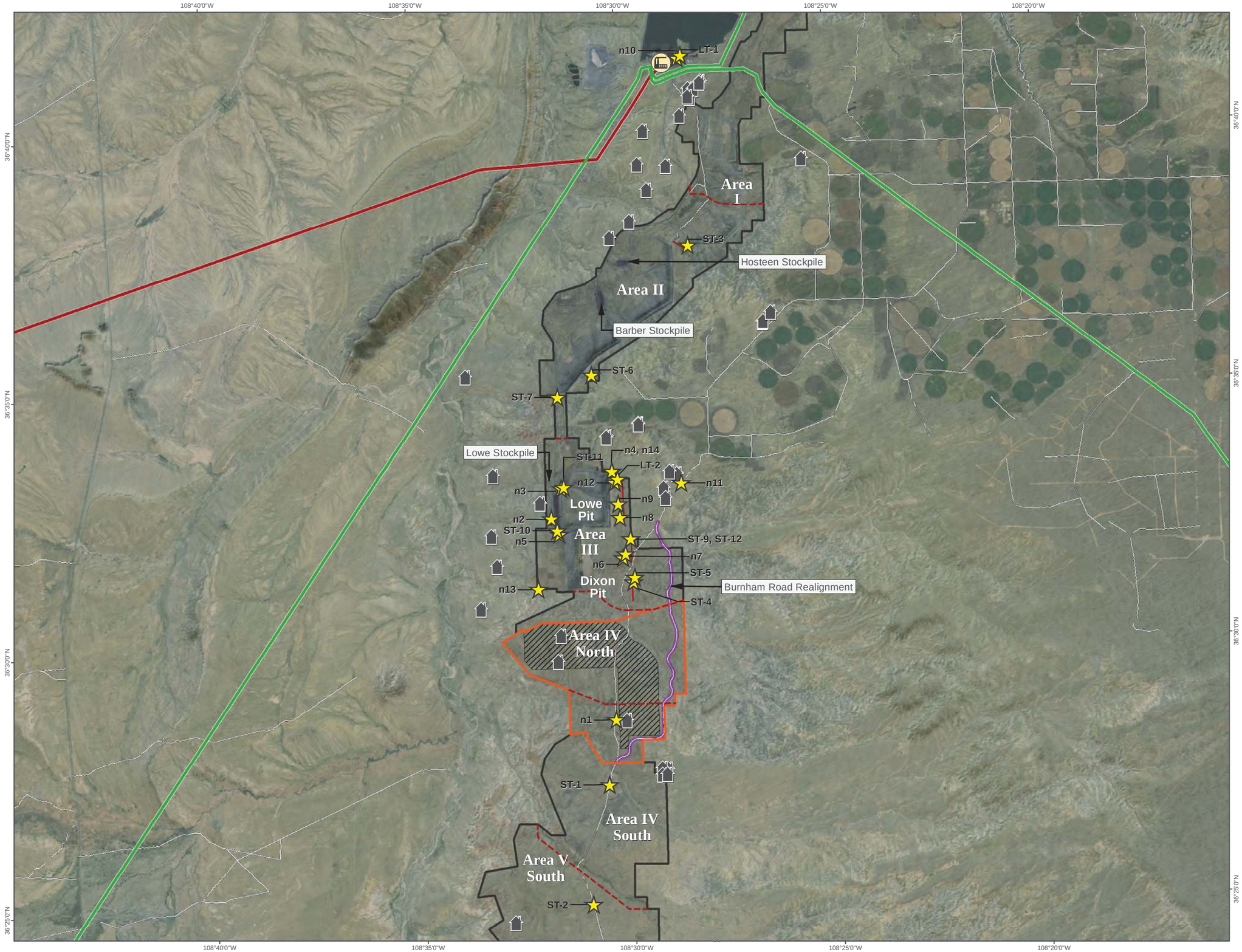


Figure 4.14-2

Noise Sampling Locations & Area Residences

PROJECT FACILITIES

Four Corners Power Plant

NOISE SAMPLING FEATURES

Residences

Noise Sampling Locations

Blasting during 2012 measurements

PROJECT BOUNDARIES

Navajo Mine Lease Area

Navajo Mine Resource Areas

Proposed Pinabete Mine Permit Boundary

Development Area

TRANSMISSION LINES

345kV

500kV

N

0 1 2 4

Scale in Miles

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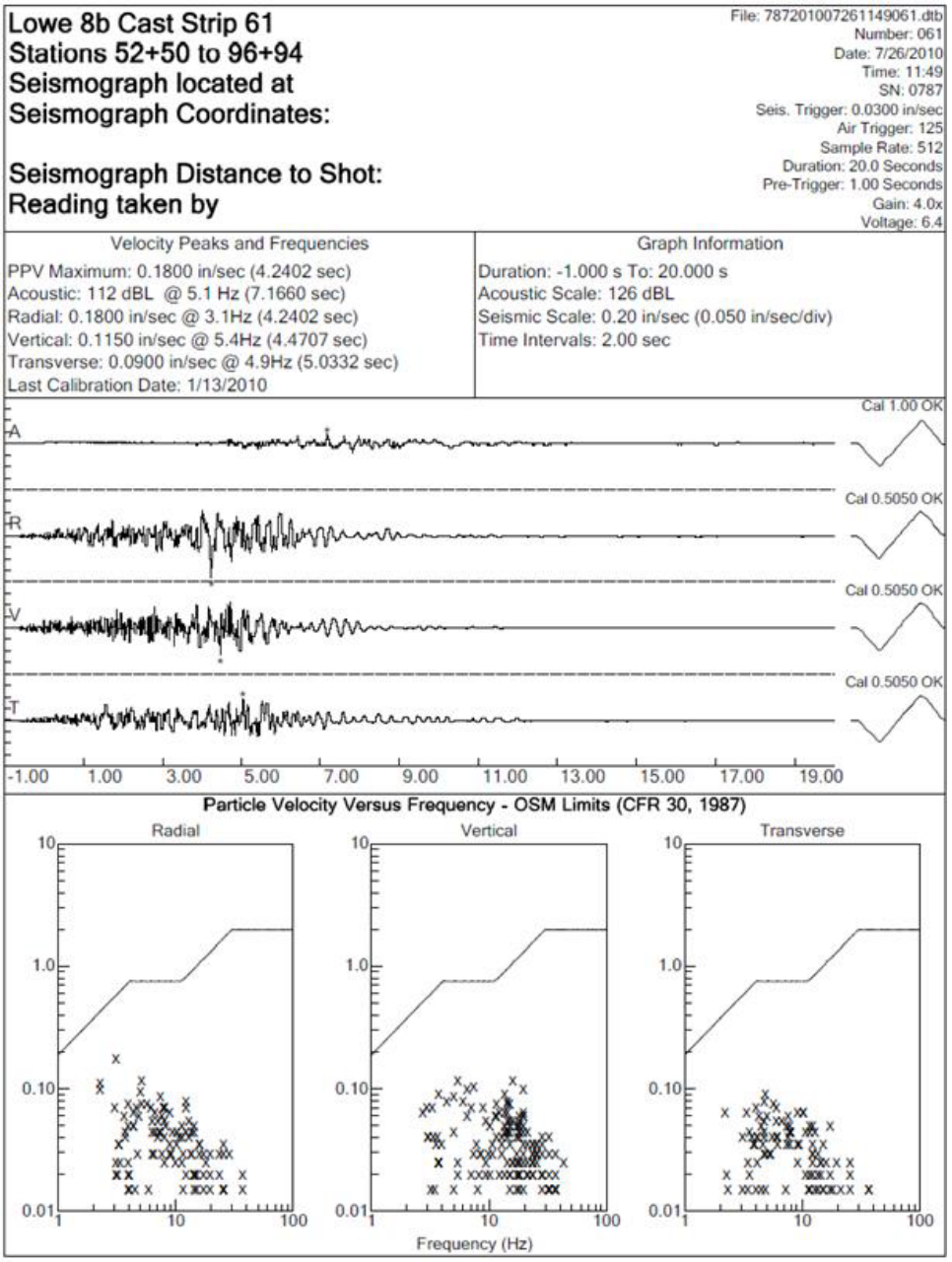
Vibration Measurements

As required by OSMRE blasting regulations, BNCC routinely measured vibration levels during blasting operations to ensure that air blasts and ground-borne vibrations are within allowable levels. A chart from a typical blast is provided on Figure 4.14-3 (BNCC 2010). Blasts are typically audible for about 2 seconds. The blast shown on Figure 4.14-3 occurred on July 26, 2010, along Strip 61 in Lowe Pit and represents an average blast routinely occurring at the mine. The seismograph was located at the nearest residence, approximately 5,539 feet from the blasting area. As shown in the chart, the maximum air blast was measured at 112 dBL and the maximum ground-borne vibration was measured at 0.18 in/sec PPV_{max}. Both of these measurements were within OSMRE-allowable levels.



Source: BNCC 2010

Figure 4.14-3 Typical Vibration Measurement at Residence 5,539 Feet from Blasting Area during Blasting Activities – Area IV North

Prior to initiating mining activities in Area IV North, ambient noise measurements were conducted near a residence just south of the southern boundary of Area IV North (Site 1), with another measurement conducted near a residence just to the northwest of the northern boundary of Area IV North (Site 13). The average noise levels during these measurements ranged from 33 to 46 dBA L_{eq}, with a maximum noise level ranging from 36 to 72 dBA L_{max}. The high maximum noise level during one of the measurements was caused by a pickup truck passing closely by on the adjacent unpaved road. Excluding the truck, noise levels during both measurements were similar and at the low end of the stated range.

Area IV South

Currently, no mining activities occur in Area IV South, and only a few scattered residences are present. No predominant noise sources exist in the area, and noise from the active mining areas in Area III is not readily audible in Area IV South. Two noise measurements were conducted in Area IV South, including the one referenced above as being just south of the southern boundary of Area IV North. That measurement (Site 1 with the pickup truck passing by) averaged 46-dBA L_{eq} with a maximum noise level of 72-dBA L_{max}. The other noise measurement in Area IV South (Site ST-1) averaged 35-dBA L_{eq} with a maximum noise level of 50-dBA L_{max}.

Outside Lease Boundary

One additional noise measurement was conducted over a mile to the east of the lease boundary outside Area III, near some residences. No predominant noise sources exist in the area and noise from the active mining areas in Area III was barely audible. Noise levels during this measurement (Site 11) averaged 44-dBA L_{eq}, with a maximum noise level of 65-dBA L_{max}. The higher average and maximum noise levels during the measurement were caused by a pickup truck passing by on the adjacent unpaved road. Excluding the truck, noise levels during the measurement were similar to those measured in Area V.

Sensitive Receptors

Some land uses are more sensitive to noise levels than others due to the amount of noise exposure (in terms of both time and insulation from noise) and the types of activities typically involved. Residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, auditoriums, and parks and outdoor recreation areas are more sensitive to noise than are commercial and industrial land uses. Workers at industrial and mining facilities are generally not included in discussions of noise-sensitive receptors, but are covered under worker protection programs, such as OSHA or MSHA regulations for noise exposure.

Several isolated single-family residences lie within the vicinity of the proposed mining disturbance of Area IV North; the closest residence is 4,500 feet away (refer to Figure 4.14-2). The noise observed at this location was measured at 46-dBA L_{eq} and 72-dBA L_{max} with the peak noise associated with a truck passing by in proximity to the residence. Three of the residences are within 1 mile of the edge of the disturbance area. Four additional residences lie within 1 mile of the mining disturbance of Area III. The nearest structure is approximately 3,880 feet north of Area III. Noise observed near this residence at Noise Monitoring Site No. 2 (see Table 4.14-3) was measured at 46 dBA L_{eq} with L_{max} at 56 dBA associated with dozers on Lowe Stockpile.

4.14.2.2 Four Corners Power Plant

Ambient Noise Levels

Primary noise sources in the area of the FCPP include the coal plant generating units, rail line, pump house, ash storage and processing equipment and appurtenances, and other associated facilities. Area I no longer has any coal extraction operations. Previous long-term noise levels measured approximately 700 feet from the coal plant, corresponding to the edge of the facility boundary, (Site LT-1) averaged 54-dBA L_{eq} with a maximum noise level of 78-dBA L_{max}, while a short-term noise measurement approximately 300 feet from the coal plant (Site 10) averaged 61-dBA L_{eq} with a maximum noise level of 64-dBA L (DOI and BIA 2007).

Sensitive Receptors

The FCPP generating units are located more than 1/2 mile from any sensitive land uses such as schools, hospitals, and convalescence homes. The nearest sensitive receptors are homes located greater than 1 mile from the FCPP. Noise from the FCPP is not detectable at this distance.

4.14.2.3 Transmission Lines

Ambient Noise Levels

The existing transmission system consists of seven transmission lines, the ROW renewals for four of which are connected actions, ranging in voltage from 230 to 500 kV transmitted from the FCPP to Arizona, California, New Mexico, and Texas (transmission of power from the FCPP to California will cease after APS purchases SCE's share of Units 4 and 5). Two types of noise are often associated with transmission lines, including noise from the transmission lines and towers, and noise from activities for routine inspection and maintenance of the facilities. The noise generated by routine maintenance is generally negligible. Transmission line noise, which includes corona, insulator, and Aeolian noise, can be generated throughout the transmission line route and is, therefore, more likely to affect sensitive receptors. Corona noise is the most common noise associated with transmission lines and is heard as a crackling or hissing sound. Corona is the breakdown of air into charged particles caused by the electrical field at the surface of conductors. This type of noise varies with both weather and voltage of the line, and most often occurs in conditions of heavy rain and humidity (typically >80 percent). An electric field surrounds power lines and causes implosion of ionized water droplets in the air, which produces sound. During relatively dry conditions, corona noise typically results in continuous levels of 40 to 50 dBA in close proximity to the transmission line, such as at the edge of the ROW (CPUC 2009). In many locations, this noise level is similar to ambient noise conditions in the environment. During wet or high humidity conditions, corona noise levels typically increase. Depending on conditions, wet-weather corona noise levels could increase to 50 to 60 dBA and could increase to over 60 dBA under some conditions (CPUC 2009). Insulator noise is similar to corona noise but is not dependent on weather. It is caused by dirty, nicked, or cracked insulators, and is mainly a problem with older ceramic or glass insulators. New polymer insulators minimize this type of noise. Aeolian noise is caused by wind blowing through the conductors and/or structures. This type of noise is usually infrequent and depends on wind velocity and direction. Wind must blow steadily and perpendicularly to the lines to set up an Aeolian vibration, which can produce resonance if the frequency of the vibration matches the natural frequency of the line (CPUC 2009). Existing noise along the transmission lines is expected to be similar to those measured at Sites ST-2 and ST-11 ranging from 34- to 44-dBA L_{eq} with a L_{max} of 65 dBA associated with maintenance activities (i.e., pickup trucks accessing the transmission lines from unpaved roads).

Sensitive Receptors

Numerous residences and other sensitive receptors, including parks, and schools, are located in close proximity (within 1/2 mile) to the transmission line ROWs. Because approximately 391 miles of transmission lines are being evaluated in this analysis, it is impractical to list each sensitive receptor along these lines. However, none of the sound levels produced by the transmission line-associated activities described above would be incompatible with these receptors.

4.14.3 Changes to Noise and Vibration Affected Environment Post-2014

Two completed federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions; and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared in the following Section. Neither of these completed federal actions would change the affected environment for noise and vibration.

4.14.4 Environmental Consequences

The EPA guideline for acceptable noise levels for sensitive receivers uses the 24-hour noise metric and sets a noise level of 55 dBA Day Night Average Noise Level ($L_{dn)}$ as the acceptable limit for outdoor use areas (EPA 1974). Because no other enforceable noise standards apply to the Project, the EPA-acceptable noise levels are used as the criteria for evaluating Project noise impacts.

The methodology for evaluating potential noise impacts from mining activities from the Project 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 the area of activity to the nearest residential dwellings.

Vibration impacts for this analysis are described based on the OSMRE Blasting Performance Standards contained in 30 CFR 816.61-68 (OSMRE 1986). A chart of the Blasting Criteria Level from the regulations is contained in Figure 4.14-1. To ensure that no adverse impacts occur from blasting operations, NTEC 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 showed 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 NTEC, along with standard vibration propagation rates to calculate potential vibration levels at the nearest residential dwellings to the planned blasting areas.

Thresholds of Significance

Impacts for noise are based on the 24-hour L_{dn} noise metric for activities that are performed during daytime and nighttime hours. As defined in Section 4.14.2, 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 pm and 7 am. Conversely, the 1-hour L_{eq} noise metric is an average over a shorter time period and does not include any penalties for nighttime noise. Thresholds used to evaluate potential noise and/or vibration impacts are based on applicable criteria; noise or vibration effects would be considered major if:

- Hourly sound levels from construction or mining activities reached 90 dBA at residences. No Federal, state, or local guidelines exist for construction noise or noise generated by mining operations. However, the Federal Transit Administration (FTA) has published a guideline that specifically addresses issues of community noise. This guideline recommends that hourly sound levels of 90 dBA at residential uses from construction noise, including pile driving, would be considered a major impact (FTA 2006). This metric is also applied to noise generated during mining operations.
- Vibration from short-term construction or long-term blasting activities at the mine would exceed 0.2 in/sec PPV at residential structures based on FTA guidelines.

- The 24-hour L_{dn} of 55 dBA were exceeded at residences. No Federal, state, or local guidelines regulate property line limits of power plants. However, the EPA (1974) guideline recommends that noise levels of 55-dBA L_{dn} at residential land use would be considered a major impact. This threshold differs from the hourly FTA (2006) threshold because this threshold is averaged over 24 hours.

4.14.4.1 Alternative A – Proposed Action

Navajo Mine

Noise levels and noise impacts from the Proposed Action are directly related to the operation of facilities and the number and types of heavy equipment being used for the specific activity. During the mining process, noise could be generated from a number of activities and equipment used. The typical mining steps utilized by NTEC are:

1. Vegetation removal (where it exists)
2. Topdressing removal (where it exists)
3. Drilling and blasting of overburden
4. Overburden removal using draglines and occasionally truck/shovel or truck/loader fleets
5. Drilling and blasting of the uncovered coal
6. Coal removal using frontend loaders and bottom-dump coal haul trucks
7. Drilling and blasting of interburden
8. Interburden removal using draglines and occasionally truck/loader fleets or dozers
9. Repeating Steps 5 through 8 for each mineable coal seam

The FHWA (2006) maintains the most comprehensive database of construction and heavy equipment source noise. The database was created in conjunction with the EPA and is widely used for highway and nonhighway projects.

Table 4.14-5 lists equipment noise source data and the quantity of equipment to be used in the Navajo Mine Permit Area 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 L_{eq}, which is calculated from the 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 (HDR 2012). Though not all equipment used in the existing Navajo Mine Permit Area would be used for the Pinabete Permit Area, this table identifies the maximum number of each piece of equipment that would be expected to be used.

Table 4.14-5 Equipment Source Noise and Quantity in the Pinabete 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	2
Track Dozers	82	40	13
Rubber Tire Dozers	82	40	2
Front-end Loaders, Large	79	40	7
Front-end Loaders, Small	79	40	4
Graders	85	40	6
Scrapers	84	40	3
Coal Haul Trucks	76	40	5
End Dump Haul Trucks	76	40	7
Mix Trucks	79	40	2
Water Trucks	76	40	4
Cable Reels	75	20	2
Locomotives (electric)	78	50	4
Rail Cars	65	50	42
Stemming Trucks	75	40	1

Source: FHWA 2006; OSMRE 2012a; HDR Engineering, Inc. 2012

The closest sensitive receptor to the Pinabete Permit Area (a private residence) is approximately half a mile from the mining operations. Vibration levels from surface mining operations are typically less than 0.10 to 0.20 in/sec at 10 feet from the source. Ground-borne vibration dissipates very rapidly with distance, reducing the typical mining-related vibrations to less than the threshold of 0.2 in/sec (PPV) at a distance greater than 10 feet from the source and to an imperceptible level at about 200 feet from the source—well before reaching the nearest residence a half mile away. Consequently, mining-related vibrations (except for blasting activities) would be less than the threshold of 0.2 in/sec (PPV) at the closest sensitive receptor. Therefore, impacts from ground-borne vibration were evaluated only for blasting activities.

Similarly, 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. The nearest residence is approximately half a mile from the edge of the proposed mining disturbance area. All residences within approximately 1 mile of the proposed mining disturbance area were evaluated for noise impacts and vibration impacts from blasting.

Mining Activities

Most activities under the Proposed Action fall under the general category of mining activities, which consist of a progression of activities described in Chapter 2, Current Operations. These activities would use most of the equipment listed in Table 4.14-5. 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 Tables 4.14-3 and 4.14-4.

The highest noise levels from mining activity would be associated with coal removal, producing an estimated maximum hourly noise level of 84 dBA L_{eq} at 50 feet from operating equipment. Vegetation and topdressing removal activities throughout the disturbance area would also produce an estimated hourly noise level of 82 dBA L_{eq} at 50 feet from the operating equipment. Overburden and interburden removal near the coal seams would produce an estimated hourly noise level of nearly 82 dBA L_{eq} at 50 feet from the operating equipment.

Impacts for noise are based on the 24-hour L_{dn} noise metric for activities that are performed during daytime and nighttime hours. 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 am to 7:00 pm. 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, when safety or equipment hazards 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 4.14-6 shows the calculated noise levels at each of the surrounding receivers, which are all residences, including the peak hourly daytime L_{eq} noise level, and the 24-hour L_{dn} noise level. The table also includes a determination of whether the noise level constitutes a noise impact based on the FTA guideline of 90 dBA for hourly noise and EPA guideline of 55 dBA L_{dn} or greater for 24-hour noise levels.

Table 4.14-6 Calculated Noise Levels and Impact Determination at Surrounding Residences for Mining Activities

Receiver Description	Distance and Direction from Permit Area Boundary	Hourly Noise Level (dBA L_{eq})	24-Hour Noise Level (dBA L_{dn})	Above Significance Threshold
Removal of Vegetation and Topdressing – Daytime Only Activity				
Nearest Residence - North	4,500 feet west	46.8	53.8	No
Nearest Residence - South	2,745 feet southeast	51.0	58	Yes
Blasting of Overburden, Interburden, and Coal* - Daytime Only Activity				
Nearest Residence - North	4,500 feet west	46.3	53.3	No
Nearest Residence - South	2,745 feet southeast	50.5	57.5	Yes

Receiver Description	Distance and Direction from Permit Area Boundary	Hourly Noise Level (dBA L_{eq})	24-Hour Noise Level (dBA L_{dn})	Above Significance Threshold
Drilling and Removal of Overburden and Interburden – Daytime and Nighttime Activity				
Nearest Residence - North	4,500 feet west	54.3	60.7	Yes
Nearest Residence - South	2,745 feet southeast	58.5	64.9	Yes
Removal of Coal – Daytime and Nighttime Activity				
Nearest Residence - North	4,500 feet west	50.6	57.0	Yes
Nearest Residence - South	2,745 feet southeast	54.8	61.3	Yes

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

At the closest receptor (residence approximately 2,745 feet southeast of the Pinabete Permit Area), noise level resulting from mining activities shown in Table 4.14-6, would range from 57.5 to 64.9-dBA L_{dn}, which would exceed the impact threshold of 55 dBA L_{dn}. As such, noise from the mining activities would result in short-term adverse impacts at this residence for the duration of mining activity in the nearby area.

Accordingly, the following measures are recommended to reduce noise and annoyance when operations are within approximately ½ mile (2,500 feet) of a receptor during Project activities:

- All equipment should be operated and maintained to minimize noise generation. Equipment and vehicles should be kept in good repair and fitted with “manufacturer-recommended” mufflers.
- Natural barriers such as vegetation curtains or soil berms should be installed where practicable at the boundaries of active mining operations within 1 mile of any occupied residence.
- Portable noise screens or enclosures to provide shielding for high-noise activities or equipment should be used as where practicable. The effectiveness of a barrier depends upon factors such as relative height of the barrier relative to the line-of-sight from the source of the receiver, the distance from the barrier to the source and to the receiver, and the reflections of sound. To be effective, a barrier must block the line-of-sight from the source to the receiver. A properly designed noise barrier can reduce noise as much as 20 dBA.
- Alternate methods of noise shielding are acceptable, if noise monitoring is conducted to verify that the 55-dBA level at the receptor site is achieved.
- Combine noisy operations to occur in the same period. The total noise produced would not be significantly greater than the level produced if the operations were performed separately.

As discussed above, no perceptible impact from ground-borne vibrations would occur from most of the mining activities. The possible exception would be ground-borne vibrations from blasting activities.

However, NTEC typically uses the scaled-distance equation contained in the OSMRE 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. With the implementation of these controls and because blasting does not occur at night, noise and ground-borne vibration impacts from blasting operations would be minor.

Transportation of Coal

The Proposed Action would involve using off-highway haul trucks to transport the coal from the Pinabete Permit Area along existing haul roads to the coal stockpiles in Area IV. As necessary, coal may be loaded from the Area IV stockpile onto trucks and hauled to Lowe Stockpile located in Area III. From the Area III stockpile, the coal would be loaded into the railcars and transported to the coal sizing and blending facility next to the FCPP. The noise evaluations for this Project component include both the continued use of the existing rail line and haul roads. The two closest residences are approximately 4,500 feet from the nearest haul roads. As shown in Table 4.14-7, noise levels from coal transportation were calculated to be approximately 53.9 dBA L_{dn}, which is below the impact threshold of 55 dBA L_{dn}. Therefore, the analysis indicates that no significance threshold would be exceeded and no adverse noise impacts from coal transportation activities would occur.

Table 4.14-7 Calculated Noise Levels and Impact Determination at Surrounding Residences for Coal Transportation

Receiver Description	Distance and Direction from Haul Roads	Hourly Noise Level (dBA L_{eq})	24-Hour Noise Level (dBA L_{dn})	Impact
Operation of Haul Road and Rail Line Extensions - Daytime and Nighttime Activity				
Nearest Residence - North	4,500 feet west	47.5	53.9	None
Nearest Residence - South	4,500 feet southeast	47.5	53.9	None

As described above, because ground-borne vibration dissipates rapidly with distance from the source and because the nearest residence is approximately 4,500 feet from the edge of the coal transportation area, impacts from ground-borne vibrations from the coal transportation activities would be minor.

Burnham Road Realignment

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 Project component includes the construction of the realigned Burnham Road.

Only one residence is located within 1 mile of the Burnham Road realignment. Noise level calculations were conducted for this receiver only. As shown in Table 4.14-8, 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, no major noise impacts from the realignment of Burnham Road would be expected.

Table 4.14-8 Calculated Noise Levels and Impact Determination at Surrounding Residences for Burnham Road Realignment

Receiver Description	Distance and Direction from Burnham Road Realignment	Hourly Noise Level (dBA L_{eq})	24-Hour Noise Level (dBA L_{dn})	Impact
Construction of Burnham Road Realignment – Daytime Only Activity				
Nearest Residence - South	2,310 feet south	47.7	46.2	None

Source: OSMRE 2012a

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, no major impact would occur from noise or ground-borne vibrations from the construction of the Burnham Road realignment.

Reclamation

Reclamation activities would involve much of the same equipment used during active mining operations described above. Therefore, the noise evaluation for the Project reclamation component 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 4.14-9, noise levels from reclamation activities were calculated to range from 54.0 to 58.2 dBA L_{dn} at the nearest residences. A noise level of 58.2 L_{dn} at the nearest residence would exceed the impact threshold of 55 dBA L_{dn}. Therefore, based on this analysis, reclamation activities would result in adverse noise impacts to nearby residents for the duration of activity. The same measures recommended above for mining activities are recommended to reduce noise levels and mitigate adverse effects during reclamation when in proximity to sensitive receptors.

Table 4.14-9 Calculated Noise Levels and Impact Determination at Surrounding Residences for Reclamation Activities

Receiver Description	Distance and Direction from Permit Area	Hourly Noise Level (dBA L_{eq})	24-Hour Noise Level (dBA L_{dn})	Impact
All Reclamation Activities – Daytime Only Activity				
Nearest Residence - North	4,500 feet west	47.0	54.0	None
Nearest Residence - South	2,745 feet southeast	51.2	58.2	Yes

Four Corners Power Plant

If the lease is amended, then APS would proceed with installing emission reduction equipment on Units 4 and 5; expanding the DFADAs within the existing power plant boundaries; and continuing operation of the independent switchyard and transmission lines. Primary noise sources in the area of the FCPP include the coal plant, rail line, pump house, and other associated facilities. Previous long-term noise levels measured approximately 700 feet from the coal plant (Site LT-1) averaged 54-dBA L_{eq} with a maximum noise level of 78-dBA L_{max}, while a short-term noise measurement approximately 300 feet from the coal plant (Site 10) averaged 61-dBA L_{eq} with a maximum noise level of 64-dBA L (DOI and BIA 2007). The nearest sensitive receptors are homes located greater than 1 mile from the FCPP. Noise from the FCPP is not detectable at this distance.

Expanding the DFADAs within the existing power plant boundaries would have no substantial effect on noise in the area. In addition, the future DFADAs are located further from nearby sensitive receptors than the existing DFADAs. As such, noise impacts from power plant operation would be minor.

Installation of the “hot side/high dust” SCRs between the boiler economizer and secondary air preheater on Units 4 and 5 would likely involve the installation of SCR component ductwork, construction of an ammonia loading and storage facility, installation of piping and electrical runs, erection of structural steel, and tie-in to the plant. The installation of the SCRs within the existing power plant would likely require the limited use of hand tools, power tools, and crane, which would not result in major increases in noise level in the area while Units 4 and 5 are operating. The shutdown of Units 4 and 5 during tie-in would temporarily decrease noise in the area. Therefore, noise impacts from installation of the SCRs would be minor.

Ground- and air-borne-induced vibration from the power plant operation does not affect the local area. As such, no vibration impacts would occur from the power plant operation.

Transmission Lines

No changes to noise produced by routine and other maintenance activities are expected with the continued transmission system operation. As such, no noise impacts would occur from continued operation and maintenance of the transmission system.

No vibration impacts would result from continued operation of the transmission lines.

4.14.4.2 Alternative B – Navajo Mine Extension Project

Navajo Mine

Under Alternative B, OSMRE would approve an alternative mine plan for the Navajo Mine to only include mining within Area IV South. Under this alternative, NTEC would seek a 5,412-acre SMCRA permit and proposed mining disturbance in approximately 4,998 acres. Mining would commence with the construction of a new boxcut near the western lease boundary and progress eastward in north-south orientated striplines. The mining block would be divided into a North Pit and a South Pit. NTEC would operate two draglines, one in each stripline. After the coal is exposed by the stripping operation, it would either be drilled and blasted or ripped by dozers before mining. Once the coal is broken up it would be mined by front-end loaders and haul trucks. Coal would be transported to a field coal stockpile on the western permit boundary, prior to being transported 8.4 miles to Lowe Stockpile in Area III via primary haul roads.

One occupied residence is located within the boundaries of Area IV South, approximately 2,000 feet from the proposed mining pit and topdressing stockpile and approximately 500 feet from the haul road. Under Alternative B, impacts to sensitive receptors would remain the materially the same as described for the Proposed Action for the mining and reclamation activities and for the operation of the FCPP and transmission system. Transportation of coal along the adjacent haul road would result in greater noise levels at the nearby residences.

Specifically, the closest residence within the Area IV boundary is approximately 500 feet from the nearest haul roads. As shown in Table 4.14-10, noise levels from coal transportation were calculated to be approximately 73.0 dBA L_{dn}, which is above the impact threshold of 55 dBA L_{dn}. Therefore, the analysis indicates that the significance threshold would be exceeded and adverse impacts from coal transportation activities would occur.

Table 4.14-10 Calculated Noise Levels and Impact Determination at Surrounding Residences for Coal Transportation – Alternative B

Receiver Description	Distance and Direction from Haul Roads	Hourly Noise Level (dBA L_{eq})	24-Hour Noise Level (dBA L_{dn})	Impact
Operation of Haul Road and Rail Line Extensions - Daytime and Nighttime Activity				
Nearest Residence	500 feet east	66.6	73.0	Yes

As such, noise from the transportation of coal along the designated haul road would result in long-term adverse impacts at this residence for the duration of mining activity in the nearby area. The same measures to reduce noise impacts as described for the Proposed Action are recommended.

Four Corners Power Plant

Under Alternative B, The BIA would approve the lease amendment for FCPP, and FCPP would operate as described under the Proposed Action, with the same noise-related impacts described above.

Transmission Lines

Under Alternative B, the transmission line ROWs would be approved, and they would continue to be operated and maintained as described under the Proposed Action, with the same noise-related impacts described above.

4.14.4.3 Alternative C – Alternative Pinabete Mine Plan

Navajo Mine

Under Alternative C, OSMRE would disapprove the Pinabete permit application and NTEC would seek approval from OSMRE for a new 10,094 acre SMCRA permit area, and proposed mining disturbance in approximately 6,492 acres. Mining would be located in both Area IV North and Area IV South, as described for the proposed action. Mining activities in Area IV North would continue existing striplines to the south. The Area IV South pit would be located southwest of the Pinabete Arroyo and would require a new boxcut to develop the pit. Once the boxcuts are complete, only two draglines would be needed, one in each pit.

Coal from the Area IV North pit would be hauled directly to the Lowe Stockpile in Area III for a distance of 3.7 miles. A field coal stockpile would be located in Area IV South and coal from the Area IV South pit would be hauled to this stockpile prior to being hauled the 8.4 miles to the Lowe Stockpile. Burnham Road would be realigned as described under the Proposed Action; however, the length of area that would be relocated would be 6.2 miles. In addition, approximately 15.1 miles of primary haul roads and 14.8 miles of ancillary roads would be constructed. In addition, NTEC would construct approximately 16.8 miles of powerlines extending the existing transmission lines from the Navajo Mine permit area to the new permit area.

Noise and vibration produced during the construction of the additional powerlines, haul roads, and ancillary roads would be similar to those described for the construction of Burnham Road. As such, construction of additional powerlines and roads would not materially increase the temporary noise impacts to the residents located east of Area IV South boundary from those described under the Proposed Action. Therefore, noise and vibration impacts to sensitive receptors would remain the same as described for the proposed action.

Four Corners Power Plant

Under Alternative C, the BIA would approve the lease amendment for FCPP, and FCPP would operate as described under the Proposed Action, with the same noise-related impacts described above.

Transmission Lines

Under Alternative C, the transmission line ROWs would be approved, and they would continue to be operated and maintained as described under the Proposed Action, with the same potential noise-related impacts as described above.

4.14.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action. Impacts would be the same as described for the Proposed Action.

Four Corners Power Plant

Under this alternative, the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The 10 percent reduction in surface area of the DFADAs would result in the same noise-related impacts as described for the Proposed Action. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

Under this alternative, the transmission line ROWs would be approved and they would continue to be operated and maintained as described for the Proposed Action. As such, impacts would the same as described for the proposed action.

4.14.4.5 Alternative E – No Action Alternative

Navajo Mine

Under the No Action Alternative, the Navajo Mine would close, the Pinabete Permit Area (Areas IV North and South) would not be mined, and Burnham Road would not be realigned. Mining in the Navajo Mine Permit Area (Areas III and IV North) would stop when the ROD is issued in 2015. Areas I and II, which are also part of the Navajo Permit Area, have already been reclaimed and no new mining would occur in these areas. Upon permit expiration, NTEC would begin reclamation activities in Areas III and Areas IV North. Reclamation activities would continue until OSMRE approval that all reclamation requirements have been met. It is expected that all reclamation would be completed by June 2021. All ancillary buildings and facilities (e.g., communication lines, railroad) would be removed and the land would be reclaimed according to OSMRE regulatory requirements. Accordingly, current noise or vibration levels at residential dwellings around Area IV North or Area IV South would not change. Impacts from existing mining activities 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.

Four Corners Power Plant

Under the No Action Alternative APS would shut down Units 4 and 5 in 2016 when the current lease expires and EPA BART rules go into effect. All units as well as the switchyards and facilities would eventually be decommissioned and dismantled. No noise impacts would result from the shutdown of the FCPP.

A decommissioning plan has not yet been prepared by APS. Decommissioning and dismantling activities would need to be coordinated with the Navajo Nation such that the area meets the specific needs of the planned reuse. In addition to the five units, decommissioning and dismantling would include removal of all three switchyards. In general, following shutdown, the units would be prepared for dismantlement, then the buildings and equipment would be dismantled, and the site would be remediated. The timeline for this process is not mandated in regulatory statutes and unknown at this time. Following shutdown of the Units in 2016, workforce at the FCPP would be reduced to just those needed for the decommissioning planning and implementation. APS would decommission all facilities that are not required or permitted to be left behind by the 1960 and 1966 leases. As such, decommissioning and dismantling activities would need to be coordinated with the Navajo Nation so that the area meets the specific needs of any planned reuse. Although APS has not yet prepared a decommissioning plan, any demolition activities would comply with all environmental laws and regulations applicable at the time, potentially including NEPA review.

Decommissioning would require environmental abatement activities in the power block, including removal of environmental and safety hazards (e.g., asbestos, lead paint), and chemicals and oils. All waste generated during this phase would be managed and disposed of in accordance with applicable federal environmental regulations. Dismantling and demolition would commence following the removal of asbestos, PCB, lead paint and any other hazardous chemicals. Upon removal of structures and facilities, the structural foundations would be removed to 24 inches below grade, the site profiled to allow for proper drainage, and native vegetation planted as applicable. In addition to the five units, decommissioning and dismantling may also include removal of all three switchyards. The timeline for this process is at the discretion of APS and the Navajo Nation. For noise and vibration, these activities would result in a short-term increase in ambient noise levels until all demolition activity is completed.

Transmission Lines

Under the No Action Alternative, the rights-of-way for the four subject transmission lines would not be approved. Since the subject lines primarily transmit power from the FCPP, if the FCPP is shut down under the No action Alternative, the power source for the transmission lines would be removed. The lines would either be decommissioned and dismantled or left in place. As with the FCPP, decommissioning and dismantling activities would need to be considered in a separate NEPA analysis and coordinated with the Navajo Nation and the BLM such that the area meets the specific needs of the planned reuse.

It has not been determined how power will be transported in the case that the FCPP does not continue operation through a Navajo Nation lease. In this case, a new transmission system would be required, which would be subject to a separate NEPA analysis because the transmission system has not yet been developed.

4.14.5 Noise and Vibration Mitigation Measures

The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific mitigating measures for certain environmental impacts, standard operating procedures that reduce or avoid environmental impacts, and best management practices for specific activities. These are described in Section 3.2.6.14. These measures are part of their application materials and are enforceable through permit or lease conditions. In addition, the Project Applicants must comply with additional protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section for each resource category. Where the environmental analysis in this EIS recommends additional protective measures, over and above the applicant proposed measures and regulatory compliance, they are listed below as specific mitigation measures.

The Proposed Action, including the continued operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects to noise and vibration. Therefore, no additional mitigation is recommended.

4.15 Hazardous and Solid Wastes

This section discusses the use, storage, disposal, and transportation of hazardous materials and hazardous wastes associated with the proposed Project. It also discusses the construction of new fly DFADAs at the FCPP. The section describes the procedures and programs in place, which when implemented properly ensure that hazardous materials and hazardous wastes are safely handled. Also included are emergency response procedures and levels of preparedness for each facility in the event of a spill or release. Accidental releases of materials and wastes are also discussed in this section including the capability to respond to an accidental release. The ROI for this section is the footprint of the Pinabete Permit Area, the FCPP including a 7.5-mile radius (radius of the anhydrous ammonia worst-case release scenario), and the transmission lines plus a ½-mile perimeter boundary.

This section also includes a discussion of CCRs, which currently are not regulated. The EPA is considering changes to the regulatory context of these materials, which have the potential to change the manner in which they are analyzed, classified as to type of waste, and stored. Since the disposal of CCR is subject to regulatory uncertainty, and has been a feature of the operations of the FCPP and Navajo Mine, a detailed description of the issues is included in a distinct subsection (Section 4.15.1.2), which provides a background for understanding subsequent discussions of CCR.

4.15.1 Regulatory Compliance Framework

4.15.1.1 Federal Regulations

Solid Waste Disposal Act/Resource Conservation and Recovery Act (RCRA) (42 U.S.C Part 6901 et seq)

RCRA is a federal program established to regulate solid and hazardous waste management. RCRA amends earlier legislation (the Solid Waste Disposal Act of 1965), but the amendments were so comprehensive that the act is commonly called RCRA rather than the Solid Waste Disposal Act. RCRA defines solid and hazardous waste, authorizes EPA to set standards for facilities that generate or manage hazardous waste, establishes a permit program for hazardous waste treatment, storage, and disposal facilities, and authorizes EPA to set criteria for disposal facilities that accept municipal solid waste. RCRA was last reauthorized by the Hazardous and Solid Waste Amendments of 1984. The amendments set deadlines for permit issuance, prohibited the land disposal of many types of hazardous waste without prior treatment, established criteria applicable to municipal solid waste landfills, and established a new program regulating underground storage tanks. 40 CFR Part 260 contains the regulations promulgated by the EPA to implement the requirements of RCRA as described above. Characteristics of hazardous waste are described in terms of ignitability, corrosivity, reactivity, and toxicity, and specific types of wastes are listed.

Asbestos Hazard Emergency Response Act (15 U.S.C. Part 52) and Clean Air Act (42 U.S.C. Part 7401 et seq)

The Asbestos Hazard Emergency Response Act provides a classification system for asbestos-containing materials and specifies training requirements for workers in contact with asbestos. The CAA establishes requirements for removal of asbestos-containing materials.

Toxic Substances Control Act (15 U.S.C Part 2601-2692)

This act includes requirements for the storage, use, cleanup, and disposal of polychlorinated biphenyl (PCB)-containing materials.

Spill Prevention, Control, and Countermeasure Rule (SPCC) (40 CFR Part 112)

The SPCC rule includes requirements for oil spill prevention, preparedness, and response to prevent oil discharges to navigable waters and adjoining shorelines. The rule requires specific facilities to prepare,

amend, and implement SPCC Plans. The SPCC rule is part of the Oil Pollution Prevention regulation, which also includes the Facility Response Plan rule. Both the NTEC Navajo Mine and FCPP store oil in quantities that require they have a SPCC Plan.

Risk Management Program

Under the authority of Clean Air Act Section 112(r), the Chemical Accident Prevention Provisions require facilities that produce, handle, process, distribute, or store certain chemicals to develop a Risk Management Program, prepare a Risk Management Plan, and submit the plan to EPA. Applicable facilities were initially required to comply with the rule in 1999, and the rule has been amended on several occasions since then, most recently in 2004. One of the listed chemicals covered under the Risk Management Program, liquid ammonia, may be used at the FCPP as part of the proposed SCR system. The different options for ammonia transport, use, and storage are addressed in this Section of the EIS.

Emergency Planning and Community Right-to-Know Act (42 U.S.C. Part 11001 et seq)

The Emergency Planning and Community Right-to-Know Act establishes requirements for Federal, state, and local governments, Indian tribes, and industry regarding emergency planning and "Community Right-to-Know" reporting on hazardous and toxic chemicals. The Community Right-to-Know provisions help increase the public's knowledge and access to information on chemicals at individual facilities, their uses, and releases into the environment. Under EPCRA and 40 CFR Parts 350-372, tribes can establish tribal emergency response commissions (TERCs), which are responsible for coordinating certain emergency response activities and can appoint tribal emergency planning committees (TEPCs).

Local emergency planning requirements, Section 302, require any facility that has any of the chemicals listed on the extremely hazardous substances list at 40 CFR Part 355 at or above its threshold planning quantity must notify the Tribal Emergency Response Commission within 60 days after they first receive a shipment or produce the substance on site.

Emergency notification requirements, Section 304, require facilities to notify the Tribal Emergency Response Commission if there is a release into the environment of a hazardous substance that is equal to or exceeds the minimum reportable quantity set in the regulations. This requirement covers the 355 extremely hazardous substances, as well as the more than 700 hazardous substances subject to the emergency notification requirements under CERCLA Section 103(a)(40CFR 302.4).

Hazardous chemical storage reporting requirements, Section 311, require facilities that have chemicals held above certain threshold quantities to send a list of these chemicals to the Tribal Emergency Response Commission. FCPP uses and stores chemicals on-site in threshold quantities that trigger Emergency Planning and Community Right-to-Know Act reporting. Navajo Mine and the transmission lines do not use or store chemicals on-site in threshold quantities that trigger reporting.

Toxic chemical release inventory, Section 313, requires EPA and the states to collect data annually on releases and transfers of certain toxic chemicals from industrial facilities and to make the data available to the public in the Toxics Release Inventory (TRI). States and communities, working with facilities, can use the information to improve chemical safety and protect public health and the environment. The TRI is a publicly accessible EPA database containing information on the disposal and other releases of over 650 toxic chemicals from more than 20,000 industrial facilities in the United States. TRI was established in 1986 by Section 313 of the Emergency Planning and Community Right-to-Know Act and later expanded by the Pollution Prevention Act of 1990. Facilities are required to submit data that meets TRI reporting criteria annually. One of the reporting categories is *on-site disposal to land*. A facility must report the volume of toxic chemicals as defined by EPA that has been disposed of via land disposal at their facility in any given year. The information is available online on the TRI website.

EPA has finalized a rule that provides tribal governments with more opportunities to fully participate in the TRI Program. This final rule primarily revisits EPA's July 26, 1990, action (55 Federal Register 30632),

which required facilities located on tribal lands to report to the appropriate tribal government official (as designated by the tribe) and EPA, instead of to the state and EPA.

Under this rule, facilities meeting TRI reporting requirements and located on tribal lands are required to submit TRI reports to EPA and the appropriate tribe, rather than to the state in which the facility is geographically located. The final rule also clarifies that a tribal chairperson or equivalent elected official has equivalent opportunities to a state governor to petition EPA to request (1) that individual facilities located on their lands be added to TRI and (2) that a particular chemical(s) be added to or deleted from the TRI chemical list. EPA determines whether to add a facility or add/delete a chemical to the TRI Program.

EPA's action is part of its ongoing efforts to increase tribal participation in the TRI Program and improve access to information on toxic chemical releases that affect the local communities on tribal lands. Through this final rule, EPA provides tribal governments with the right to directly receive release reporting information from facilities located on tribal lands and also explicitly clarifies the rights of tribal leaders to take an active role in the TRI Program through petitions to modify the toxic chemical list or requests to add a facility within their lands to TRI (EPA 2012j).

US Department of Justice, Bureau of Alcohol, Tobacco, and Firearms, and Explosives Regulations (27 CFR Subpart K)

These regulations include storage requirements to ensure the safe storage of explosives and the prevention of accidental explosions.

4.15.1.2 Coal Combustion Residues

The EPA is considering changes to the regulatory status of CCRs. As of the publication of this Draft EIS, EPA has not issued a final rule on this subject. Accordingly, this issue is described in detail in this Section in order to provide the public, agencies, and decision makers with the current state of knowledge on the topic, and the regulatory status.

When coal is burned as a fuel source, the solid by-products of the process are different types of ash collectively known as CCR, coal combustion residues, or in the mining industry, they are collectively known as CCBs. This EIS consistently refers to them as CCRs. The types of CCRs that are generated at the FCPP are fly ash, bottom ash, and FGD materials (predominantly calcium sulfate compounds):

- Fly ash is a product of burning finely ground coal in a boiler to produce electricity. Fly ash is removed from the exhaust gases primarily by electrostatic precipitators or baghouses and secondarily by wet scrubber systems.
- Bottom ash is composed of agglomerated coal ash particles that are too large to be carried in the flue gas. Bottom ash is formed in pulverized coal furnaces and is collected by impinging on the furnace walls or falling through open grates to an ash hopper at the bottom of the furnace.
- FGD material is produced through a process used to reduce sulfur dioxide emissions from the exhaust gas system of a coal-fired boiler. The physical nature of these materials varies from a wet sludge to a dry powdered material, depending on the process.

In addition, prior to burning, coal contains various metals and other contaminants. When coal is burned, these elements are concentrated in the ash that remains. Air quality controls such as FGD and SCR are designed to reduce the volume of these compounds emitted into air, which then concentrates them in the CCR.

CCR can be either wet or dry. The wet material can either be generated wet, such as FGD, or generated dry and water is then added to the dry material to transport or “sluice” the material through pipes to a surface impoundment or “pond.” In dry systems, CCR is transported in its dry form to landfills for disposal.

CCR can either be disposed of as waste, or it may be used in some capacity commonly referred to as beneficial use. The EPA encourages beneficial use of CCR rather than disposal. Examples of beneficial use are as a component in concrete, cement, gypsum wallboard, or as structural or embankment fill. Depending on market conditions and other cost factors, some of the CCR from the FCPP is transported off site as a beneficial use while the remaining CCR is disposed of in the on-site wet surface impoundment or dry ash landfill. Prior to 2008, some of the CCR generated at the FCPP was transferred to and used at the Navajo Mine site for mine backfill.

The two primary concerns related to disposal of CCR have to do with how it is stored after disposal. The first issue is the storage of wet CCR in ponds or impoundments. The wet coal ash is contained by earthen dams, and a breach or failure of the impoundment dam could result in a release of the wet CCR, which has environmental and public safety implications downstream of the release. An earthen dam contains the CCR impoundment at the FCPP and is regulated by the New Mexico Office of the State Engineer, Dam Safety Bureau.

The second concern is related to the metals and other compounds found in CCR. These metals are potentially toxic and have the potential to leach into the groundwater. Two factors increase this leaching risk from disposal units: the use of wet surface impoundments instead of dry landfills, and unlined disposal units have a higher risk of leaching than do disposal units with composite liners to prevent leaking and leaching.

Regulatory History of CCR

By far the largest waste stream currently generated and disposed of at the FCPP and in the past at the Navajo Mine is CCR. To appreciate the issues surrounding CCR disposal at the FCPP and in the past at the Navajo Mine, it is worthwhile to go through a brief overview of the long and sometimes complex history behind the current and proposed future regulations for disposal of CCRs.

The disposal of CCR has been controversial for many years, beginning as early as 1978 when the EPA first proposed hazardous waste management regulations. At that time, the EPA excluded the regulation of CCR from its final hazardous waste regulations until data regarding the materials' potential hazard to human health or the environment could be analyzed; this is known as the Bevill Exclusion. After performing a study on the potential for CCR to cause adverse effects to human health and the environment, the EPA published the required regulatory determinations, one in 1993 and one in 2000 (EPA 1993; EPA 2000) and both times continued to exempt CCR from being regulated as a hazardous waste. However, in the 2000 determination (EPA 2000), EPA stated that national regulations under Subtitle D were needed for CCR disposal in landfills and surface impoundments because of new data about the potential risks to human health and the environment (EPA 2010a) and because of EPA's concerns about the adequacy of state regulatory programs (DOE and EPA 2006).

In 2008, in response to an ash dike rupture at a coal ash impoundment at the Tennessee Valley Authority's facility in Kingston, Tennessee, the EPA reexamined its previous determination that CCR should not be regulated as a hazardous waste. The EPA cited findings and analyses from a revised risk assessment and an updated documentation of damages from CCR management practices and ultimately proposed to list the material as a hazardous waste (EPA 2009a). The final draft proposal, published on June 21, 2010 (EPA 2010b), proposes two regulatory options for consideration. Under the first option, EPA would draw on its existing authority to list a waste as hazardous and regulate it. The second option would keep the Subtitle C exclusion in place, but would establish national criteria applicable to landfills and surface impoundments under RCRA's Subtitle D nonhazardous solid waste requirements (EPA 2010b).

In October 2012, the EPA announced that the final rule would be delayed due to new data and the subsequent need to complete revisions of toxicity characteristics and toxicity characteristic leaching procedures (EPA Test Method 1311 – Toxicity Characteristic Leaching Procedure). The EPA is considering a new series of tests that would replace existing leaching testing; the new methods are known as the Leaching Environmental Assessment Framework (Kosson 2011).

Mine Disposal of Coal Combustion Residue

As with the disposal of CCR in surface impoundments and landfills, placement of CCR in mines (called CCB by the mining industry) has been somewhat controversial. Although SMRCA requirements are not specific to the unique nature of CCRs, the placement of CCR is covered under SMRCA requirements. Recently, efforts have addressed this and other discrepancies, and EPA and OSMRE have held meetings to collect and analyze technical and regulatory information related to mine filling of CCR. The National Academy of Sciences issued a report on the placement of CCRs in coal mines (NRC 2006). The NRC recommends that OSMRE take the lead in developing standards under SMCRA. EPA is working with OSMRE as they amend the SMCRA regulations to better address mine filling in active coal mines. Specific study of the placement of CCR in Navajo Mine has not identified adverse effects, and is summarized in Section 4.5.2.1.

Regulation of Coal Combustion Residue at the FCPP

CCR is regulated under RCRA Subtitle D, which establishes a framework for Federal, state, and local government cooperation in controlling the management of nonhazardous solid waste. The Federal role in this arrangement is to establish the overall regulatory direction, by providing minimum nationwide standards for protecting human health and the environment, and for providing technical assistance to states for planning and developing their own environmentally sound waste management practices. The actual planning and direct implementation of solid waste, however, remains a state and local function, meaning the EPA has a minor role in the planning and direct implementation of solid waste programs under RCRA Subtitle D. RCRA requires EPA to establish guidelines for state solid waste plans and criteria for the operation of solid waste landfills but does not specifically establish a Federal solid waste permit program in the absence of a state program.

However, state programs generally do not apply on tribal land. RCRA defines tribes as “municipalities;” therefore, tribal governments are ineligible to be treated as states. As a result, EPA has no authority to require, operate, or enforce solid waste programs for tribes; EPA can only assist tribes in developing solid waste programs under their own tribal sovereignty (Rosser 2010). Accordingly, CCR disposal for the FCPP has no direct regulatory oversight. The FCPP has no permitting process, waste characterization, groundwater monitoring, leachate collection system, dust control management, agency inspections or closure requirements specific to the ash disposal sites. APS does voluntarily monitor groundwater throughout the DFADAs, and has not identified adverse effects (Section 4.5.4.1). Through the Title V Air Permit, APS is required to and does have a Dust Control Management Plan, which includes the ash disposal sites. New Mexico State Dam Safety regulates the dam for the ash impoundment, which they periodically inspect.

In the future, it is anticipated that the EPA proposed regulations will be based either on Subtitle D (non-hazardous) or Subtitle C (hazardous). If EPA regulates CCR through Subtitle C, then EPA would enforce the regulations. If EPA regulates CCR through Subtitle D, then the authority to implement the regulations would be at the state level, which would not apply on tribal lands.

Regulation of Coal Combustion Residue at Navajo Mine

Historic placement of CCR at the Navajo Mine from Units 4 and 5 (between 1971 and 2008) was permitted under the Navajo Mine SMRCA permit and regulated by OSMRE and was implemented subject to specific performance standards. Disposal of CCR from FCPP ceased in 2008 and there is currently no CCR placement at the Navajo Mine or Proposed Pinabete Mine Lease Areas, nor is there any planned CCR placement in these areas. Specific studies of the nature of CCR at Navajo Mine have not identified adverse effects, and are summarized in Section 4.5.2.1.

4.15.2 Affected Environment Pre-2014

4.15.2.1 Navajo Mine

Hazardous Materials

The types and quantities of hazardous materials stored on the Navajo Mine Lease Area are minor, and they are below the levels that require reporting under the Emergency Planning and Community Right-to-Know Act Section 313 (BNCC 2012h).

Programs are in place at the Navajo Mine that address hazardous materials storage locations, emergency response procedures, employee training requirements, fire safety, first-aid/emergency medical procedures, and hazardous materials release containment control procedures (BNCC 2011d; BNCC 2012h; OSMRE 2012a).

The purpose of these programs is to ensure proper management of these materials and to specify how personnel would respond to any unplanned release of hazardous materials to the air, soil, or surface water. This response includes notifying the proper authorities of the release, controlling and cleaning up the release, and restoring the environment as required. A table with a list of plans that address hazardous materials handling and the health and safety aspects of hazardous materials and waste is included in Section 4.17, Human Health and Safety.

BNCC has implemented a SPCC Plan for Navajo Mine. The objectives of the SPCC Plan are to prevent the discharge of oil products and to perform safe, efficient, and timely response in the event of a spill or leak. The SPCC Plan covers all facilities that could reasonably be expected to discharge oil into, or upon, navigable waters. The majority of oil used at the Navajo Mine is stored at the Navajo North Industrial Complex and the Area III Industrial Facility. Petroleum storage tanks larger than 55 gallons have concrete secondary containment structures that are designed to handle 110 percent of the storage volume plus the precipitation volume of a 25-year/24-hour storm event occurring within the containment structure. Secondary containment is not provided for mobile refueling vehicles in areas where NTEC staff are present, and the maximum amount of time before a discharge would be detected is less than 24 hours. NTEC staff monitors and inspects the oil tanks, piping, and appurtenances and associated secondary containment structures. If the secondary containment structures need to be drained, the contents are transferred to used oils storage tanks or temporary storage containers for proper handling and disposal (BNCC 2012i).

Waste Material

The types of wastes NTEC produces can generally be categorized into three different waste types: hazardous waste (including universal waste), special waste, and recyclable materials/nonhazardous waste. All wastes and materials are inventoried and managed according to their types, regulatory requirements, and disposal. The only treatment that takes place on site is the bioremediation of petroleum-contaminated soils (BNCC 2012i).

The Navajo Mine operates a waste storage facility at the Area III Industrial Complex for the temporary storage of wastes before they are transported off site. Nonhazardous wastes are stored in dumpsters at designated areas around the mine site and transported by a third-party contractor to San Juan County Regional Landfill or other permitted solid waste landfill for disposal. Hazardous and universal wastes (e.g., aerosols, antifreeze, paint and related materials, and batteries) and special wastes (e.g., absorbents, rubber hoses, used oil filters, and railroad ties) are accumulated, managed, and disposed of in accordance with applicable EPA and Department of Transportation regulations (BNCC 2012i).

Explosives and Ammonium Nitrate and Fuel Oil (ANFO) Storage

Explosives and ANFO are stored in specially designed facilities within the Navajo Mine SMCRA permit area. Explosives (e.g., primers, blasting cords, delays, boosters) are stored in a facility built in accordance with US Department of Justice, Bureau of Alcohol, Tobacco, Firearms, and Explosives regulations (27

CFR Subpart K). A typical ANFO facility has ammonium nitrate silos, diesel fuel storage tanks, and silos for emulsion blasting products. Both the explosive and ANFO storage facilities are designed with proper drainage and sedimentation control to minimize surface runoff from leaving the facility and entering the waterways (BNCC 2012h).

Historic CCR Placement

The SMRCA permit for the Navajo Mine provided performance standards for placement of CCRs, which were used as partial mine backfill between 1971 and 2008. The performance standards required physically characterizing the ash, covering the ash with three meters of spoil, prohibiting ash placement beneath large drainages, and performing required reclamation on the affected areas, including installing erosion control measures and returning the land to the pre-mine topographic relief. The precautionary measures were designed to prevent the ash from being exposed on the ground and to prevent plant roots and surface water from directly coming into contact with the buried ash. Due to the arid environment of northwestern New Mexico and the absence of any significant groundwater, ash placement was in dry pits and ramps.

Surface cover above the DFADAs was designed with positive drainage away from the ash disposal locations and to avoid any puddling, sheet flow, or other collection of water above or adjacent to these disposal areas. This design specification has kept most of the permanent program and interim DFADAs unsaturated, which can be verified from the monitoring well data. In addition, all post-mining drainages that intersected a DFADA were modified to flow across the DFADA at approximately right angles to the long axis of the disposal site to minimize potential infiltration of surface waters into the ash. This design specification limits the amount of contact time that running water has with the surface over ash-deposit reclaimed areas.

Navajo Mine monitors a suite of groundwater wells in a historic, pre-SMRCA CCR placement area (Bitsui and Watson pits) that has become water-saturated due to NAPI activity adjacent to the area. It is important to note that placement of CCRs in this area occurred not only prior to SMCRA but prior to NAPI activities. The influence of NAPI activity in the area has raised groundwater tables and increased surface water movement contributing to the saturation level of the buried CCRs. Groundwater monitoring data of all the DFADAs are discussed in Section 4.5.2.1.

Prior to SMCRA, groundwater sampling and analysis was not required, therefore there are no data available for the historical DFADAs. As part of EPA's TRI Program, BNCC is required to self-report releases to land. The TRI is a publicly-accessible EPA database containing information on the disposal and other releases of over 650 toxic chemicals from more than 20,000 industrial facilities in the United States. Table 4.15-1 includes the TRI Chemicals as defined by EPA reported by BNCC as on-site land disposal releases. Based on the report, a mass balance calculation was used by BNCC to derive the volumes listed in the table.

Table 4.15-1 Navajo Mine On-site Land Disposal Releases of Toxic Release Inventory Chemicals excluding Dioxin and Dioxin-like Compounds (Measured in Pounds)

Compound	2008	2007	2006	2005	2004	2003	2002
Arsenic	NR	NR	NR	NR	NR	8500	7100
Barium	9,197	937,940	1,012,638	1,078,881	975,787	1,300,000	1,100,000
Beryllium	NR	10,006	10,791	11,478	10,340	14,000	12,000
Chromium	NR	43,240	45,792	47,874	44,936	57,000	49,000
Cobalt	NR	12,312	13,237	13,728	12,877	18,000	15,000
Copper	NR	82,861	89,481	95,102	79,771	108,000	89,000
Lead	670	70,337	75,811	80,667	73,560	100,000	83,000

Compound	2008	2007	2006	2005	2004	2003	2002
Manganese	NR	142,311	153,095	162,054	152,551	206,000	170,000
Mercury	NR	257	265	309	315	490	410
Nickel	NR	36,791	38,216	39,630	37,627	45,000	40,000
Selenium	NR	7,953	8,820	11,757	10,553	15,000	12,000
Vanadium	NR	123,697	133,601	142,214	135,142	180,000	150,000
Zinc	NR	59,332	63,859	68,161	61,143	84,000	69,000
Thallium	NR	5,835	10,189	10,428	9,344	12,000	9,500
Totals	**9,867**	**1,532,872**	**1,655,795**	**1,762,283**	**1,603,946**	**2,147,990**	**1,806,010**

Source: USEPA 2012a

NR = Not Reported

4.15.2.2 FCPP

The discussion of the FCPP use and storage of hazardous materials includes data with all of the five units operating. APS shut down Units 1 through 3 on December 30, 2013 in compliance with the EPA FIP that specifies BART for the power plant. As such, the volumes of hazardous materials described in this section decreased, as the continued operations of FCPP was reduced to only Units 4 and 5.

Hazardous Materials

Programs are in place at the FCPP that address hazardous materials storage locations, emergency response procedures, employee training requirements, fire safety, first-aid/emergency medical procedures, and hazardous materials release containment control procedures (APS 2012d).

For chemical spills and emergencies, the FCPP response procedures are outlined in the Station Fire/Emergency Contingency Plan (APS 2012d). Small spills are fully managed by FCPP employees. If spills are larger or have significant risk, the FCPP would contract with cleanup vendors for spill cleanup. As described in the Station Fire/Emergency Contingency Plan, the on-shift fire crew chief in charge of the incident would determine whether additional offsite support is required. Oil spill contingency and cleanup procedures are outline in a site-specific SPCC Plan. Procedures for proper handling of hazardous materials and wastes are detailed in Section 4.17, Health and Safety.

Table 4.15-2 is a list of the hazardous materials stored at the FCPP. Although many of the materials are stored in a central warehouse, others are staged at various locations throughout the FCPP in smaller quantities for use.

Table 4.15-2 FCPP Hazardous Materials Inventory

Chemical	Container Types	Max Quantity On Site (pounds)
Abrasives-Ferric Oxide/Silica Amorphous Hydrated and Coal Slag	Silos, steel drums and bags	10,000-99,999
Acrylate CoPolymer, AS 7320	Aboveground tank and tote bin	10,000-99,999
Aliphatic and Paraffinic Hydrocarbon Solvent	Bag, silo, tank wagon	10,000-99,999
Aluminum Oxide	Tank inside building, steel drum	10,000-99,999
Anion Exchange Resin DOW 550A	Tank inside building, fiber drum	10,000-99,999

Chemical	Container Types	Max Quantity On Site (pounds)
Aqua Ammonia	Aboveground tank, tank inside building, plastic or metallic drum	10,000-99,999
Asbestos	Bag, other	10,000-49,999
Calcium Hydroxide	Aboveground tank, tank inside building, tank wagon	10,000-49,999
Calcium Hypochlorite	Plastic or metallic drum	10,000-99,999
Calcium Oxide	Silo, tank wagon	10,000-49,999
Calcium Silicate, Mineral Wool (fiberglass)	Bag, box, other	1,000,000-9,999,999
Cation Exchange Resin DOW 650C	Tank inside building, fiber drum	1,000,000-9,999,999
Cement-Based Concrete	Bag	10,000-99,999
Coal and Coal Dust	Silo, other	10,000,000-99,999,999
Coal Bottom Ash	Silo, other	1 billion+
Coal Fly Ash and Cenosphers	Silo, tank wagon, other	1 billion+
De-Icer Compound	Bag, other	100,000-999,999
Di-Ammonia and Tetra-Ammonium EDTA	Bag, tank wagon	10,000-99,999
Dielectric Oil	Steel drum, other	1,000,000-9,999,999
Diesel Fuel No. 1 and 2	Aboveground tank, tank wagon, can	100,000-999,999
DMC 550 Road Stabilizer and Dust Suppressant	Tote bin	100,000-999,999
Emulsified Sulphur 70%	Aboveground tank, tank wagon	10,000-99,999
Gasoline (Note: an EHS)	Aboveground tank, can	10,000-99,999
Gear Oil	Tote bin, plastic bottle or jug	10,000-99,999
High Temp Lubricant Almasol 1250	Can	10,000-99,999
Hydrazine Solution 35% (Note: an EHS)	Tank inside building, tote bin	10,000-99,999
Hydrochloric Acid	Tank wagon, tote bin, metallic or plastic drum	10,000-99,999
Hydrogen Compressed	Aboveground tank, tank wagon, other	1,000-9,999
Isoparafinic Petroleum Distillate Flocculent	Tote bin	10,000-99,999
Sulfuric Acid 25%	Aboveground tank, tank inside building, plastic or metallic drum	10,000-99,999
Linear Alkyl Sulfonate (Dustreat DC6109)	Aboveground tank	10,000-99,999
Liquid Cationic Polymer (AS-222)	Aboveground tank, tank inside building, tank wagon	10,000-99,999
Lubrication Grease (Dynalite L-LEP-No. 2)	Cans	10,000-99,999
Magnesium Oxide	Silo, tank wagon	100,000-999,999

Chemical	Container Types	Max Quantity On Site (pounds)
Organophosphoric Acid Corrosion Inhibitor	Tote bins, plastic drums	10,000-99,999
Propane	Aboveground tank	1,000-9,999
Refractory Cements	Bags	10,000-99,999
Silica Sand, Crystalline Silica	Aboveground tank, bags	10,000-99,999
Sodium Hydroxide	Aboveground tank, tank inside building, plastic or metallic drum	100,000-999,999
Sulfur Hexafluoride	Cylinder, other	10,000-99,999
Sulfuric Acid – 93% (Note: an EHS)	Aboveground tanks, plastic drums	100,000-999,999
SURTAC 2000 Lubrication Oil	Tanks, tote bins, tank wagon	10,000-99,999
Turbine Lubrication Oil	Aboveground tank, tank inside building, tote bin	100,000-999,999

Source: APS 2012d

Hazardous Waste

To ensure proper storage and disposal of hazardous waste, the FCPP maintains a Hazardous Waste Management Plan (APS 2012d). The plan includes the specific requirements associated with identification, storage, and disposal of hazardous wastes. Under normal operating conditions, the FCPP is a Conditionally Exempt Small Quantity Generator because it generates less than 220 pounds of non-acute hazardous waste per month and has an on-site accumulation of less than 2,200 pounds of non-acute hazardous waste at any time.

Hazardous waste at the FCPP is stored in a centralized location prior to off-site disposal. In addition to the Hazardous Waste Staging Area, hazardous waste is staged at satellite locations near points of waste generation. Waste containers at the satellite locations are placed on the pavement or concrete, or inside buildings to minimize the risk if spilled. Documented inspections of both the staging area and the satellite areas are performed weekly (APS 2012d). Table 4.15-3 identifies the FCPP hazardous/nonhazardous waste inventory, excluding CCRs.

Table 4.15-3 FCPP Hazardous/Nonhazardous Waste Inventory (excluding CCR)

Waste Name	Quantity Generated (Annual)	Disposal Method/Location	Transportation
RCRA Nonhazardous Waste (not including CCR)	705 tons	Subtitle D Landfill/Waste Management	Waste Management Transporter
Hazardous Waste (Hydrazine Bead Blast, Silver Plating, Paints/Coatings)	2.5 tons	RCRA Permitted Incinerator/Landfill/Clean Harbors	Transporter with EPA ID
Used Oil	44,000 gallons	Burned for energy recovery/FCPP	Burned on site
Construction Debris	Varies	Landfilled/DFADA (historically in the Gridded Disposal Area)	Landfilled on site
Universal Waste (lamps, batteries, mercury containing equipment)	550 pounds	Recycle/Veolia	Transporter with EPA ID

Waste Name	Quantity Generated (Annual)	Disposal Method/Location	Transportation
Electronic Components	11 tons	Recycle/Veolia	Transporter with EPA ID
Friable Asbestos	31 tons	Subtitle D Landfill/Painted Desert Landfill, Holbrook, AZ. Note: Until approximately 1998, asbestos was landfilled on site in the Gridded Disposal Area	Truck
PCB Ballasts	10 pounds	PCB Permitted Landfill/Veolia	Transporter with EPA ID
Petroleum-Contaminated Soil	Variable	Permitted Land Farm/Enviro Tech	Truck

Source: APS 2012d

Ongoing Investigations

During a 2011 field investigation conducted at the FCPP for Southern California Edison Company, soil and groundwater impacted by diesel fuel was discovered in the vicinity of the Garage Fueling Area. The 2011 investigation reported that soil samples collected near the current fueling area “contained concentrations of TPH ranging from 230 mg/kg to 6,400 mg/kg”, and that the groundwater grab sample “contained 170 mg/l of TPH”. The investigation concluded that it is likely that a release of diesel fuel and oil to the subsurface has occurred in the vicinity of the active Garage Fueling Area. As a result of the investigation, a Monitor Well Installation, Soil and Groundwater Sampling Plan was developed for this area. The investigation is ongoing (Mongollon Environmental Services LLC 2013).

Inactive Ash Impound Areas

A figure of the ash impoundment areas is included in Section 3 as Figure 3-2. Ash Ponds 1 and 2 were constructed in the 1960s by erecting a dike on existing ground downstream from the power plant. Ash slurry was allowed to flow through existing washes until it was captured by the dike. The ash ponds were not lined and contain an average depth of approximately 24 feet of ash. Ash Ponds 1 and 2 were taken out of service when Ash Pond 3 was constructed in 1976.

In the late 1970s, Evaporation Ponds 1 through 4 were constructed on top of Ash Ponds 1 and 2. The Evaporation Ponds were constructed with a single liner of 20-mil HDPE and a 1-foot layer of earth and gravel fill placed over the liner on the sides of the ponds. The evaporation ponds were used for storage of seepage intercept water, runoff, and other industrial water from the FCPP. A phase-out of the evaporation ponds began in 2001. As of October 2011, the evaporation ponds are no longer in use.

Ash Pond 3 is currently inactive and was used as an impoundment for the fly ash and FGD solids from Units 1, 2 and 3. The Lined Decant Water Pond (LDWP) was built over Ash Pond 3 and is lined with two layers of HDPE geosynthetic liner. It is intended to collect and retain liquid decanted from the Lined Ash Impoundment (LAI). Ash Pond 4 was constructed adjacent to Ash Pond 3, and Ash Pond 5 was constructed adjacent to Ash Pond 4. Both Ponds 4 and 5 were used as impoundments for the fly ash and FGD solids from Units 1, 2, and 3 but are currently inactive.

Ash Pond 6 is located on the northwestern side of the DFADA and was used to impound the fly ash and FGD solids from Units 1, 2, and 3, but is currently inactive. Ash Pond 6 was designed in 1984 and constructed shortly thereafter. The North Embankment of Ash Pond 6 is adjacent and parallel to the

northern lease boundary of the site. Ash Pond 6 is constructed with a clay core embankment that has been keyed into the unweathered shale bedrock.

Gridded Disposal Area

The Gridded Disposal Area is currently inactive. It was used for disposal of asbestos-containing materials up until 1998. It also received coal dust and ash from FCPP cleanup activities, lime grit, and construction and other industrial debris until 2010. In 1984, a portion of the Gridded Disposal Area was used to land farm oil/solvent-contaminated soil as a method of remediation.

Active Ash Disposal Areas

The LAI and LDWP are the only active CCR impoundments (ponds) on site. The DFADA is an active, lined landfill facility that was constructed in 2007 and is used for disposal of dry fly ash from Units 4 and 5 as well as small amounts of construction debris.

In the future, Units 4 and 5 FGD waste will be dewatered and placed in the DFADA. DFADA Site 1 is tallest on the West Berm, approximately 110 feet above natural grade. DFADA Site 2 utilizes a composite liner system. DFADA Sites 1 and 2 are projected to reach capacity by 2016. Therefore, additional DFADA sites will be needed in the future to accommodate dry fly ash/FGD disposal through 2041.

Details of the current wet ash disposal system including all of the system components are included below in Table 4.15-4.

The ash disposal areas are operated in accordance with an Operations and Maintenance Manual that has been reviewed by the New Mexico Office of the State Engineer. Daily inspection rounds are performed of the entire ash pond facilities by operations staff to observe the general condition of structures and embankments. Identified deficiencies are documented and repaired. Maintenance of the two impoundments is performed by APS staff under the guidance of APS managers and engineers. Instrument readings are reported twice annually to the New Mexico Office of the State Engineer. Inspections are made every 6 months by APS engineers and on an irregular annual to multi-year schedule by New Mexico OSE personnel (GEI 2009).

Table 4.15-4 Wet Ash Disposal System Components

Name	Description	Year in Service	Wastes Disposed
Lined Ash Impoundment (LAI)	The LAI is constructed on top of the old ash impoundments #3 and #4. The LAI's dikes are constructed of compacted clay material, in accordance with dam construction specifications approved by the New Mexico Office of the State Engineer, Dam Safety Bureau. The dikes are built on top of the clay dikes used for old ash impoundments #3 and #4. The LAI is constructed with a 60-mil HDPE liner that lines the entire impoundment area, including the dikes.	Commissioned in 2003 (in-service). Expanded in 2007	(1) Fly ash; (2) bottom ash; (3) boiler slag; (4) flue gas emission control residuals; and (5) other, boiler acid cleaning waste, treated sewage, chemical metal cleaning wastes, air pre-heater wash, co-disposal waste, turbine foam cleaning waste, and stack flue gas residues.
Lined Decant Water Impoundment (LDWP)	The Lined Water Impoundment is constructed on top of the old ash impoundment #3. The Lined Water Impoundment's dikes are constructed of compacted clay material in accordance with dam construction specifications approved by the New Mexico Office of the State Engineer, Dam Safety Bureau. The dikes are built on top of the clay dikes used for old ash impoundment #3. The Lined Water Impoundment is constructed with two 60-mil HDPE liner layers that line the entire impoundment area, including the dikes. The second HDPE liner barrier also includes a leak detection system. The Lined Water Impoundment contains no solid ash material and is not an ash management unit.	Commissioned in 2003 (in-service)	Flue gas emission control residuals and other – blow dust/dirt.
Upper Retention Sump	The Upper Retention Sump is a below-grade compacted soil cement basin that is part of the generating Units 4 and 5 sulfur dioxide scrubber system. It is used for temporary surge capacity of coal combustion products and FGD materials from the normal waste disposal processes of the scrubbers. The material in the basin is returned to the generating Units 4 and 5 thickener equipment and then sent to the LAI.	Commissioned in 1984 (in-service)	Flue gas emission control residuals and other – scrubber area washdown, dirt, and coal dust.
Low-Volume Wastewater System Decant Cells	The Low-Volume Wastewater System Decant Cells are below grade cells constructed with engineered fill (bottom ash placed on top of clay material). Each of the three cells contains floor drains (French type drains) to decant water from the solids contained in the FCPP's low-volume wastewater system. The decant cells help remove solids from the low-volume wastewater, prior to the water entering the Low-Volume Wastewater Pond.	Commissioned in 2004 (in-service)	Fly ash, bottom ash, flue gas emission control residuals and other – boiler blowdown, back pass boiler washdown, metal cleaning waste, coal dust, dirt, de minimus lubricants, demineralizer regeneration waters, stormwater, corrosion and flocculent chemicals, and potable water flushings.
Low-Volume Wastewater Pond	The Low-Volume Wastewater Pond is a below-grade water treatment pond. The pond allows solids in the water to settle, for later dredging (prior to the water flowing back into the FCPP's cooling lake).	Commissioned in 1979 (in-service)	Fly ash, bottom ash, flue gas emission control residuals and other – boiler blowdown, back pass boiler washdown, metal cleaning waste, coal dust, dirt, de minimus lubricants, demineralizer regeneration waters, stormwater, corrosion and flocculent chemicals, and potable water flushings.

Due to the absence of regulatory oversight for CCR disposal, no sampling or testing data are available for either the active or inactive DFADAs. As part of EPA's TRI Program, APS is required to self-report releases to land disposal. Table 4.15-5 includes the TRI chemicals reported by APS as on-site land disposal releases. Based on the report, APS used a mass balance calculation to derive the volumes listed in the table.

Table 4.15-5 FCPP On-site Land Disposal Releases of Toxic Release Inventory Chemicals excluding Dioxin and Dioxin-like Compounds (Measured in Pounds)

Compound	2011	2010	2009	2008	2007	2006
Barium	2,074,802	2,104,979	2,367,918	2,048,044	1,115,508	965,700
Beryllium	22,050	22,361	25,149	21,791	11,800	10,060
Chromium	151,509	105,108	93,192	82,842	47,000	71,580
Cobalt	26,223	26,589	29,861	25,855	14,000	12,072
Copper	182,390	184,870	207,839	180,212	98,000	84,500
Lead	155,776	157,803	177,680	154,973	84,000	72,083
Manganese	341,920	323,025	350,156	306,124	168,212	150,940
Mercury	851	850	993	462	203	219
Nickel	72,827	65,185	66,775	60,167	25,000	27,190
Selenium	19,770	20,111	22,600	19,196	111,600	10,056
Vanadium	273,728	277,508	311,986	269,907	146,783	130,750
Zinc	130,611	132,459	148,841	128,572	69,935	60,360
Thallium	NR	NR	NR	NR	NR	8,662
Totals	3,452,457	3,420,848	3,802,990	3,298,145	1,792,041	1,595,510

Source: USEPA 2012k.

NR - signifies nothing reported for this facility.

Dam Safety

As part of the EPA's ongoing effort to assess the management of CCR, they performed a dam safety assessment of the coal impounds at coal-fired power plants throughout the US. As part of that effort, on May 19 and 20, 2009 a site assessment of the dam safety of FCPP's LAI embankment dam and LDWP was performed.

The assessment was completed by contractors who are specialists in the area of dam integrity. The report for the assessment reflects the professional judgment of the engineering firm, and is signed and stamped by a professional engineer. The report is based on a visual assessment of the site, interviews with site personnel, and the review of geotechnical reports and studies related to the design, construction, and operation of the impoundments. The engineering firm also reviewed past state/Federal inspections of the impoundments. As part of the assessment, the contractors were asked to rate the impoundments as "satisfactory," "fair," "poor," or "unsatisfactory," terms commonly used in the field of dam safety. The site assessment for the FCPP impoundments determined they were satisfactory, which states, "No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required" (GEI Consultants 2009). Suggested maintenance activities included: restoration of the uneven dam crest on the west embankment of the LDWP impoundment to full height with compact fill; and removal of tamarisk trees from the downstream toe of the west embankment

of the LDWP. It was also suggested that structural analysis be performed of the HDPE decant drop inlet structure to varying water depth and the influence of multiple penetrations of the manhole sides. All suggested maintenance activities were completed by APS in 2009.

Also, as part of the assessment the dam was given a hazard potential classification. The hazard potential classification is a rating for a dam based on the potential consequences of failure. The rating is based on the potential for loss of life, damage to property and environmental damage that may occur in the event of dam failure. The hazard potential classification is not a reflection of the dam's condition, but of the downstream resources only. The FCPP was classified as Significant Hazard Potential in the report. Dams assigned the significant hazard potential classification are those dams where failure or misoperation would result in no probable loss of human life but could cause economic loss, environmental damage, disruption of lifeline facilities, or affect other concerns (GEI Consultants 2009).

The New Mexico Office of the State Engineer performs inspects of the dams at the FCPP. These inspections have not resulting in any notices of violation or substantial areas for repair, retrofit, or replacement.

Emergency Action Plan for Active Impoundments

An Emergency Action Plan (EAP) for the LAI and the LDWP was prepared that addresses emergency procedures in the unlikely event of a dam failure (APS 2011). The EAP prepared for the LAI and LDWP is a formal document that identifies potential emergency conditions that could develop at the LAI and LDWP, provides a plan for communication of the conditions, and specifies preplanned actions to be followed to minimize property damage and loss of life. The EAP also provides procedures and information to assist FCPP in issuing early warning information of the emergency situation to responsible emergency management authorities.

Overall, the EAP's purpose is threefold:

- Safeguard the lives and reduce property damage of the citizens living within the LAI and LDWP potential flood or inundation area.
- Provide effective plans for surveillance of the LAI and LDWP, prompt notification to local emergency management agencies, and citizen warning and evacuation response, when required.
- Assign emergency actions to be taken by the dam operator/owner, public officials, emergency personnel, and outline responsibilities of each party involved in the emergency management process in the event of a potential or imminent failure of the LAI and LDWP.

4.15.2.3 Transmission Lines

Most of the materials used for operation and maintenance of the APS transmission lines are petroleum-based products. The storage, handling, and spill response procedures for these materials are covered in the APS SPCC Plan Tier III Multi-Facility Substations. Limited amounts of other low-toxicity hazardous materials also may be used for operation and maintenance of the transmission lines. Proper storage, handling, and spill response procedures for these materials are included in APS's hazardous materials management program.

With regard to the PNM transmission lines, proper storage and handling, including spill cleanup of petroleum-based products, are covered in the SPCC Plan for PNM. Crews performing work in the switchyards may carry materials of trade quantities of nonoil-based hazardous material. Breakers in the switchyards contain sulfur hexafluoride gas, and approximately 100 pounds of sulfur hexafluoride gas are kept on site for maintenance of the breakers. Other than sulfur hexafluoride gas, no bulk storage of hazardous materials that are not oil-based occurs in the switchyards. PNM transmission maintenance crews carry limited amounts of hazardous materials. Examples include fuel, paints, solvents, and power-actuated connections. Activities such as pole treatment using fumigants are carried out by contractors.

PNM crews carry fire extinguishers and shovels and work in accordance with agency fire restrictions during drought conditions. All unused or waste materials generated by the PNM transmission crews are returned to the PNM Albuquerque Service Center.

4.15.3 Changes to Hazardous and Solid Wastes Affected Environment Post-2014

Two completed federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions; and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4).

The use of SCR requires a catalyst, and spent catalyst would constitute a new waste stream for FCPP. A contract would be set up with the catalyst supplier to handle the spent catalyst.

In addition, SCR requires the use of ammonia. Ammonia would be transported by truck from the nearest large metropolitan area that has the capability to manufacture the required form of ammonia. The three types of ammonia being considered by APS are anhydrous ammonia, aqueous ammonia (29% by weight), and solid urea. Volumes of storage for extremely hazardous substances listed in Table 4.15-2 would not increase as a result of the transportation or use of ammonia at the FCPP. The potential environmental consequences of the different options for ammonia sources, including OSMRE's recommendation, are addressed in the following section.

4.15.4 Environmental Consequences

The followings steps were used to assess the impacts associated with handling, storage, and disposal of hazardous materials and solid wastes:

- The chemicals listed in Table 4.15-1 and the amounts stored on site were reviewed to determine the need for and appropriateness of their use;
- The chemicals stored on site in small amounts or whose physical state is such that probability is low that a spill would migrate off site and have a major impact on the public or the environment were removed from further assessment.
- The measures to prevent spills were evaluated for effectiveness. Preventative measures include engineering controls such as secondary containment and administrative controls such as worker training and safety management programs.
- The measures to respond to accidents were reviewed. These measures include engineering controls such as spill cleanup and spill containment equipment and administrative controls such as training and written emergency response plans.
- For chemicals or solid wastes that have the potential to migrate off site and affect the public, an analysis of the theoretical impacts on the public or the environment of a worst-case spill was performed.

This impact assessment considers the severity of potential direct and indirect impacts as well as the geographic extent, and duration of potential impacts. Duration of impacts is described as short-term and long-term. For the power plant and transmission lines, short-term impacts are those that would occur immediately following approval of the lease renewal plus a reasonable period afterwards (i.e., a total of about 5 years). Long-term impacts are those that would persist beyond or occur after the 5-year period and beyond closure of the FCPP. Long-term impacts may include impacts from historical activities that may have remained unaddressed. For the Pinabete Permit Area and continued operation of the Navajo Mine, short-term impacts are those that would occur during construction and includes those that would occur from the time when mining begins in a unit through reclamation when vegetation has been re-established. Long-term impacts are those that would persist for the duration of the mining permit and permanent impacts are those that would remain beyond or occur after reclamation.

The criteria for defining significance under NEPA (CFR 1508.27) includes the degree to which a release of a hazardous material or waste would affect public health or safety and the environment, the degree to which a release of a hazardous material or waste would be highly controversial, and the degree to which the possible effects of a release of a hazardous material or waste is highly uncertain or involves unique or unknown risks. The magnitude of impacts for the purposes of this section are defined as major, moderate, minor, and negligible as outlined in Table 4.15-6.

Table 4.15-6 Magnitude of Impacts

Magnitude	Release Has Impacts on Public Health and Safety or the Environment	Effect of Release Is Controversial	Effect of Release Is Uncertain and/or Involves Unknown Risks
Major	Spill or release of a hazardous material as defined by the EPA in 40 CFR Part 302 that migrates off-site with major impacts on public receptors and/or the environment	Spill or release of a hazardous material as defined by the EPA in 40 CFR Part 302 that migrates off-site with major impacts on public receptors and/or the environment	Spill or release of material whose risks are unknown or uncertain at the time of the release that migrates off site and cause major impacts on public receptors and/or the environment
Moderate	Spill or release of a hazardous material as defined by the EPA in 40 CFR Part 302 that migrates off-site with minimum impacts on public receptors and/or the environment	Spill or release of a hazardous material as defined by the EPA in 40 CFR Part 302 that migrates off-site with minimum impacts on public receptors and/or the environment	Spill or release of material whose risks to the public or environment are not well known or documented that migrates off-site and cause minor effects on public receptors and/or the environment
Minor	Spill or release of a hazardous material which is not a substance defined by the EPA in 40 CFR Part 302 that does not migrate off-site	Spill or release of moderate a hazardous material which is not a substance defined by the EPA in 40 CFR Part 302 that does not migrate off-site	Spill or release of material whose risks to the public or environment are not well known or documented that does not migrate off-site
Negligible	Small to medium (<50 lbs) spill or release of low hazardous material which is not a substance defined by the EPA in 40 CFR Part 302 that doesn't migrate off-site	Small (<50 lbs) spill or release of hazardous material which is not a substance defined by the EPA in 40 CFR Part 302 that doesn't migrate off-site	Small (<50 Lbs) spills or releases of commonly known hazardous materials with well documented risks which is not a substance defined by the EPA in 40 CFR Part 302 and that does not migrate off-site

4.15.4.1 Alternative A – Proposed Action

Navajo Mine

The proposed Pinabete Permit Area includes 5,569 acres and would be composed of portions of the current Navajo Mine Permit Area and additional unpermitted areas of the Navajo Mine Lease Area. The Pinabete Permit Area would be mined in the same manner as described for the current Navajo Mine operations. No new hazardous materials would be brought on-site or new wastes generated under the Proposed Action. Existing hazardous materials and waste storage areas for the Navajo Mine Permit Area are adequately sized to handle any relatively small increase of hazardous materials or wastes associated with the Proposed Action (BNCC 2012h). None of the hazardous materials currently in use for the Navajo Mine Lease Area called out in Section 4.15.1 are stored in threshold quantities that trigger Emergency Planning and Community Right-to-Know Act reporting. The trigger threshold volume that requires Emergency Planning and Community Right-to-Know Act reporting varies by chemical, and some

chemicals do not require reporting under the provision regardless of the volume in which they are stored onsite. The increases of chemical volumes for the proposed Pinabete Permit Area would not trigger Emergency Planning and Community Right-to-Know Act reporting. Therefore, any impact from an accidental release or spill of these materials would be negligible to minor. These potential impacts would occur throughout the Project life. Hazardous and universal wastes (e.g., aerosols, antifreeze, paint and related materials, and batteries) and special wastes (e.g., absorbents, rubber hoses, used oil filters, and railroad ties) would continue to be accumulated, managed, and disposed of in accordance with applicable EPA and Department of Transportation regulations (BNCC 2012i).The hazardous materials and waste storage, handling, transportation, and disposal management programs for the existing Navajo Mine are listed in Section 4.15.1 and meet regulatory requirements for these activities therefore these programs along with the engineering controls identified in the programs are adequate for mitigating any potential hazardous materials releases or spills.

The environmental consequences of the past placement of CCR in Navajo Mine is addressed fully, including groundwater monitoring, in Section 4.5.2.1, Water Resources and Hydrology. The conclusion from that Section is that the potential impacts of placement of CCRs in Navajo Mine were minor.

Four Corners Power Plant

APS would continue to operate with only Units 4 and 5 in operation (Units 1-3 were shut down December 30, 2013) for the duration of the lease agreement, with the addition of SCR equipment. APS would install “hot side/high dust” SCRs between the boiler economizer and secondary air pre-heater on Units 4 and 5 in compliance with BART requirements.

Ammonia is a key component to the SCR’s successful operation. The ammonia reacts with nitrogen oxides over catalyst surfaces to form nitrogen and water. Ammonia would be supplied to the FCPP by a reagent processing plant, which has yet to be identified. The assumption for the purpose of this analysis is that the ammonia would be transported by truck from the nearest large metropolitan area that has the capability to manufacture the required form of ammonia. Each SCR would have two reactors, and each reactor would contain three layers of catalyst and a cavity for a future catalyst layer. After the first three years, the top degraded layer would be replaced with the next lower layer. The catalyst would either be honeycomb, plate, or corrugated type, and possibly composed of a titania-vanadia base metal. A contract would be established with the catalyst supplier to handle the spent catalyst. APS would use a contractor to install the SCR.

Other than the installation of SCR, Units 4 and 5 would continue operating as described previously. The size of the leased acreage or footprint of the FCPP facilities would not change. Units 1, 2, and 3 were shut down December 30, 2013 but will remain in place for the duration of the lease term. No impacts were associated with the shutdown of Units 1, 2, and 3, and no demolition or disposal activities are anticipated until the end of life of the facility. Other than minor equipment upgrades, no changes or modifications are anticipated for the three FCPP switchyards, Moenkopi switchyard, 12-kV Moenkopi line, or Moenkopi access road during the lease term.

<u>Ammonia Reagent Off-Site and Transportation Consequence Analysis</u>

Ammonia would be transported to the FCPP and stored on site to be used to control oxide emissions through selective catalytic reduction. The three types of ammonia source being considered by APS are anhydrous ammonia, aqueous ammonia (29% by weight), and solid urea. The number and size of tanks, footprint area, and an estimate of the number of truck shipments per year are shown for the three ammonia options in Table 4.15-7.

Table 4.15-7 Ammonia Reagent Options

Option	Number of Tanks*	Footprint Area (square feet)	Product Amount per Year (tons)	Number of Shipment Trucks per Year
Anhydrous Ammonia	2 rows of 4 (8 total)	39,000 (tanks, unloading and pumping equipment)	9,966	643 (12 per week)
29.4% Aqueous Ammonia	3 rows of 6 (18 total)	57,000 (tanks, unloading and pumping equipment)	33,797	1,504 (29 per week)
56.7% Dry Urea Pellets	3 rows of 6 (18 total)	67,000 (tanks, unloading, pumping, and hydrolyzing equipment)	17,534	874 (17 per week)

[1]Tanks would be horizontal 10-foot diameter X 40-foot length, 20,000-gallon (useable volume)

Varying risks are associated with ammonia depending on its form during storage, use, and transportation. Below is a comparison of the risks associated with the three proposed ammonia options.

Anhydrous ammonia is a colorless, highly irritating gas with a sharp, suffocating odor. Anhydrous ammonia is 99.5% commercial grade ammonia (with 0.5% water). Anhydrous ammonia is very volatile and boils at -33.3 degrees Celsius under atmospheric pressure. Anhydrous ammonia must be pressurized or refrigerated to be maintained as a liquid. Irritating effects of ammonia exposure generally begin at levels between 25 and 50 parts per million (ppm). More serious effects generally do not occur until levels are greater than 100 ppm. Immediate health effects of exposure to anhydrous ammonia include burning of the eyes, nose, and throat after breathing small amounts. Exposures to levels exceeding 30 ppm result in immediate irritation to the nose and throat. Acute exposure to higher levels (500 ppm) has been shown to cause chocking and difficulty breathing. Exposure to levels of 5,000 ppm of anhydrous ammonia can cause rapid death from a swollen throat or from chemical burns to the lungs. Eye exposure to concentrated gas or liquid can cause serious corneal burns or blindness. Generally, the severity of symptoms depends on the degree of exposure.

The effects of exposure to emissions from an aqueous ammonia release would be the same as exposure to an anhydrous ammonia release under similar concentrations. The difference between anhydrous ammonia and aqueous ammonia is anhydrous ammonia is more concentrated and is a gas at atmospheric temperatures and aqueous ammonia is a liquid and less concentrated at atmospheric temperatures. Anhydrous ammonia is stored under pressure and when released into the atmosphere during an accidental release, rapid vaporization of the liquid ammonia occurs with the dispersion of an ammonia cloud downwind of the release. Aqueous ammonia on the other hand is far less concentrated and ammonia emissions are released through evaporation of the spilled liquid. The variation in outcomes during an accidental release using these two mechanisms is depicted by an accidental release model, described in more detail below.

Urea is a solid and so risks during transportation and storage are greatly reduced compared to liquid transportation and storage. Ammonia is generated on site from urea by a hydrolysis reaction that yields a vapor phase mixture of ammonia, carbon dioxide, and steam. At any given time the on-site storage of ammonia generated from urea would be less than 50 pounds. An accidental release of this amount of ammonia would have negligible to minimum impacts. As shown in Table 4.15-8, no regulatory requirement exists for the storage, use, and transportation of urea, whereas due to the potential risk and the volumes of ammonia, the anhydrous ammonia and aqueous ammonia options would be covered by various regulatory requirements.

Table 4.15-8 Regulatory Requirements for Ammonia Reagent Options

Regulation	Anhydrous Ammonia	Aqueous Ammonia (29%)	Urea
Risk Management Plans (Clean Air Act 40 CFR 68)	X	X	NR
Hazardous Materials Release Reporting (CWA 40 CFR 116.4)	X	X	NR
Hazardous Materials Release Reporting (CWA 40 CFR 117.3)	X	X	NR
Hazardous Waste Requirements (RCRA 40 CFR 261.22 Corrosive, No. D0005)	X	X	NR
Storage and Handling of Anhydrous Ammonia (OSHA CFR 1910.111)	X	NR	NR
Process Safety Management (OSHA CFR 1910.119)	X	X	NR
Personal Protective Equipment (OSHA CFR 1910.132 to 1910.136)	X	X	NR
Hazardous Materials Release Reporting (CERCLA 40 CFR 302.4)	X	X	NR
Emergency Planning, Community Right to Know (SARA 40 CFR 370, 372 and 355)	X	X	NR

Source: Salib and Keeth n.d.

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

NR = Not Regulated (no requirement for this material for the referenced regulation). Urea storage has no known regulatory requirements. The process piping and vessels would contain some free ammonia, but the quantity present at any point in time would be well below the threshold value of 10,000 pounds.

SARA = Superfund Amendments and Reauthorization Act

Ammonia emissions from potential release scenarios for anhydrous and aqueous ammonia were calculated following methods provided in the Risk Management Plan (RMP) Rule under Section 112(r) of the Clean Air Act off-site consequence analysis guidance (EPA 2009b). A release scenario for the urea option was not modeled since it is a solid and would not migrate as the liquids would (anhydrous and aqueous ammonia). In addition, urea is not a hazardous material covered under the RMP requirement, and the associated risks would be minor.

Three release scenarios were modeled for both the anhydrous ammonia and the aqueous ammonia reagent options. The three scenarios modeled were a worse-case release, an alternative release, and a transportation release. Under RMP, EPA has defined the worst-case scenario as the release of the largest quantity of a regulated substance from a single vessel or process line failure that results in the greatest distance to an endpoint. The EPA definition of the alternative scenario are scenarios that are more likely to occur than the worst-case scenario and that will reach an endpoint offsite, unless no such scenario exists. The alternative scenario that was modeled was a hose leak during offloading ammonia from the truck to the onsite ammonia tank. The transportation scenario modeled is also an alternative scenario, which would be more likely to occur than the worse-case scenario. Since the location of the ammonia supplier has not been determined, Denver was used as the most likely location for an ammonia supplier. An accidental release was modeled at three population centers between Denver and FCPP, Denver, Albuquerque and Farmington.

EPA has adopted Emergency Response Planning Guidelines that estimate the concentrations at which most people will begin to experience health effects if they are exposed to a hazardous airborne chemical for 1 hour. A chemical may have up to three ERPG values, each of which corresponds to a specific tier of health effects. The ERPG-1 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor. The ERPG-2 is the maximum airborne

concentration below which individuals could be exposed without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action, and the ERPG-3 is the maximum airborne concentration below which individuals could be exposed without experiencing or developing life-threatening health effects. The EPA has established (ERPG)-2 as the toxic endpoint for ammonia for the off-site consequence analysis required by the RMP. The RMP*Comp™ software program, which was developed by National Oceanic and Atmospheric Administration and EPA, was used to calculate the toxic endpoint. A factor was used to convert the results given by the model from the previous ERPG-2 for ammonia, which was 200 ppm and was updated in 2011 to 150 ppm. Results obtained using RMP*Comp™ are expected to be conservative (EPA 2009b). The results of the accidental release modeling are included in Table 4.15-9.

Table 4.15-9 Accidental Release Modeling Results for Ammonia Reagent Options

Ammonia Reagent	Worst-case Release (distance to toxic endpoint)	Alternative Release (distance to toxic endpoint)	Transportation Release (distance to toxic endpoint)
Anhydrous Ammonia	7.5 miles (9.9 kilometers)	1.3 miles (1.7 kilometers)	0.8 mile (1.3 kilometer)
	Public receptors[1] affected: 47[2]	Public receptors[1] affected: 28[2]	Public receptors[1] affected: Denver 3,138[4] Albuquerque 2,326[3] Farmington 1,1654[5]
Aqueous Ammonia (29%)	2.9 miles (4.7 kilometers)	0.1 mile (0.3 kilometer)	0.1 mile (0.3 kilometer)
	Public receptors[1] affected: 31[2]	Public receptors[1] affected: 0[2]	Public receptors[1] affected: Denver 392[4] Albuquerque 291[3] Farmington 146[5]
Urea	n/a	n/a	n/a

[1]Public receptor definition is based on RMP Rules and is the "residential populations within the circle defined by the endpoint for your worst-case and alternative release scenarios." Source: Chemical Emergency Preparedness and Prevention Office, EPA 1999

[2]Assumes 2.77 average persons per household (Source: Census 2013c).

[3] Assumes accidental release occurs around the Albuquerque area, which has an average population density of 944 people/square mile (Source: Census 2013a).

[4]Assumes accidental release occurs around the Denver area, which has an average population density of 3,552 people/square mile (Source: Census 2013b).

[5] Assumes accidental release occurs around the Farmington area, which has an average population density of 72 people/square mile (Source: Census 2013c).

Figures 4.15-1 and 4.15-2 provide a visual depiction of the model results. Based on the modeling results, impacts of a potential worst-case accidental release of ammonia from the anhydrous option could potentially impact 47 public receptors during on-site storage and could potentially impact 3,138 public receptors if a transportation accident were to occur within the city limits of Denver. The accident is staged in Denver because this is the largest metropolitan center in the project area so it is assumed that the ammonia would come from a service provider in Denver. Moreover, the greatest number of public receptors is located in Denver, so this would represent the worst case accident scenario. The impact of a potential alternative-case accidental release of anhydrous ammonia could potentially impact 28 public receptors during on-site storage and could potentially impact 392 public receptors if a transportation accident where to occur within the city limits of Denver. In all cases the impacts of an accidental release during transportation is greater than the impacts during storage.

Although the probability of a worst-case accidental release under either the anhydrous or the aqueous ammonia option is extremely low, there are a large number of truck trips over the life of the SCR units. In addition, the RMP regulations do not take into account probability when considering the worst-case release scenario. The probability of an alternative-case accidental release of either the anhydrous or the aqueous ammonia option is somewhat higher although the consequences for both as modeled would clearly be lower. In the event of an accidental release, APS has established a mutual agreement for emergency response with San Juan County, New Mexico Fire Department which includes 18 volunteer departments that answer to one central command center. The nearest department is the Valley Department (District 1) that consists of four stations and about 40 firefighters. Station 3 is the nearest station to FCPP, located approximately 5 miles away. Local responders would only handle evacuation of local populations. If anhydrous or aqueous ammonia were transported onsite, FCPP would be required to have the equipment and trained staff to respond to a hazardous material emergency, in accordance with the RMP.

In comparison to the modeled scenarios involving transport of liquid ammonia, the urea option would have negligible impacts because an accidental release would have no off-site consequences, and no transportation of gaseous or liquid ammonia is required under this option.

The ammonia source option with the lowest public safety and environmental impact risk is the urea option. Compared to the moderate to major risks of transport of liquid ammonia (anhydrous or aqueous), transport of solid urea has minor risks. OSMRE recommends that the solid urea option be selected in order to eliminate the risks of truck transportation of liquid ammonia, and the risks of storage of liquid ammonia. With this option, the impacts would be minor. In comparison, the impacts of transport of anhydrous ammonia or aqueous ammonia would be addressed through regulatory compliance, but still be moderate.

Surface Impoundment Dam

As described in Section 4.15.1, a site assessment of the dam safety of FCPP's LAI embankment dam and LDWP was performed, and as part of the assessment, the dam was given a hazard potential classification, which is a rating for a dam based on the potential consequences of failure. The hazard potential classification is not a reflection of the dam's condition. The FCPP was given a hazard potential classification of significant hazard potential in the report. Dams assigned the significant hazard potential classification are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, or disruption of lifeline facilities, or can result in other concerns.

In addition to the hazard potential classification the contractors were asked to rate the condition of the impoundments as "satisfactory," "fair," "poor," or "unsatisfactory," terms commonly used in the field of dam safety. The site assessment for the FCPP rated all of the ash impoundments as satisfactory, which states, "no existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required" (GEI Consultants 2009). Minor maintenance items were identified and APS followed up with a written response and action plan, indicating the suggested items would be addressed and completed prior to the end of 2009 (APS 2009).

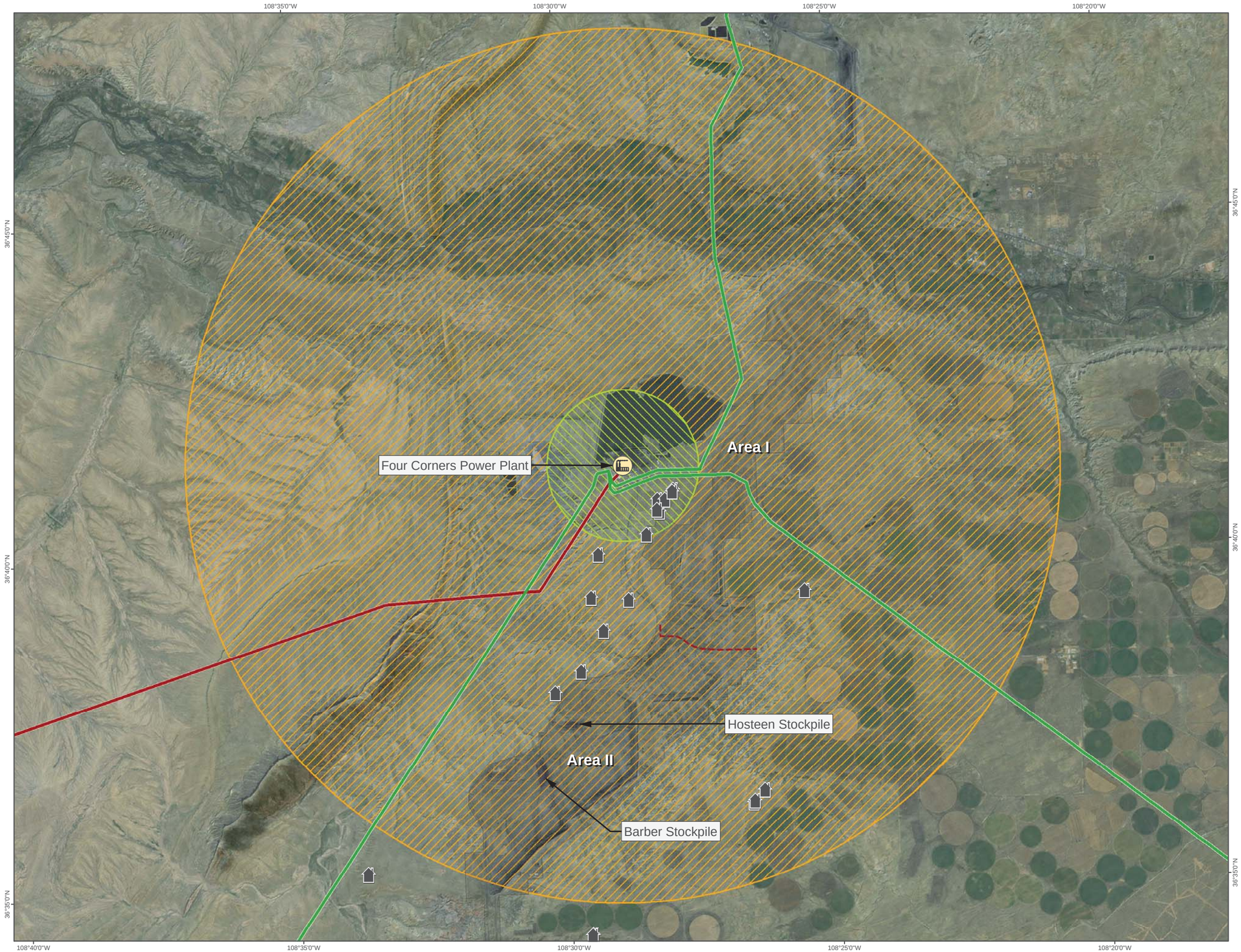


Figure 4.15-1

Anhydrous Ammonia
Accidental Release Model
Results

PROJECT FACILITIES

Four Corners Power Plant

RELEASE MODELS

Worst-case Release Scenario

Alternative-case Release Scenario

Residences

PROJECT BOUNDARIES

Navajo Mine Lease Area

Navajo Mine Resource Areas

TRANSMISSION LINES

345kV

500kV

N

0 0.75 1.5 3

Scale in Miles

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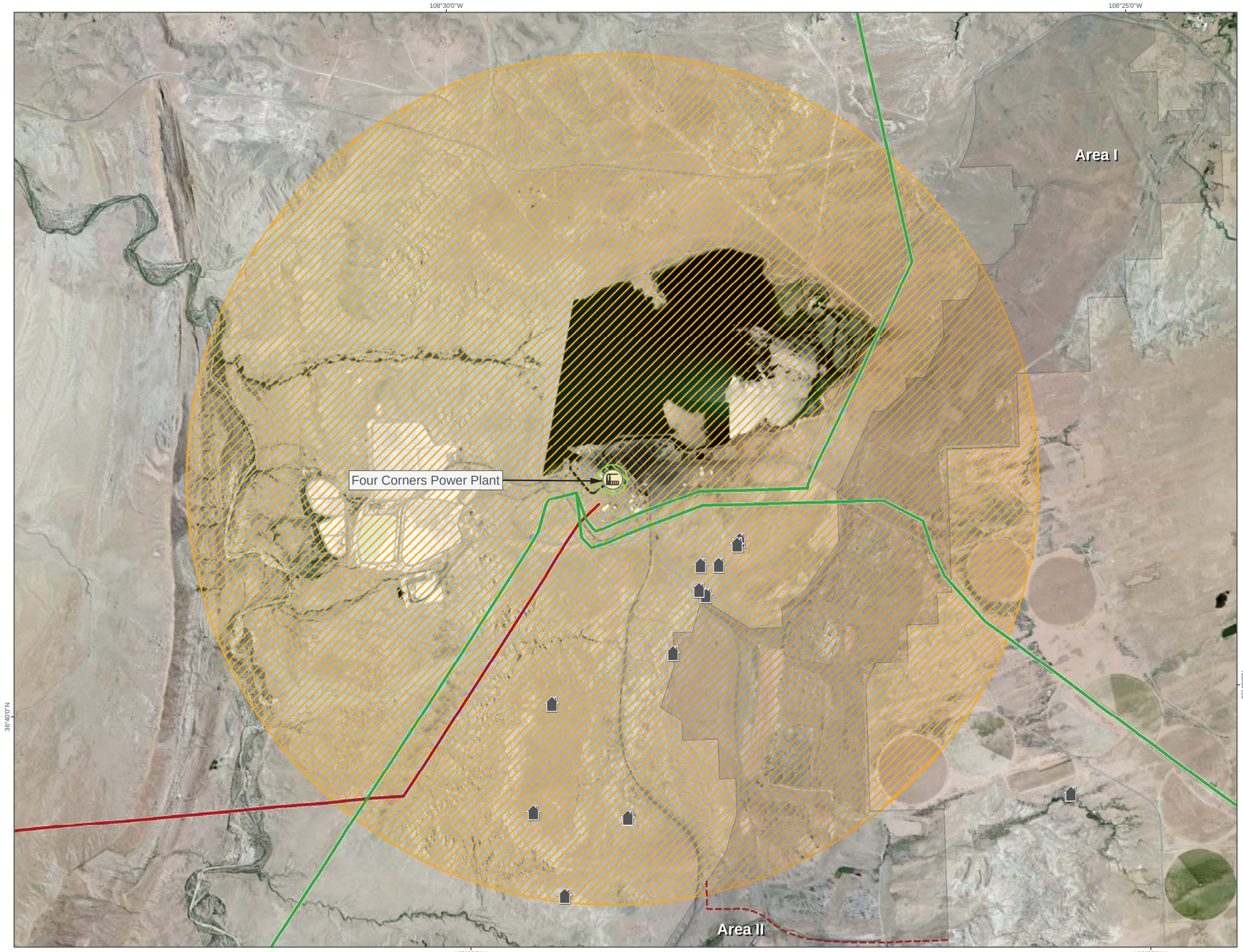

Figure 4.15-2

Aqueous Ammonia (30%)
Accidental Release Model
Results

PROJECT FACILITIES

Four Corners Power Plant

RELEASE MODELS

Worst-case Release Scenario

Alternative-case Release Scenario

Residences

PROJECT BOUNDARIES

Navajo Mine Lease Area

Navajo Mine Resource Areas

TRANSMISSION LINES

345kV

500kV

N

0 1,750 3,500 7,000
Scale in Feet

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Based on this assessment of the dam, impacts from the potential accidental release would be minor. APS would comply with all regulatory requirements and complete preparation of an EAP and an Ash Impound Dam Inspection and Maintenance Program. Under continued operation of the FCPP, the existing EAP for the LAI and LDWP must be finalized and approved by the State of New Mexico Office of State Engineer, Dam Safety Bureau. Modifications to the ash impoundments or any new ash impoundments would require a revision of the EAP and the Bureau's review and approval by the Office of State Engineer, the New Mexico Department of Homeland Security and Emergency Management. In addition, a Dam Inspection and Maintenance Program must be developed for the existing and any new ash impoundments at the FCPP in coordination with or approved by State of New Mexico Office of State Engineer, Dam Safety Bureau. Further, any new disposal units (landfills or surface impoundments) would require siting above the natural water table and could not be located in wetlands, within 200 feet of a fault zone, or in a seismic impact zone. Any new disposal units could not be located in an unstable area (e.g., a location susceptible to natural or human-induced events or forces capable of impairing the integrity of the unit). Compliance with the developed plans and all regulatory requirements would address the potential for an accidental release.

CCR Management

Between 2014 and 2016, FGD waste generated from Units 4 and 5 would continue to be placed in DFADA Sites 1 and 2 until these sites reach capacity. APS would construct five additional DFADAs to accommodate future disposal of all fly ash, bottom ash, and FGD waste generated through the duration of the lease term. The total area of new DFADAs would be approximately 350 acres in surface area and approximately 80 feet high. Estimated annual storage volumes would be 1,118 acre-feet per year. Each site is anticipated to be in operation for 5 years. In addition to the five new sites, a surge pond (lined impoundment) would be constructed to capture generated FGD waste and historic ash impoundment seepage intercept water. All soil for impoundments and berms surrounding the impoundment would be borrowed from areas inside the existing APS lease area.

As described in Section 4.15.1, the EPA is currently considering whether to manage CCR as either a Subtitle C hazardous waste or a Subtitle D solid waste. EPA is anticipated to issue a Final Rule on CCR by the end of 2014. The FCPP would be required to comply with EPA's Final Rule.

Promulgating the Subtitle D standards would result in the creation of standards applicable only to owners and operators of coal combustion residual landfills and surface impoundments. Further, in contrast to its broad authority to enforce Subtitle C requirements, EPA could promulgate the Subtitle D standards, but would have limited authority to enforce them. Instead, if finalized, EPA would encourage states to adopt and enforce the standards, but could not require states to do so (CRS December 5, 2012). However, Subtitle D standards would not have an enforcement agency on tribal lands. Mitigation is provided to address this gap.

Section 4.5, Water Resources and Hydrology, evaluates groundwater monitoring data collected by APS from 1987 to 2012 in the current DFADA. Owing to the geology of the area, all of the groundwater samples, including those representing background conditions, have elevated levels of total dissolved solids (TDS), chlorides, sulfate, arsenic, cadmium, nitrate, selenium, thallium, and boron. The wells within the DFADA, and the wells outside the area of influence of the DFADA, all have these elevated levels. Owing to the similarity in groundwater concentrations, if there is any ongoing release from the unlined ash disposal ponds 1 and 2, or the later ponds, the effect cannot be readily discerned from the natural background concentrations. Both new and existing disposal units would be subject to groundwater monitoring requirements. If certain hazardous constituents (including arsenic, cadmium, or selenium) are detected at a level exceeding groundwater protection standards, as listed in Section 3, the FCPP would have 90 days to assess corrective measures and select a remedy that would protect human health and the environment.

Closure and Post-closure Requirements

Under current regulations, there are no closure or post-closure requirements for the FCPP or the DFADA. To address this uncertainty, OSMRE recommends implementation of a mitigation measure which includes development of a closure and post-closure management plan for areas where CCRs have been disposed or where they will be disposed. The plan should include provisions for providing adequate surface protection during closure, including provisions to limit surface water run-on that could increase leaching. The plan should also include provisions for groundwater monitoring.

Transmission Lines

Existing transmission lines directly associated with the FCPP require ROW renewals within the period of time this NEPA review is being conducted. These transmission lines, owned and operated by APS or PNM, are considered connected actions to the continued operation of the mine and power plant. No new transmission lines would be developed as a component of the Proposed Action. The potential environmental impacts from the continued operations of the transmission lines are analyzed in this section. Operations and maintenance of the transmission lines would remain as described in Section 2. No new towers or access roads would be constructed as part of the Proposed Action, and no changes to the existing ROWs would occur. No new hazardous materials would be used, and no new solid or hazardous waste would be generated. The hazardous materials currently in use by APS and PNM for the transmission lines are predominately petroleum-based and managed under a SPCC program. Other materials are of medium to low toxicity and of medium to low volume. Because of the volume and toxicity levels of these materials, any impact from an accidental release or spill of these materials would be local and negligible to minor. The hazardous materials and waste storage, handling, transportation, and disposal management programs for the existing transmission lines are listed in Section 4.15.1, and these programs along with the engineering controls identified in the programs are adequate for management of any potential off-site release or spills.

4.15.4.2 Alternative B – Navajo Mine Extension Project

Navajo Mine

Under Alternative B, OSMRE would approve an alternative mine plan for the Navajo Mine to only include mining within Area IV South. Under this alternative, NTEC would seek a 5,412-acre SMCRA permit and proposed mining disturbance in approximately 4,998 acres. Mining would commence with the construction of a new boxcut near the western lease boundary and progress eastward in north/south-orientated striplines. The mining block would be divided into a North Pit and a South Pit. NTEC would operate two draglines, one in each stripline. After the coal was exposed by the stripping operation, it would either be drilled and blasted or ripped by dozers before mining. Once the coal was broken up, it would be mined by front-end loafers and haul trucks. Coal would be transported to a field coal stockpile on the western permit boundary prior to being transported 8.4 miles to Lowe Stockpile in Area III via primary haul roads.

Under Alternative B, impacts from the on-site storage of hazardous materials and solid waste would remain the same as described for the Proposed Action.

Potential impacts from historical mine placement of CCRs would remain after Navajo Mine closure. NTEC would develop, a closure and post-closure management plan for areas where CCRs have been placed, as described in Alternative A.

Four Corners Power Plant

Under Alternative B, the BIA would approve the lease amendment for the FCPP, which would operate as described under the Proposed Action. No changes are proposed for the FCPP under this alternative; therefore, impacts for hazardous and solid waste would be the same as for the Proposed Action.

Transmission Lines

Under Alternative B, the transmission line ROWs would be approved, and they would continue to be operated and maintained as described under the Proposed Action. No changes are proposed for either the APS- or the PNM-owned transmission lines; therefore, impacts for hazardous and solid waste would be the same as for the Proposed Action.

4.15.4.3 Alternative C – Alternative Pinabete Mine Plan

Navajo Mine

Under Alternative C, OSMRE would disapprove the Pinabete permit application, and NTEC would seek approval from OSMRE for a new 10,094-acre SMCRA permit area and proposed mining disturbance in approximately 6,492 acres. Mining would be located in both Area IV North and Area IV South, as described for the Proposed Action. Mining activities in Area IV North would continue existing striplines to the south. The Area IV South pit would be located southwest of Pinabete Arroyo and would require a new boxcut to develop the pit. Once the boxcuts were complete, only two draglines would be needed, one in each pit.

Coal from the Area IV North pit would be hauled directly to Lowe Stockpile in Area III for a distance of 3.7 miles. A field coal stockpile would be located in Area IV South, and coal from the Area IV South pit would be hauled to this stockpile prior to being hauled the 8.4 miles to Lowe Stockpile. Burnham Road would be realigned as described under the Proposed Action; however, the length of area that would be relocated would be 6.2 miles. In addition, approximately 15.1 miles of primary haul roads and 14.8 miles of ancillary roads would be constructed. In addition, NTEC would construct approximately 16.8 miles of powerlines, extending the existing transmission lines from the Navajo Mine Permit Area to the new permit area.

Under Alternative C, OSMRE would renew the existing Navajo Mine SMCRA permit (NM3000F). For both the Navajo Mine Permit Area and the Pinabete Permit Area, operations and reclamation would be conducted as described under the Proposed Action. Impacts of Alternative C would be similar to impacts under the Proposed Action. Short-term impacts may be slightly higher than the Proposed Action due to road construction activities. An additional 29.9 miles of haul roads and ancillary roads would be constructed under Alternative C that would not be constructed under the Proposed Action. Larger volumes of hazardous materials and waste would be generated during construction of the additional roads. Increased impacts would be a direct result of construction activities and would not continue once roads are constructed and operational. Potential impacts from historical mine placement of CCRs would remain after Navajo Mine closure. NTEC would develop, a closure and post-closure management plan for areas where CCRs have been placed, as described in Alternative A.

Four Corners Power Plant

Under Alternative C, the BIA would approve the lease amendment for the FCPP, which would operate as described under the Proposed Action. No changes are proposed to the FCPP under Alternative C; therefore, impacts for hazardous and solid waste would be the same as for the Proposed Action.

Transmission Lines

Under Alternative C, the transmission line ROWs would be approved and they would continue to be operated and maintained as described under the Proposed Action. No changes are proposed for either the APS- or PNM-owned transmission lines; therefore, impacts for hazardous and solid waste would be the same as for the Proposed Action.

4.15.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action. Impacts would be the same as described for the Proposed Action

Four Corners Power Plant

Under this alternative, the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The 10% reduction in surface area of the DFADAs would result in the same XXX-related impacts as described for the Proposed Action. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

Under Alternative D, the transmission line ROWs would be approved, and they would continue to be operated and maintained as described under the Proposed Action. No changes are proposed for either the APS- or the PNM-owned transmission lines; therefore, impacts for hazardous and solid waste would be the same as for the Proposed Action.

4.15.4.5 Alternative E – No Action Alternative

Navajo Mine

Under the No Action Alternative, the Navajo Mine would close. The Pinabete Permit Area (Areas IV North and South) would not be mined. Burnham Road would not be realigned. Mining in the Navajo Mine Permit Area (Areas III and IV North) would cease when the ROD is issued in 2015. All ancillary buildings and facilities (e.g., communication lines, railroad) would be removed, and the land would be reclaimed according to OSMRE guidelines in the approved reclamation plan. Under the No Action Alternative, short-term impacts would increase due to removal of ancillary buildings, facilities, and hazardous materials. After removal, impacts from hazardous materials would be reduced to no impact due to the lack of on-site storage of hazardous materials.

Four Corners Power Plant

Under the No Action Alternative APS would shut down Units 1 through 5 in 2016 when the current lease expires and EPA's BART rules goes into effect. The Four Corners Power Plant would be decommissioned and held for future use. In addition to the five units, all three switchyards would also be decommissioned. Several potential future uses of the site are possible. It could continue as an energy generation site with several potential technology scenarios. The infrastructure could also be demolished and the site redeveloped for industrial, commercial, or residential uses. It is entirely speculative at this time to predict the likely alternative future uses for the site. APS has not yet prepared a decommissioning plan. Any decisions regarding the future uses must be with the concurrence of the other owners. Currently the site is help undivided by all of the owners; future uses may therefore require subdivision of the property. Any such uses would be subject to environmental review at either the tribal or federal level, including potentially under NEPA, at the time they are developed and proposed. Impacts on hazardous waste and solid waste would be short-term and predominately associated with disposal of demolition materials.

Management of existing ash disposal units would continue beyond the closure of the mine; in accordance with regulatory requirements, APS would prepare a closure plan for these units to be approved by EPA Region 9, OSMRE, and in cooperation with the NNEPA.

Transmission Lines

Under the No Action Alternative, the ROWs for the four subject transmission lines would not be approved. Since the subject lines primarily transmit power from the FCPP, under the No Action Alternative, the power source for the transmission lines would be removed. The lines would either be decommissioned and dismantled, or left in place. As with the FCPP, decommissioning and dismantling activities would need to be coordinated with the Navajo Nation and the BLM such that the area meets the specific needs of the planned reuse. Compliance with all environmental laws and regulations would occur throughout the demolition process. Any potential impacts for hazardous and solid waste would be associated with decommissioning and dismantling activities. Because these activities would occur in compliance with all environmental laws and regulations, these impacts would be expected to be negligible to minimal and short-term.

4.15.5 Hazardous and Solid Wastes Mitigation Measures

The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific mitigating measures for certain environmental impacts, standard operating procedures that reduce or avoid environmental impacts, and best management practices for specific activities. These are described in Section 3.2.6.15. These measures are part of their application materials and are enforceable through permit or lease conditions. In addition, the Project Applicants must comply with additional protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section for each resource category. Where the environmental analysis in this EIS recommends additional protective measures, over and above the applicant proposed measures and regulatory compliance, they are listed below as specific mitigation measures.

To address the unknown nature of the off-site contamination from past disposal activities and the uncertainty of the regulatory requirements for CCR, OSMRE recommends APS implement the measures listed below. Depending on the outcome of the EPA's Final Rule, some or all of these measures may be requirements of EPA's Final Rule on CCR.

Location Restrictions

Any new disposal units (landfills or surface impoundments) should be sited above the natural water table and should not be located in wetlands, within 200 feet of a fault zone, or in a seismic impact zone. Any new disposal units should not be located in an unstable area (e.g., a location susceptible to natural or human-induced events or forces capable of impairing the integrity of the unit). A review of existing disposal units must ensure they are not located in an unstable area or they would be subject to closure requirements (described below).

Operating Requirements

New and existing disposal units would be subject to fugitive dust controls and liquid runoff/run-on control. Conditions of the permit program must include record-keeping requirements that specify that all records, reports, studies, or other documentation demonstrating compliance with the requirements must be made publicly available at the facility or on a publicly accessible Internet site.

Any existing or proposed surface impoundments should be subject to design and inspection requirements similar to MSHAs, including certification from an independent registered professional engineer that the impoundment's design is in accordance with engineering practices applicable to that unit; weekly inspections to identify potentially hazardous conditions or structural weakness;, and annual inspections to assure design, operation, and maintenance of the unit is in accordance with engineering practices applicable to such units in accordance with regulations similar to those promulgated under MSHA at 30 CFR Section 77.216, by an independent registered professional engineer.

Design Requirements

Any new landfills and surface impoundments should be constructed with a composite liner. Existing surface impoundments must have solids removed and be retrofitted with a composite liner by a deadline determined by the permit program. New disposal units should be constructed with a composite liner.

Groundwater Monitoring and Corrective Action Requirements

Groundwater monitoring should be conducted for both new and existing disposal units. If certain hazardous constituents (including arsenic, cadmium, or selenium) are detected at a level exceeding groundwater protection standards, the FCPP should assess corrective measures and select a remedy that would protect human health and the environment within 90 days.

Closure and Post-closure Requirements

Under current regulations, there are no closure or post-closure requirements for the FCPP or the DFADA. APS should develop a closure and post-closure management plan for areas where CCRs have been disposed or where they will be disposed. The plan should include provisions for providing adequate surface protection during closure, including provisions to limit surface water run-on that could increase leaching. The plan should also include provisions for groundwater monitoring.

4.16 Recreation

Recreational resources for the purposes of this EIS are generally defined as recreational activities such as wildlife viewing, hunting, fishing, picnicking, hiking, and sightseeing, and the publicly accessible facilities and land areas that provide these recreational opportunities. The primary ROI examined for recreational resources encompasses the Project Area associated with the Navajo Mine Permit Area, Pinabete Permit Area and the FCPP, and the ROWs associated with the four associated transmission lines (see Section 1.1). In addition, the ROI includes regional recreational resources within the Four Corners region generally within 15 to 20 miles of the Navajo Mine and FCPP and approximately 5 miles from the transmission line ROWs. The regional recreational resources ROI is the general viewing area in which the Project features and activities could indirectly affect recreational opportunities and experiences. This ROI is consistent with the BLM's Visual Resource Management Process (BLM 2012b), which defines distant or seldom seen views at greater than 15 miles from the proposed activities (see also Section 4.13, Visual Resources).

4.16.1 Regulatory Compliance Framework

4.16.1.1 Navajo Nation Recreation Management

The Navajo Nation requires permits for all recreation-related activities on the Navajo Nation Tribal Trust Lands. The Navajo Parks and Recreation Department issues camping, hiking, or backcountry permits (Navajo Nation Parks and Recreation 2012a). Hunting and fishing permits are issued by the NNDFW. The area within 10 miles of the Pinabete Permit Area and the FCPP is within Navajo Nation Hunting Unit 13, which is managed for archery, muzzleloader, and rifle deer and elk hunts (NNDFW 2012a). Detailed information regarding hunting seasons, numbers of permits, and hunter success rates are provided in the Navajo Nation Hunting and Trapping Proclamation. The majority of hunting permits are issued to members of the Navajo Nation, but permits are also issued to non-Navajos. Non-Navajos are required to use a licensed Navajo Nation guide when hunting on Navajo Nation Tribal Trust Land (NNDFW 2012b). Fishing and small game permits, also issued by NNDFW, are combined into one permit. Watercraft permits are required to use motorized and non-motorized boats in the Navajo Nation. The Navajo Nation prohibits rock climbing on Navajo Nation Tribal Trust Lands and monuments (NNDFW 2012c).

4.16.1.2 Hopi Tribe

The Hopi Tribe Tribal Trust Lands contain no designated public recreation areas. The Hopi Tribe provides guided tours of some of the villages and some ceremonies are open to the general public, although photography, video recording, and sketching by visitors are not allowed (Visit Hopi 2012). The Hopi Tribe generally does not allow hunting, fishing, or hiking unless with a hired guide (Arizona Handbook 2012).

4.16.1.3 BLM Land Management Plan – Recreation Management Component

The BLM's Farmington Field Office has jurisdiction over the BLM facilities traversed by the transmission lines (BLM 2012c). The BLM's Resource Management Plan for the Farmington Field Office indicates that the purpose of the outdoor recreation program is "to ensure the continued availability of public land for a diverse array of quality resource-dependent outdoor recreation opportunities. Recreation use is managed to protect the health and safety of visitors; to protect natural, cultural, and other resource values; to stimulate enjoyment of public lands; and to resolve user conflicts" (BLM 2003). The National Park Service does not have a comparable Visual Resources Management Component. In general, projects are evaluated on a case-by-case basis using viewshed analysis, visual stimulations and in some instances public input. The NPS also draws upon BLM's Visual Resource Management and the USFS's Scenery Management System, which have both been in place since the 1970s. There are three NPS managed Parks in the ROI: Canyon de Chelly National Monument, Chaco Cultural National Park and El Malpais National Park, and each park has a unique management plan.

4.16.2 Affected Environment Pre-2014

4.16.2.1 Regional Recreation Resources

Regional recreational resources within the ROI include Navajo Nation recreational opportunities, BLM-managed recreation areas, scenic roads and trails, and dispersed recreation use areas (see Figure 4.16-1; Public Lands Information Center 2012). Popular recreational activities within the ROI include, but are not limited to, hiking, boating, fishing, windsurfing, whitewater rafting, horseback riding, use of off-highway vehicles (OHVs), mountain biking, wildlife viewing, and visiting scenic attractions (BLM 2012d). The following subsections summarize the regional recreational resources within the ROI.

Four Corners Geotourism Initiative

Collaborative efforts to promote tourism of the Four Corners region include a geotourism initiative developed in partnership with National Geographic Society and numerous Federal, state, and local agencies and interest groups. Geotourism is defined as “tourism that sustains or enhances the geographical character of a place — its environment, culture, aesthetics, heritage and the well-being of its residents. Geotourism incorporates the concept of sustainable tourism — that destinations should remain unspoiled for future generations — while allowing for ways to protect a place’s character.” The Four Corners Geotourism Stewardship Council along with the National Geographic Society developed an interactive website and map that promotes geotourism of the Four Corners area. This initiative provides information regarding area tourism destinations and promotes the natural, historic, and cultural assets unique to the Four Corners area (National Geographic Society 2013).

Navajo Nation Recreational Opportunities

Recreational opportunities on Navajo Nation land include sightseeing, visiting parks and historic sites, photography, and hiking and walking. The ROI has no designated recreation areas or facilities on Navajo Nation lands and, therefore, the majority of recreational use is associated with dispersed recreational activities, such as camping, hiking, or hunting, as allowed under designated permits. In addition, scenic views of the distinguishable landforms, including Barber Peak, Table Mesa, Beautiful Mountain, and Shiprock Natural National Landmark, provide sightseeing opportunities in the region. The Navajo Nation manages many fishing lakes on Navajo Nation Tribal Trust Land, but no fishing lakes are located within the recreational resources ROI with the exception of Morgan Lake, described below (NNDFW 2012d). As mentioned above, the Project Area is within Navajo Nation Hunt Unit 13. Table 4.16.1 provides a summary of the number of hunting permits available in 2012 as well as 2011 hunt success rates within Unit 13.

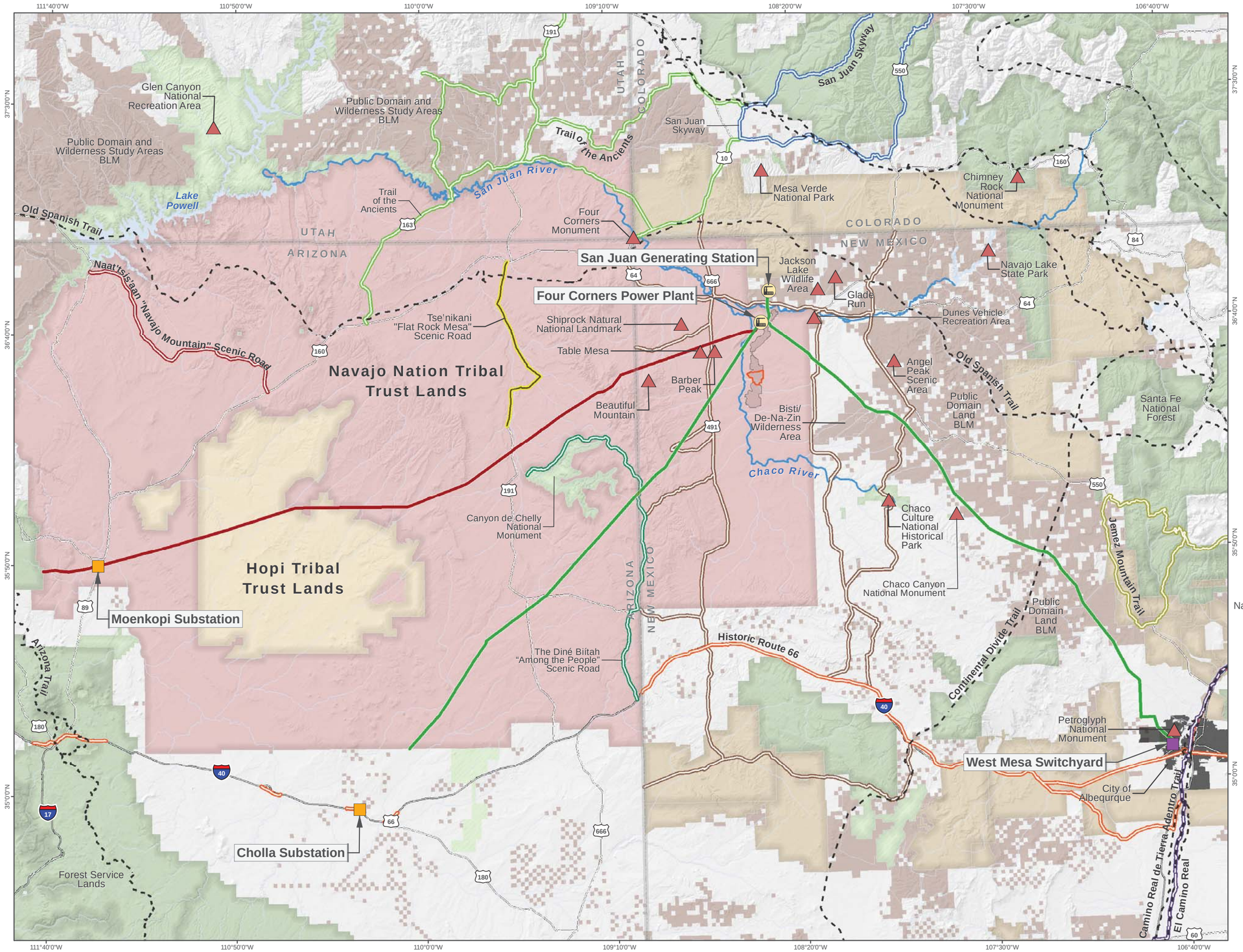

Figure 4.16-1

Recreational Resources in the Vicinity of the Project Area

PROJECT FACILITIES

- Power Plant
- Substation
- Switchyard

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Proposed Pinabete Permit Boundary

TRANSMISSION LINES

- 345kV
- 500kV

RECREATION FEATURES

- Monuments/Tourism Sites
- National Historic Trails

SCENIC HIGHWAYS & ROADS

- El Camino Real
- Historic Route 66
- Jemez Mountain Trail
- Naat'tsis'aan "Navajo Mountain" Scenic Road
- San Juan Skyway
- Trail of the Ancients
- Tse'nikani "Flat Rock Mesa" Scenic Road
- Proposed Trail of the Ancients NSB
- The Diné Biitah "Among the People" Scenic Road

FEDERAL LANDS

- Bureau of Land Management
- Bureau of Reclamation
- Forest Service
- National Park Service
- Tribal Trust Lands

N

0 12.5 25 50
Scale in Miles

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Table 4.16.1 Big Game Hunting in Hunt Unit 13 (2012)

Hunt Type	Hunt Dates	Permits Available	Hunt Success (%)	Comment
Archery Deer Hunt	Sept. 8-16, 2012	44	8	Includes data for Hunt Units 13 to 15
Rifle Deer	November 3 - 11, 2012	17	29	
Archery Elk	September 8 – 30, 2012	100	5	Includes data for Hunt Units 13 and 14
Muzzleloader Elk	October 3 - 7, 2012	25	32	Includes data for Hunt Units 11 to 14
Youth Elk	October 10 - 14, 2012	30	10	Includes data for Hunt Unit 14
General Elk	January 9 – 20, 2013	30	25	Includes data for Hunt Units 1 to 8, 11 to 15
Special Deer	Oct. 1, 2012 - Jan. 31, 2013 Any 30 days	1	100	Includes data for Hunt Units 1 to 16; Navajo tribal members only
Special Elk	Sept. 1 – Oct. 15, 2012 and Jan. 1 - Feb. 15, 2013 Any 30 days	1	100	Includes data for Hunt Units 1 to 16; Navajo tribal members only

Source: NNDFW 2012b

According to the 2011 Navajo Nation Visitor Survey, the most important recreational and leisure activities for visitors in the region are general sightseeing (85.3 percent), visiting parks (46.7 percent), photography (39.8 percent), hiking or walking (35.6 percent), visiting historic areas or sites (33.5 percent), shopping (30.3 percent), looking at and buying arts and crafts (25.6 percent), visiting museums (22.2 percent), and eating traditional Navajo foods (20.4 percent) (NNDED 2011). The Navajo Nation's 2009-2010 Comprehensive Economic Development Strategy states that 565,933 people visited Navajo Nation Tribal Trust Lands and the surrounding vicinity in 2007, the most recent year for which data are available (NNDED 2010).

BLM-Managed Recreation Areas

The ROI has two BLM-managed recreation areas, Dunes Vehicle Recreation Area and Glade Run Recreation Area; one scenic area, Angels Peak Scenic Area; and one wilderness area, Bisti/De-Na-Zin Wilderness. The 800-acre Dunes Vehicle Recreation Area is used primarily for OHV use, motorcycle riding, mountain biking, and hiking/backpacking (BLM 2012d). Glade Run Recreation Area is popular for OHV use, hiking, and horseback riding. Approximately 3/4 of the 19,000-acre Glade Run Recreation Area is managed for limited trail use, and 3,800 acres in the southern portion of the recreation area are managed as an open OHV area (BLM 2011). Hunting is not permitted in either of the BLM-managed recreation areas. Both areas are open to the public year-round, though roads may become impassable during bad weather. Moreover, portions of the recreation areas may be closed to the public for short periods during authorized competitions or events (BLM 2012e).

Angels Peak Scenic Area offers about 10,000 acres of rugged terrain recognized for its geologic features and scenic panoramic views from the nearly 7,000-foot Angel Peak. The area provides hiking, photography, wildlife viewing, camping, picnicking, and dispersed hiking opportunities along the rim (BLM 2012f). Bisti/De-Na-Zin Wilderness is a 41,170-acre remote desert wilderness that offers some of the most unusual scenery found in the Four Corners region. This wilderness area is open year-round with no

fees, but it has no amenities. Bisti/De-Na-Zin Wilderness area offers primitive recreational opportunities for hiking, backpacking, camping, wildlife viewing, photography, and horseback riding (BLM 2012g).

Chimney Rock National Monument

Chimney Rock National Monument is located in southern Colorado about 75 miles northeast of the FCPP. The monument site encompasses approximately 4,726 acres of San Juan National Forest and is surrounded by Southern Ute Indian Reservation. The monument was designated on September 21, 2012, by Presidential Proclamation due to nationally significant archaeology, archaeoastronomy, visual and landscape characteristics, and geological and biological features, as well as objects of cultural and educational value. The Secretary of Agriculture through the US Forest Service (USFS), in partnership with the Chimney Rock Interpretive Association, a nonprofit organization (USFS 2012), manages Chimney Rock National Monument.

Mesa Verde National Park

Mesa Verde National Park is located in southwestern Colorado about 40 miles north of the FCPP and encompasses about 52,000 acres. The park was established in 1906 to preserve archaeological sites built by the Ancestral Puebloans who inhabited Mesa Verde for more than 700 years (550 to 1300 AD) and currently has over 4,700 archaeological sites, including 600 cliff dwellings. The park draws over 550,000 visitors annually (NPS 2013a).

Petroglyph National Monument

Petroglyph National Monument, authorized by Congress in 1990, stretches along the western side of the City of Albuquerque. The monument protects one of the largest petroglyph sites in the United States, encompassing approximately 7,250 acres, hundreds of archeological sites, and approximately 24,000 images carved by Pueblo Indians and early Spanish settlers. The City of Albuquerque and the National Park Service (NPS) cooperatively manage the monument; two-thirds of the monument is on city-managed land. The monument is managed with the goal of protecting the petroglyphs and other significant natural and cultural resources, while providing for a fulfilling visitor experience (NPS 2013b).

New Mexico State Park and Wildlife Areas

Jackson Lake Wildlife Area, managed by the New Mexico Department of Game and Fish, is located just north of the FCPP and covers about 840 acres. Recreational opportunities at the wildlife area include waterfowl hunting during the open hunting season, year-round fishing, wildlife viewing (deer, waterfowl, and songbirds), photography, and hiking (NMDGF 2012). Navajo Lake State Park is located northeast of FCPP and consists of three areas – Pine River, Sims Mesa, and San Juan River. The Pine River and Sims Mesa areas are located adjacent to lake and recreational facilities, including visitor centers, developed campgrounds, day use areas, and a full service marina. The San Juan River area below the dam is a world-renowned trout fishing location and includes wheelchair-accessible fishing facilities on the river, campgrounds, day use areas, and hiking trails (New Mexico State Parks 2013b).

Scenic Roads and Trails

The ROI has three designated Navajo Nation Scenic Roadway systems that provide scenic views of the region (see Figure 4.16-1). These roadways are recognized by the Navajo Nation as "*being a special resource the community wants to preserve and a place the local residents want to share with visitors*" (Navajo Nation Scenic Roads 2009). The 105–mile-long Diné Biítah "Among the People" Scenic Road, located on Routes 12 and 64, starts at Route I-40, passes north towards Canyon de Chelly National Monument, and crosses the Four Corners-West Mesa transmission line ROW. Tse'nikani Scenic Road is located on US 191 just north of the Four Corners-Moenkopi transmission line. The Trail of the Ancients within the Navajo Nation encompasses multiple roads in New Mexico in proximity to the Project and is proposed as a National Scenic Byway to connect to the larger network of the Trail of the Ancients Scenic

Byway within Colorado, Utah, and Arizona. These roads provide views of untouched Navajo Nation lands with striking vistas of desert landscapes, red rock formations, and historical and cultural landscapes (Navajo Nation Scenic Roads 2009).

The Old Spanish National Historic Trail, designated as part of the National Trails System in 2002, is a historic trade route that traverses about 1,200 miles, connecting Northern New Mexico to Southern California. The trail passes through the ROI about 15 miles to the north of the FCPP. The trail passes through federally managed lands under the administration of the BLM, NPS, USFS, US Fish and Wildlife Service (USFWS), Bureau of Reclamation, U.S. Army Corps of Engineers, and US Department of Defense, as well as through tribal lands, privately held lands, and lands under the administration of state and municipal agencies. The BLM and NPS have been directed to share administration of the national historic trail. The BLM and NPS are currently preparing a Comprehensive Management Plan and associated EIS, with the intent to protect the trail's natural and historic resources and recreational opportunities (NPS 2012a; BLM 2012h).

The Continental Divide Trail crosses the existing Four Corners-West Mesa transmission line ROW on BLM lands in New Mexico. The trail is a US National Scenic Trail, designated due to its natural beauty and the opportunities for scenic viewing, primitive hiking, and horseback riding that it provides. The trail crosses about 3,100 miles of land between Mexico and Canada. The portion of the trail that crosses BLM lands in New Mexico does not have designated pathways, except where it follows ranch roads. In addition, equestrian facilities are intermittent and in various stages of development (BLM 2012i).

River Recreation

The San Juan River flows east to west, originating along the southern slope of the San Juan Mountains in southwestern Colorado. It flows through Farmington and passes about 5 miles north of the Project Area before it drains into the Colorado River in Utah. Camping and hiking along the river is allowed with permits from the Navajo Nation, if recreating on the Navajo Nation Tribal Trust Land along the southern bank; or from the BLM, if recreating on the BLM land along the northern bank. A permit issued by the BLM is also required to boat on the San Juan River (Navajo Nation Parks and Recreation 2012b). The San Juan River provides world-class trout fishing, primarily upstream from Farmington and downstream of Navajo Lake (Farmington Convention and Visitors Bureau 2009).

The Chaco River is an intermittent wash that flows northwest through Chaco Canyon. It passes within 5 miles to the west of the Pinabete Permit Area and directly to the west of the FCPP. Water from Morgan Lake is released via a canal into an unnamed wash, which flows into Chaco Wash and then joins the San Juan River approximately 5 miles northwest of the FCPP. Dispersed recreation, including small game, furbearer, and game-bird hunting and trapping occurs along the Chaco River (DOI and BLM 2007).

Community Rodeos

Community rodeos are a popular activity throughout the region. Numerous rodeo associations in New Mexico promote the sport of rodeo with competitors from across America. The associations coordinate hundreds of rodeos annually throughout the state of New Mexico. Rodeos near Farmington New Mexico take place year round with the majority of the competitions taking place during the summer months, June through September. Rodeos near Farmington consist of tie-down roping, steer wrestling, saddle bronco riding, bareback bronco riding, bull riding, and barrel racing (New Mexico Rodeo Association 2013).

4.16.2.2 Project Area Recreation Resources

Four Corners Power Plant

With the exception of Morgan Lake, no parks, trails, scenic trails, or scenic landmarks are destinations for visitors within 10 miles of the existing FCPP (AECOM 2012c). Dispersed recreation, including small game, furbearer, and game-bird hunting and trapping, may occur around the FCPP; and hunting, fishing,

and trapping are known to occur along the San Juan River and Chaco Wash, which both pass the FCPP. The plumes from the FCPP stacks and the brown haze from the plant emissions are visible for short periods of time in areas surrounding the plant where dispersed recreation may occur

The FCPP is a secure facility with a fence and controlled access and is closed to the public (see Section 4.17, Health and Public Safety) (Cardno ENTRIX 2012).Morgan Lake, located directly adjacent to the FCPP to the north, is a 1,200-acre human-made reservoir that provides water for industrial and domestic use at the FCPP. Cooling water used during power plant operations is discharged into Morgan Lake and, as a result, the lake's water temperature ranges from 65 to 90°F depending on the time of the year. Morgan Lake is open to the public for recreation year-round and, due to the warm water temperatures, fishing, boating, and windsurfing are possible year-round. The Navajo Nation stocks the lake with channel catfish, largemouth bass, bluegill, and carp for recreational fishing and manage it as a quality bass lake. A license, issued by the Navajo Nation, is required to fish at Morgan Lake. Other activities at the lake include picnicking at designated picnic areas, windsurfing, and boating. There are no motor size restrictions at Morgan Lake, though watercraft permits are required for boating in motorized or non-motorized boats, as well as for windsurfing. Permits are valid for all water bodies on the Navajo Nation and are not specific to Morgan Lake. Swimming is not permitted at Morgan Lake (NNDFW 2012d). The lake also serves as a destination for hikers (JJ Clacs and Company 2002). The San Juan Chapter has proposed a nature trail from the San Juan Chapter House to Morgan Lake. Navajo Mine and Pinabete Permit Areas

No designated parks, trails, scenic roads, or scenic landmarks are destinations for visitors within the Navajo Mine and Pinabete Permit Area. The primary land use in the Permit Area and adjacent areas includes very low-intensity livestock grazing, along with a few scattered dwellings. About 3.4 miles of Burnham Road, a BIA road, crosses through the Permit Area. The remainder of the roadways consists of two-track unimproved roads that are primarily utilized by Navajo Nation members with customary use rights in the area; public use is infrequent. Dispersed recreation, including small game, furbearer, and game-bird hunting and trapping may occur within the Pinabete Permit Area and in the areas adjacent to the Navajo Mine Permit Area. However, due to the remoteness of the area and the limited public roadway access within the Permit Area, potential is limited for dispersed recreational use in the Permit Area and adjacent land areas.

In terms of public safety and access restrictions for dispersed recreational use, various controls are in place both to prevent unauthorized entry or travel through the site and to direct authorized visitors away from hazardous mining activities (BNCC 2012j). These controls include, but are not limited to, communication, site security, inspections, signage, audible alarms, fencing, barriers, and training. Most areas of the Navajo Mine have controlled access, through fencing and security stations at the Navajo North and Area III facilities. For uncontrolled public access roads, various ground control measures (e.g., berms or barriers) minimize traffic risks and the potential for unauthorized entry into restricted areas. In addition, security routinely patrols the mine site, intercepts unauthorized personnel, and escorts them back to the public access road (see also Section 4.17, Health and Public Safety).

Transmission Lines

The existing transmission line ROWs primarily traverse Navajo Nation Tribal Trust Lands, Hopi Tribe Tribal Trust Lands, and BLM-managed land. The existing Four Corners-West Mesa transmission line crosses NPS and City of Albuquerque land (see Figure 4.16-1) when it bisects Petroglyph National Monument, which is a destination for visitors. With the exception of Petroglyph National Monument, the existing transmission lines do not bisect any parks or scenic landmarks that would be destinations for visitors. Dispersed recreational use, such as hiking and OHVs, may occur along portions of the ROWs where public access occurs. With the exception of Petroglyph National Monument, the ROI has very few developed recreational facilities within proximity to the transmission line ROWs (see Figure 4.16-1). Table Mesa and Barber Peak are located immediately to the south of the Four Corners-Moenkopi transmission line, Beautiful Mountain is located about 5 miles south, and Shiprock Natural National Landmark is located approximate 7 miles to the north. Canyon de Chelly National Park, located on the Navajo Nation

and managed by the NPS (NPS 2012b), is located south of Four Corners-Moenkopi transmission line and north of the Four Corners–Cholla transmission line in northwestern Arizona. Chaco Canyon National Monument and Chaco Culture National Historical Park are located south of the Four Corners-West Mesa transmission line ROW in New Mexico. The NPS manages both areas (NPS 2012c).

The Continental Divide Trail crosses the existing Four Corners-West Mesa transmission line in New Mexico. The Diné Biítah "Among the People" Scenic Road bisects the Four Corners-Cholla transmission line about 30 miles southwest of the Pinabete Permit Area and FCPP, but no scenic tourist attractions are in the vicinity where the Scenic Byway bisects the transmission line ROW. No other designated trails or scenic byways pass within 5 miles of the ROWs, as depicted on Figure 4.16-1.

For the Four Corners-San Juan and the Four Corners-West Mesa transmission lines ROWs, PNM has obtained easements from landowners for the construction, operation, and maintenance of the transmission lines, but PNM does not own the land underlying the ROWs. Public access to land underlying the transmission line ROW is determined by the landowners, which in this case includes private individuals, private businesses, tribes, and government agencies. Some sections of the ROWs are publicly accessible, while others are restricted by the landowner's choice. At the point where transmission lines enter the boundary of a power plant or switchyard, access is restricted in accordance with facility security requirements (PNM 2012).

For the Four Corners-Moenkopi and Four Corners to Cholla transmission lines, APS does not hold easements or access rights outside the transmission line ROW. Access to the transmission line ROW is achieved exclusively through the use of public roads and is generally open to the public unless access is restricted by the landowner. The public is excluded from coming into close proximity to the transmission lines due to the distance between the transmission lines and the ground, as mandated by the National Electrical Safety Code.

4.16.3 Changes to Recreation Resources Affected Environment Post-2014

Two completed federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions; and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared in the following Section. Neither of these completed federal actions would change the affected environment for recreational resources.

4.16.4 Environmental Consequences

Recreational opportunities and access could be affected by the Proposed Action and alternatives, in some instances due to direct impacts on adjacent recreation areas and in other instances through indirect impacts on recreation-related activities. Mining construction activities and operations could result in short-term noise impacts due to drilling and blasting activities and increased vehicular traffic within the Project Area. Modifications to the Project Area site topography as a result of the mining operations could result in changes to the visual character of the region and potential changes in the recreational setting and experience within viewing distance of the Project. This section analyses these potential impacts to recreation and determines whether they are major. The Proposed Action and alternatives would not reduce or increase recreational fishing and hunting opportunities as a result of potential changes in fisheries populations and potential effects on wildlife populations and mobility. In addition, the long-term landownership and management of the Project following reclamation would not result in any changes to existing potential recreational use and access within the ROI. Therefore, these issues are not addressed further.

Impacts on recreation resulting from the Proposed Action and alternatives were assessed in a qualitative manner by considering the direct and indirect impacts caused by construction activities, mining and power plant operations, maintenance activities, and post-reclamation land use. Compatibility with relevant recreation management plans was also assessed. The likely direct impacts on recreational use and

access were considered, as well as the indirect potential changes in the existing recreational setting and experience. For the purposes of this EIS, a major impact on recreational resources would occur if implementation of the Proposed Action or alternatives would directly or indirectly result in any of the following conditions:

- Substantial reduction or displacement of existing recreational opportunities, such as wildlife viewing, hunting, or other existing recreational activities within the recreation ROI;
- Conflict with or incompatibility with recreation-related policies or objectives of existing applicable management plans;
- Major impact on scenic, or cultural quality, or other factors that contribute to the recreational opportunities and experience within the recreation ROI; or
- A reduction of public access to public recreation areas or opportunities.

The impact analysis includes both short-term and long-term effects. At the Navajo Mine and Pinabete Permit Areas, short-term impacts would occur during construction activities and mining operations and may persist through the reclamation phase of each individual area. Long-term impacts persist for the duration of the mining permit period (through 2041) and permanent impacts persist beyond or occur after reclamation. For the FCPP and transmission lines, short-term impacts are those that would occur immediately following approval of the lease renewals plus a reasonable period afterwards (i.e., a total of about 5 years). Long-term impacts are those that would persist beyond or occur after the 5-year period.

4.16.4.1 Alternative A – Proposed Action

Navajo Mine

According to the 2011 Navajo Nation Visitor Survey (NNDED 2011), the most important recreational and leisure activities for visitors in the region are general sightseeing and visiting parks. The Proposed Action would have the potential to impact the recreational experience and dispersed recreational opportunities within the recreational resources ROI by affecting the scenic beauty, impacting hunting and fishing opportunities, or increasing ambient noise levels in the immediate project vicinity. Under the Proposed Action, mining construction and operation activities would occur within the Permit Areas, and public access restrictions, such as restricted access to two-track roads within the Permit Areas, would be implemented for safety purposes. The Proposed Action would include realignment of Burnham Road within the Navajo Mine and Pinabete Permit area boundaries, and additional trucking and construction activities during the mining construction and operation periods. In addition, mining construction and operation would result in long-term changes to the site topography and vegetation within the Permit Areas, which would alter the visual character of the area, though the resulting impact on recreational resources would be minor because the changes in topography and vegetation caused by the Proposed Action would result in the same visual character as the current mining operations adjacent to areas currently being mined.

No designated public recreational facilities lie within the Navajo Mine and Pinabete Permit Areas; therefore, the Proposed Action would not directly or indirectly impact potential recreational resources associated with designated public recreation facilities within the Pinabete Permit Area.

The public access restrictions to the Permit Areas would have the potential to displace dispersed recreational opportunities within the Navajo Mine and Pinabete Permit areas, such as trapping, hunting, fishing, and hiking activities. These impacts would be long term (dispersed recreational opportunities would be restored following reclamation); however, opportunities for dispersed recreational opportunities would be available in adjacent publicly accessible land areas. Though mining activities would raise the ambient noise level in the immediate area, these noise levels are expected to be similar to existing conditions associated with current mining operations within the adjacent mine areas. Noise levels would

not be above levels considered to be a nuisance or harmful to nearby sensitive receptors (see Section 4.14, Noise and Vibration). Because noise levels are low and would not increase above baseline conditions, there would be no impacts to the recreational experience. Moreover, trucks and equipment used during mining activities would not result in impacts on recreational resources because they would only travel on roadways contained within the Permit Areas that do not offer recreational opportunities.

The Pinabete Permit Area would be located adjacent to the existing Navajo Mine operations and the existing regional recreation areas are located at long viewing distances (typically greater than 15 miles) from the Navajo Mine Permit Area. The Navajo Nation scenic sites within the recreational resources ROI (including Table Mesa, Barber Peak, and Shiprock) are all more than 10 miles from the Permit Areas. Similarly, no designated federal or state recreation areas lie immediately adjacent to the Permit Areas; the closest recreation areas (Jackson Lake, Dunes Vehicle Recreation Area, and Glade Run) are located 15 to 20 miles from the Permit Areas, which is not within viewing distance from the Permit Areas. Moreover, where mining is visible, views of the mining activities associated with the Proposed Action would be comparable with the existing scenic character of the region. Therefore, the recreational experience at these recreation areas and throughout the ROI would be similar to the existing conditions, and the potential impacts on regional recreation resources would be negligible (see also Section 4.13, Visual Resources).

Post-reclamation goals stated by the Burnham Community are to create suitable lands for grazing and agriculture, promote range management practices that make ranching a sustainable use of the land, and retain existing wildlife (BNCC 2012j). Under the Proposed Action, the post-mining land use for the Pinabete Permit Area has been designated as rangeland for grazing domestic livestock and wildlife habitat, which is the same as the pre-mining land use and is expected to be equal to or greater than the pre-mining quality. The post-reclamation land use of the Permit Areas would be similar to the pre-mining conditions at the Pinabete Permit Area and Navajo Mine Permit Area sites that have already been reclaimed. These lands would provide long-term recreational opportunities for dispersed recreational activities. The Proposed Action would not alter long-term recreational uses and access within the ROI and, therefore, would not conflict with or be incompatible with recreation-related policies or objectives or the existing applicable management plans in the ROI, including the BLM Farmington Field Office Management Plan and Navajo Nation recreation management.

Four Corners Power Plant

Under the Proposed Action, public access to the FCPP would continue to be restricted with fences and locked gates, but public recreational opportunities and public access at Morgan Lake would remain. The Proposed Action would result in continued operation of Units 4 and 5 with increased emission controls, and implementation of an additional ash pond. Discharges to Morgan Lake would be the same as under existing conditions and, thus, water temperatures and associated year-round potential for recreational opportunities at Morgan Lake would not be impaired. Similarly, the proposed ash disposal area and associated borrow areas would be located in the southwest portion of the Four Corners Power Plant Lease boundary, and Morgan Lake is located in the northeastern portion; the existing ash ponds are located between Morgan lake and the proposed future ash ponds. Therefore, the proposed ash ponds and disposal area would not alter existing recreational opportunities at Morgan Lake. The proposed surge pond location is located northeast of the existing ponds, closer to Morgan Lake. However, the power plant is also located adjacent to this portion of Morgan Lake, resulting in an industrial baseline character, and therefore the proposed surge pond would not impact recreational opportunities. Therefore, recreational access and opportunities associated with Morgan Lake would remain the same as existing conditions, and implementation of the Proposed Action would not cause any adverse effects.

Under the Proposed Action, the regional recreational opportunities and experiences within the ROI would remain largely similar to existing conditions. Increased emission controls for Units 4 and 5 may result in a reduced emissions plume, which could result in some minor improvements to the visual setting and overall visibility in the area. Since visibility and views of the landscape are a component of the

recreational experience in this region, this could potentially result in minor beneficial impacts to recreation. The Proposed Action would not alter roadway access and, therefore, no impacts on access to recreation areas within the ROI would occur. Short-term minor noise impacts during the construction of the ash disposal area may occur on-site but these impacts would be temporary and intermittent and would have no substantial effect on noise in the area. As such, they would not impact dispersed recreation in the adjacent areas, nor would they be audible from distant recreation areas. Long-term noise levels under the Proposed Action at the FCPP would be similar to existing conditions (see Section 4.14, Noise and Vibration) and would not impact recreational experiences within the ROI.

Transmission Lines

Under the Proposed Action the existing ROW leases for the Four Corners-Moenkopi, the Four Corners–Cholla, the Four Corners-San Juan, and the Four Corners-West Mesa transmission lines would be renewed and existing alignments would remain. The existing recreational activities along the transmission line ROWs would not be altered because the Proposed Action would not result in changes to ROW access or maintenance activities. Public access along the transmission line ROWs, which are currently publicly accessible in some locations, would not change from the existing conditions as a result of the Proposed Action. Public access is currently and would continue to be at the landowner's discretion. Public access would continue to be restricted at the points where transmission lines enter the boundary of a power plant or switchyard. The ROWs would not be realigned and existing maintenance and operations of the transmission lines would not change under the Proposed Action; therefore, no impacts on recreational resources associated with the transmission lines would occur.

Moreover, the Proposed Action would not alter the recreational experience (including scenic beauty, hunting, and hiking) in the ROI because the transmission lines already exist and the Proposed Action would not alter existing conditions. Dispersed recreational opportunities (such as hunting, hiking, and OHV use), which may occur along portions of the transmission line ROWs, would not be impacted because the Proposed Action would not alter existing conditions. Similarly, renewing the leases on the existing transmission line ROWs would not conflict with or be incompatible with existing recreation-related policies or objectives.

4.16.4.2 Alternative B – Navajo Mine Extension Project

Navajo Mine

Under Alternative B, the mining operations would be comparable to those described in the Proposed Action but would occur in a slightly different part of the Navajo Mine Lease Area. As such, Alternative B would result in a similar set of effects on the recreational experience and dispersed recreational opportunities within the recreational resources ROI as described for the Proposed Action. No designated public recreational facilities currently lie within the Navajo Mine Lease Area, including the Navajo Mine Extension Project Area, so Alternative B would not directly impact recreational resources. The Navajo Mine Extension Project Area is also located adjacent to the existing Navajo Mine operations, and the existing regional recreation areas are located at long viewing distances (typically greater than 15 miles) from the Navajo Mine Permit Area, so no impacts to public recreational facilities would occur, as described under the Proposed Action. Potential adverse impacts associated with mining operations would be comparable to those described for the Proposed Action, including impacts from trucks and equipment traffic, impacts on ambient noise, and impacts on scenic beauty. Alternative B would also result in the realignment of Burnham Road, with the same potential impacts.

The public access restrictions to the Alternative Mine Plan and associated potential displacement of dispersed recreational opportunities (e.g., trapping, hunting, and hiking) would be comparable to those described for the Proposed Action, though the alternate permit area boundary would result in access restrictions in a slightly different location.

Under Alternative B, mining would occur within Pinabete Arroyo and require a diversion of flows from the arroyo around mining activities. Diversion of the Pinabete Arroyo may indirectly impact dispersed recreation downstream by impacting wildlife along the arroyo (see Section 4.7, Wildlife and Habitats). However, these impacts are expected to be negligible because Pinabete Arroyo is ephemeral and as such only intermittently supports wildlife and the associated hunting and fishing opportunities throughout the year. Moreover, reclamation activities would include reestablishing the approximate original channel location, though reclamation would not occur for over 40 years. All other reclamation activities would be the same as described for the Proposed Action and would not conflict with recreation-related policies and objectives in the ROI.

Four Corners Power Plant

Under Alternative B, the BIA would approve the lease amendment for FCPP, and FCPP would operate as described under the Proposed Action, with the same recreation-related impacts described above.

Transmission Lines

Under Alternative B, the transmission line ROWs would be approved, and they would continue to be operated and maintained as described under the Proposed Action, with the same potential recreation-related impacts as described above.

4.16.4.3 Alternative C – Alternative Pinabete Mine Plan

Navajo Mine

Under Alternative C, the mining operations would be comparable to those described in the Proposed Action but would occur in a slightly different part of the Navajo Mine Lease Area. As such, Alternative C would result in a similar set of effects on the recreational experience and dispersed recreational opportunities within the recreational resources ROI as described for the Proposed Action. No designated public recreational facilities currently lie within the Navajo Mine Lease Area, including the Alternative Pinabete Mine Plan Area, so Alternative C would not directly impact recreational resources. The Alternative Pinabete Mine Plan Area is also located adjacent to the existing Navajo Mine operations, and the existing regional recreation areas are located at long viewing distances (typically greater than 15 miles) from the Navajo Mine Permit Area, so no impacts to public recreational facilities would occur, as described under the Proposed Action. Potential adverse impacts associated with mining operations would be comparable to those described for the Proposed Action, including impacts from trucks and equipment traffic, impacts on ambient noise, and impacts on scenic beauty. Alternative C would also result in the realignment of Burnham Road, with the same potential impacts.

The public access restrictions to the Alternative Pinabete Mine Plan and associated potential displacement of dispersed recreational opportunities (e.g., trapping, hunting, and hiking) would be comparable to those described for the Proposed Action, though the alternate permit area boundary would result in access restrictions in a slightly different location.

Similar to Alternative B, mining would occur within Pinabete Arroyo and require a diversion of flows from the arroyo around mining activities. Diversion of the Pinabete Arroyo may indirectly impact dispersed recreation downstream by impacting wildlife along the arroyo (see Section 4.7, Wildlife and Habitats). However, these impacts are expected to be negligible because Pinabete Arroyo is ephemeral and as such only intermittently supports wildlife and the associated hunting and fishing opportunities throughout the year. Moreover, reclamation activities would include reestablishing the approximate original channel location, though reclamation would not occur for over 40 years. All other reclamation activities would be the same as described for the Proposed Action and would not conflict with recreation-related policies and objectives in the ROI.

Four Corners Power Plant

Under Alternative C, the BIA would approve the lease amendment for FCPP, and FCPP would operate as described under the Proposed Action, with the same recreation-related impacts described above.

Transmission Lines

Under Alternative C, the transmission line ROWs would be approved, and they would continue to be operated and maintained as described under the Proposed Action, with the same potential recreation-related impacts as described above.

4.16.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action. Impacts would be the same as described for the Proposed Action.

Four Corners Power Plant

Under this alternative, the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The 10% reduction in surface area would result in the same recreation-related impacts as described for the Proposed Action. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

Under this alternative, the transmission line ROWs would be approved and they would continue to be operated and maintained as described for the Proposed Action. As such, impacts would the same as described for the proposed action.

4.16.4.5 Alternative E – No Action Alternative

Navajo Mine

Under the No Action Alternative, mining would cease when the ROD is issued in 2015; the Navajo Mine would close; and the previously mined areas would be reclaimed. Post-reclamation goals stated by the Burnham Community are to create suitable lands for grazing and agriculture, promote range management, and retain wildlife. The post-reclamation land use under the No Action Alternative would be comparable to the post-reclamation land use under the Proposed Action, although it would occur sooner under the No Action Alternative. It is expected that following reclamation, the land would returned to pre-mining quality and would provide recreational opportunities the same as before mining. Reclaimed lands would provide long-term recreational opportunities for dispersed recreation, such as trapping, hunting, fishing, and hiking. The No Action Alternative would not alter long-term recreation within the ROI and, therefore, would not be in conflict with or incompatible with recreation-related policies or objectives or the existing applicable management plans in the ROI.

The No Action Alternative would improve the recreational setting because ambient noise levels would decrease due to cessation of mining operations and a decrease in adjacent traffic. No access restriction would inhibit dispersed recreation within the Project Area, and indirect impacts on scenic beauty from designated recreation areas would not occur.

Four Corners Power Plant

Under the No Action Alternative, APS would shut down Units 4 and 5 and decommission and dismantle the units and all of the switchyards and facilities.

The elimination of the emissions from the stacks on Units 4 and 5 would reduce the visibility of the FCPP to people recreating in the area. Moreover, all of the operating units and ancillary facilities would eventually be dismantled, which would result in a moderate beneficial impact by improving the scenic beauty in the ROI. The site would be remediated, and access restrictions would be removed, increasing the opportunity for dispersed recreation in the area.

If the FCPP were to shut down Morgan Lake would no longer be necessary. Discharges to Morgan Lake would not continue. If the river pumping plant and the pipeline to Morgan Lake were not operated or removed, over time Morgan Lake would evaporate and cease to exist, so all recreational opportunities in Morgan Lake would cease to exist.Elimination of water to Morgan Lake would have a major, long-term impact on recreational resources in the Project Area. It is not known if or how the river pump station would be operated if APS chose to leave the river pumping plant and the pipeline behind, and the Navajo Nation took possession of those facilities.

Transmission Lines

Under the No Action Alternative, the transmission line ROWs would not be renewed. The power lines would either be decommissioned and dismantled or left in place. If the transmission lines were left in place, the recreational setting would not change from the existing condition. If the transmission lines were dismantled, moderate beneficial impacts would occur from improving the scenic beauty in the ROI. Currently, no decommissioning plan exists. Removal of the transmission line structures would occur under a separate approval process and recreational impacts would be assessed in the environment documents analyzing that particular action.

4.16.5 Recreation Resources Mitigation Measures

The Project Applicants must comply with protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section. Where the environmental analysis in this EIS recommends additional protective measures, over and above the protective regulatory measures, they are listed below as specific mitigation measures.

The Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects to recreation resources. Therefore, no additional mitigation is recommended.

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4.17 Health and Safety

This section includes a discussion of both public health and safety and worker safety. The public health discussion focuses primarily on the human health risks from exposure to contaminants in air emissions produced by the existing and proposed activities at the Navajo Mine and FCPP including stack emissions, dust generation, and diesel particulate matter. Other potential public health risks, including risks to public safety such as downed power lines, are also discussed. Public health and worker safety associated with hazardous materials and coal combustion, including the potential for public and worker exposure to hazardous wastes and hazardous materials is discussed in Section 4.15, Hazardous and Solid Wastes. A discussion of baseline levels of contaminants in air that could contribute to human health risks is included in Sections 4.1, Air Quality, of this EIS.

The ROI for public health with respect to the FCPP is the 50-km radius air quality study area; for the Navajo Mine it is the existing Navajo Mine and Pinabete Permit Area plus a ½-mile buffer zone around the perimeter; and for the transmission lines it is the ROW plus a ½-mile buffer zone on either side. The ROI for worker safety and public safety is the FCPP's footprint, existing Navajo Mine and Pinabete Permit Area, and transmission line ROW plus a ½-mile buffer zone on either side.

4.17.1 Regulatory Compliance Framework

4.17.1.1 Federal Regulations

Surface Mining Control and Reclamation Act (SMCRA)

SMCRA is the primary federal law that regulates the environmental effects of coal mining in the United States. SMCRA requires companies to obtain a permit to mine on Indian Reservations, federal lands, or state lands in states that do not have a state run SMCRA program through OSMRE. Such permits include provisions to protect air and water quality. The protection of air and water quality in turn protects the public from exposure to contaminants which could impact public health.

Federal Mine Safety and Health Act of 1977

The Federal Mine Safety and Health Act requires that the U.S. Department of Labor's Mine Safety and Health Administration (MSHA) inspect all mines multiple times each year to ensure safe and healthy work environments for miners. In addition to setting safety and health standards for preventing hazardous and unhealthy conditions, MSHA's regulations establish requirements for:

- Immediate notification by the mine operator of accidents, injuries, and illnesses at the mine;
- Training programs that meet the requirements of the Mine Act;
- Obtaining approval for certain equipment used in gassy underground mines; and
- Requirements for the use of personal protective equipment (PPE).

MSHA is similar to the Occupational Safety and Health Act in intent and organizational purpose; however, MSHA is specific to mining operations.

Mine Improvement and New Emergency Response Act of 2006

This legislation amends the Mine Safety and Health Act of 1977 and contains a number of provisions to improve safety and health for miners working in America's mines. It requires mine-specific emergency response plans in underground coal mines; added new regulations regarding mine rescue teams and sealing of abandoned areas; requires prompt notification of mine accidents; and requires enhanced civil penalties.

In addition to this act, the Navajo Mine would also be required to comply with various parts of 30 CFR: Part 48, which outlines requirements for training and retraining of miners; Part 62, which addresses occupational noise exposure; and Part 77, which covers mandatory safety standards for surface coal mines.

Occupational Safety and Health Act (29 USC 651 et seq)

The Occupational Safety and Health Act allows the Occupational Safety and Health Administration to issue workplace health and safety regulations. These regulations include limits on chemical exposure, employee access to information, requirements for the use of personal protective equipment (PPE), and requirements for safety procedures. The employees working at the FCPP and performing maintenance of transmission lines are covered under the Occupational Safety and Health Act, while mine workers are covered under MSHA.

Clean Air Act (CAA) of 1970, 42 USC 7401 et seq, as amended 1990

The CAA passed by the Congress in 1970, and amended in 1990, authorized the EPA to establish National Ambient Air Quality Standards (NAAQS) for pollutants known as criteria pollutants that threaten human health and the environment (40 CFR Part 50). Criteria pollutants include ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), respirable particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and lead (Pb). The CAA established two types of NAAQS:

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

Additional detail regarding the NAAQS and the criteria pollutants including their impacts to health are included in Section 4.1, Air Quality. The ambient air quality standards are intended to protect the public health and welfare and specify the concentration of pollutants (with an adequate margin of safety) to which the public may be exposed without adverse health effects. The standards are designed to protect those segments of the public most susceptible to respiratory distress (known as sensitive receptors). The Four Corners area which includes the Project Area is designated attainment for all National Ambient Air Quality Standards (NAAQS).

Title III: Air Toxics. Toxic air pollutants are those pollutants which are hazardous to human health or the environment but are not specifically covered under another portion of the Clean Air Act. These pollutants are typically carcinogens, mutagens, and reproductive toxins. The Clean Air Act of 1990 offers a comprehensive plan for achieving significant reductions in emissions of hazardous air pollutants from major sources. The new law includes a list of 189 toxic air pollutants of which emissions must be reduced. Hazardous Air Pollutants (HAPs) is the Federal term for air toxics. HAPs can be emitted from coal combustion and operation of mobile equipment.

Electrical Safety Code (NESC)

The NESC is the industry-accepted safety standard for overhead and underground electric utility and communications utility installations. Adopted by most states and Public Service Commissions, the NESC covers electric supply and communication lines, equipment, and work practices employed by both public and private electric utility installations.

4.17.2 Affected Environment Pre-2014

4.17.2.1 Navajo Mine

Public health is affected when contaminants reach a receptor (human) in sufficient amounts to result in an adverse health outcome. Although the areas surrounding the Navajo Mine Permit Area and the Pinabete Permit Area are relatively remote, some residences lie within the Navajo Mine Lease Area where humans

could be exposed to contaminants from the mine. Currently, there are three houses within the Pinabete Permit Area (DOI and BIA 2007). These residents would be relocated during the mining period.

Navajo Mine Site Access

All Navajo Mine operations are potentially accessible by members of the community and/or their domestic animals by various means. These means include authorized entry (e.g., mine tours, transit via public roads, regulatory inspections) or unauthorized entry (e.g., transit onto private roads, pedestrian encroachment, and vandalism). Public access roads allow access within the Navajo Mine Permit Area and Pinabete Permit Area. In addition to the North Plant Access Road (CR-6675), three public roads intersect the Navajo Mine Lease Area: Ramp 7 public access road, Table Mesa Road, and Burnham Road (BIA Road 3005 and Navajo Road N5082) (BNCC 2012h). For a more detailed description of land uses and public access roads in and around the Pinabete Permit Area, refer to Section 4.9, Land Use.

Various controls are in place both to prevent unauthorized entry or travel through the site and to direct authorized visitors away from hazardous mining activities. These controls include, but are not limited to, communication, site security, inspections, signage, audible alarms, fencing, barriers, site security, inspections, and training. Specific procedures up to and including road closures are implemented during blasting occurs close to the permit boundary or near public access roads.

NTEC regularly communicates with the community regarding operational changes that might affect the community (e.g., blasting notices in the local newspaper, consultations with Navajo Nation chapters and key stakeholders). NTEC manages a number of initiatives, or projects, including communication and consultation with the community to maintain awareness of changes and updates in mine activities (BNCC 2012a).

Most areas of the Navajo Mine have controlled access through fencing and security stations at the Navajo North and Area III Facilities. All visitors must register at the respective mine security stations before entering mine premises and must receive MSHA 5000-23 hazard recognition training. NTEC has procedures in place for private vehicles, site tours, etc. For instance, vehicles are inspected and cannot enter without meeting proper safety criteria (e.g., working lights and brakes, onboard fire extinguisher, no flammable materials). Vehicles are tagged with color-coded numbered signs that correspond with the sign-in log and identify which designated areas they are allowed to enter. An experienced miner as defined by MSHA must escort all tours of mine property (BNCC 2012a).

If a vehicle deviates from designated areas, or other unauthorized access is observed, the observer is required to notify security and other appropriate mine personnel. To eliminate or minimize the risk from an unauthorized entry, protocols or procedures require shutdown of hazardous operations, such as aborting a blast, de-energizing rails, or shutting down rail or haulage operations, when unauthorized access has been observed.

The community uses a number of locations around the mine site as ingress and egress routes to other locations at uncontrolled public access roads. These roads are not subject to security check-in and verification of on-site access. To address this additional risk, various ground control measures (e.g., berms or barriers) minimize the potential for unauthorized entry into restricted areas. Security routinely patrols the mine site, intercepts unauthorized personnel, and escorts them back to the public access road. Also, as described above, all mine personnel are required to eliminate or minimize risks due to unauthorized entry as part of their safe work practices (BNCC 2012a).

Public Health Studies

The major public health risk associated with the Navajo Mine is exposure to mining-related emissions such as diesel particulate matter (DPM) from vehicles and fugitive coal dust.

The harmful constituents in these emissions are particulate matter and diesel particulate matter and their respective constituents. PM emissions that are regulated under the Federal CAA through the NAAQS

include PM_{10} and $PM_{2.5}$ standards. In general, most particles with a diameter of 10 micrometers or less (PM_{10}) are trapped in a person's mouth, nose, and throat and do not reach a person's lungs. Fine particles (smaller than 2.5 micrometers in diameter [$PM_{2.5}$]) tend to reach the deepest areas of a person's lungs, where illnesses can originate. Generally, particulate emissions from mining and material handling operations are coarse and larger than 10 microns. Emissions from fuel-burning equipment such as vehicles engines are generally smaller—less than 2.5 microns (BNCC 2011d).

Most epidemiological studies which evaluate health outcomes from exposure to coal dust inhalation are related to occupational exposures while few are related to environmental exposure. A few targeted health studies have been performed within or near the Project Area and are discussed below. These studies don't specifically relate health outcomes from coal dust inhalation but provide an overall picture of community health issues.

San Juan County's most recent Community Health Profile includes a comprehensive overview of health indicators including respiratory health (San Juan County 2010). This study found that San Juan County has a higher incidence of chronic lower respiratory disease (CLRD) comprised of chronic bronchitis, asthma, and emphysema compared to New Mexico or the rest of the United States. Another study found that elevated levels of ozone in San Juan County were linked to incidence of asthma-related medical visits. This study found that San Juan County residents are 34 percent more likely to have asthma-related medical visits after 20 parts per billion increases in local ozone levels (NMDH 2007).

Another study, whose study area also included the Project Area, was undertaken to better understand the relationship between the perceived risk to respiratory health from ambient air quality and the risk presented by coal combustion inside of dwellings for cooking and heating. The study considered special exposures for vulnerable populations, and examined the relationship between coal combustion in homes in the Shiprock area (Shiprock residents have easy access to the low or no-cost coal which is made available to Navajo tribal members near Navajo Mine as part of the lease agreement between BHP and Navajo Nation) and impacts on respiratory health.

The conclusion of the report states that the presence of two large coal-fired power plants near Shiprock may contribute to that risk, but results from this study suggest that the risk could be reduced by making relatively simple and inexpensive changes to methods of home heating (Bunnell et al. 2010). Although this study highlights the role of the home use of coal, the EIS analysis focuses more on the Project-related effects to human health.

Worker and Public Safety Programs

Typical risks encountered at an industrial facility such as the Navajo Mine include exposure to dust, noise, heat stress, frostbite, lightning strikes, animal and insect bites, and chemicals, as well as the increased chance for accidents due to working directly with or in proximity to large equipment. At Navajo Mine, implementation and enforcement of safety policies and procedures reduce risks to mine workers and the public are implemented within the mine area (Cardno 2012; BNCC 2012a).

NTEC's health and safety program provides a systematic and integrated approach to the management of health and safety issues. The program consists of evaluating risks, developing programs to eliminate or mitigate the risk, auditing the programs for effectiveness, and implementing improvements or changes to the program based on feedback from the audit process. The health and safety program is used as a tool for NTEC to manage health and safety risks and minimize health and safety impacts both on site and off site. Visitors coming onsite for tours or inspections must attend a safety briefing and must wear a hard hat, steel-toed safety boots with metatarsal protection, reflective vests (or reflective coveralls or reflective safety shirt), and wrap-around safety glasses or safety glasses with side shields.

Based on health and safety risk assessments, safety protocols, MSHA regulations, and Navajo Mine policies and practices, all employees receive safety training applicable to their work area and level of risk. This training includes MSHA Part 48 training, which requires that any employee or contractor working on

site for more than 5 days within a 12-month period must receive no less than 24 hours of training before being assigned to work duties. This training includes:

- Self-rescue and respiratory devices - Instruction and demonstration in the use, care, and maintenance of self-rescue and respiratory devices, where applicable.
- Transportation controls and communication systems - Instruction on the procedures in effect for riding on and in mine conveyances where applicable; the controls for the transportation of miners and materials; and the use of mine communication systems, warning signals, and directional signs.
- Introduction of work environment – Includes a visit and tour of the mine, or portions of the mine that is representative of the entire mine. The method of mining or operation utilized shall be observed and explained.
- Escape and emergency evacuation plans; fire warning and fire-fighting - A review of the mine escape system, and escape and emergency evacuation plans in effect at the mine; and instruction in the fire warning signals and fire-fighting procedures.
- Ground control; working in areas of highwalls, water hazards, pits and spoil banks; illumination and night work - Introduction to and instruction on the highwall and ground control plans in effect at the mine; procedures for working safely in areas of highwalls, water hazards, pits and spoil banks; the illumination of work areas; and safe work procedures during the hours of darkness.
- Health - Instruction on the purpose of taking dust measurements, where applicable, and noise and other health measurements, and any health control plan in effect at the mine shall be explained. The health provisions of the Act and warning labels shall also be explained.
- Hazard recognition - Recognition and avoidance of hazards present in the mine.
- Electrical hazards - Recognition and avoidance of electrical hazards.
- First aid - Instruction in first aid methods acceptable to MSHA.
- Explosives - Include a review and instruction on the hazards related to explosives.
- Health and Safety aspects of assigned tasks - Instructions in the health and safety aspects of the tasks to be assigned, including the safe work procedures of such tasks, the mandatory health and safety standards pertinent to such tasks, information about the physical and health hazards of chemicals in the miners work area, the protective measures a miner can take against these hazards, and the contents of the mine's Hazard Communications program.

Annual refresher training (8-hour) is required after 1 year. By regulation, MSHA-approved instructors conduct all courses (BNCC 2012a; BNCC 2012h; BNCC 2012k).

All training is documented, and records are maintained on NTEC’s Learning Management System (LMS). LMS captures the training title, date, and name of the attendee. If training is MSHA-required, such as the Part 48 annual refresher or Part 77 Certified Supervisor, then in addition to being input into LMS, each participant receives a federal Form 5000-23 (BNCC 2012h).

4.17.2.2 Four Corners Power Plant

The primary human health risks associated with the FCPP come from the contaminants in air from stack emissions, gasoline or diesel burning equipment, dust from coal handling operations or other dust generating activities. The human health risks from these emission sources may impact the public either from direct inhalation of the air or from other pathways such as ingestion of fish, plants or water that have been exposed to the above-mentioned emissions. Past and present impacts to public health from emissions from FCPP are discussed in Section 4.18, Cumulative Impacts.

Hazardous materials that are flammable or toxic are handled and stored at the FCPP. A discussion of these chemicals and the risks they pose is included in Section 4.15, Hazardous Waste and Solid Wastes.

FCPP Site Access

The area surrounding the FCPP is relatively remote, with few small towns and no large populated areas in proximity. The total area of the FCPP site including ancillary facilities is 3,597 acres. A more detailed description of land uses in the area is included in Section 4.9, Land Use. The FCPP is a secure facility with a fence and controlled access on all sides. Entrance is via a gated entrance with a guardhouse. The FCPP has 24-hour security, and public access is prohibited except in the case of visitors who must have safety orientation training, wear proper PPE, and show proper identification (BNCC 2012h; Cardno Entrix 2012).

Worker and Public Safety Programs

Typical risks encountered at an industrial facility such as the FCPP include exposure to dust, noise, heat stress, falls, electrical shock, and chemicals. Safety policies and procedures in place at the FCPP are designed to reduce these risks.

The APS safety program is designed to follow a proactive plan to create a safety culture whereby employees are expected to work safely and are empowered to make the decisions and take the actions necessary to work safely. This goal is accomplished by delegating and communicating stop work authority to all personnel, including contractors. Documented safety procedures are coupled with a requirement to perform documented pre-job briefs on each job and a Job Hazard Analysis as needed.

Required safety training is completed in numerous areas to ensure employees have the knowledge necessary to work safely. Safety performance observation is used as a means of developing meaningful data to develop trends to assist with setting training requirements and to ensure written safety procedures are followed. The observation process also provides a venue for employee engagement to help build positive safety habits. APS also has an accident/incident investigation process to aid in determining causes of any incidents as well as to establish measures to prevent recurrence of an incident (BNCC 2012h).

4.17.2.3 Transmission Lines

Potential risk to humans from the transmission lines is from electromagnetic frequency (EMF) exposure, electrocution from power lines, induced currents, and hazards to small aircraft from overhead power lines.

Transmission Line Site Access

For the Four Corners-Moenkopi and Four Corners-Cholla transmission lines, APS does not hold easements or access rights outside the transmission line ROWs. Access to the transmission line ROWs is achieved exclusively through the use of public roads. Access to the transmission line ROWs is generally open to the public unless access is restricted by the landowner; APS does not restrict access to the transmission line ROWs. In the ROWs, access to the lines and towers is generally achieved through the use of unpaved roads. APS does not perform regularly scheduled maintenance to roads within the ROWs. If access roads do not exist due to terrain constraints, maintenance crews use foot access or helicopters to access the transmission lines. The public is excluded from coming near the transmission lines due to the distance between the transmission lines and the ground. These distances are mandated by the NESC (APS 2012d).

For the Four Corners-San Juan and the Four Corners-West Mesa transmission line ROWs, PNM has obtained easements from landowners for the construction, operation, and maintenance of the transmission lines, but PNM does not own the land underlying the ROWs. Public access to land underlying the transmission line ROWs is determined by the landowner, which in this case includes private individuals, private businesses, tribes, and government agencies. Some sections of the ROWs are publically accessible, while others are restricted by choice of the landowner. At the point where

transmission lines enter the boundary of a power plant or switchyard, access is restricted in accordance with facility security requirements (PNM 2012).

Electric and Magnetic Fields

Magnetic and electric fields are separate phenomena that occur naturally and as a result of human activity. Human-induced fields occur over a broad electrical and electromagnetic spectrum and are generated by communications equipment, appliances, and the generation, transmission, and local distribution of electricity. Both electric and magnetic fields are produced when transmission lines are energized. The strength of the electrical field is directly correlated to voltage, and the strength of the magnetic field is dependent on current. Both electric and magnetic fields attenuate rapidly with distance from the source. In addition, electric fields associated with transmission lines are dampened by most objects, such as trees or houses, which shield receptors; however, magnetic fields are not easily shielded by objects or materials. As a result, the primary concern regarding potential health effects associated with EMF from transmission lines is related to magnetic fields. Extremely low frequency (ELF) fields include alternating current (AC) fields and other electromagnetic, non-ionizing radiation from 1 to 300 Hz. ELF fields at 60 Hz is produced by power lines, electrical wiring, and electrical equipment.

In 1992, Congress authorized the development of the Electric & Magnetic Fields Research and Public Information Dissemination Program, or EMF-RAPID. Congress instructed the National Institute of Environmental Health Sciences (NIEHS) to review the information presented by EMF-RAPID and prepare a response. NIEHS created the EMF-RAPID website and prepared a report titled *Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields* (NIEHS 1999). This report summarizes the evidence on health risks from ELF-EMF and makes recommendations to protect the public health.

The report discusses the discrepancy between the findings from epidemiological studies and laboratory studies and the significance of the discrepancy. Epidemiology is the study of the patterns, causes, and effects of health and disease conditions in defined populations. Epidemiological studies have serious limitations in their ability to demonstrate a cause and effect relationship whereas laboratory studies, by design, can clearly show that cause and effect are possible.

The strongest evidence for health effects from ELF-EMF comes from associations observed in human populations or epidemiological studies with two forms of cancer: childhood leukemia and chronic lymphocytic leukemia in occupationally exposed adults. While the support from individual studies is weak, the epidemiological studies demonstrate, for some methods of measuring exposure, a fairly consistent pattern of a small, increased risk with increasing exposure that is somewhat weaker for chronic lymphocytic leukemia than for childhood leukemia.

In contrast, the studies conducted in a laboratory or controlled setting and the animal toxicology literature fail to demonstrate any consistent pattern across studies although sporadic findings of biological effects have been reported. No indication of increased leukemia in experimental animals has been observed. Virtually all of the laboratory evidence in animals and humans and most of the mechanistic work done in cells fail to support a causal relationship between exposure to ELF-EMF at environmental levels and changes in biological function or disease status.

The lack of consistent, positive findings in animal or mechanistic studies weakens the belief that this association is actually due to ELF-EMF, but it cannot completely discount the epidemiological findings. The lack of connection between the human data and the experimental data (animal and mechanistic) severely complicates the interpretation of these results.

In the recommended action section of the report the NIEHS states:

> *"The NIEHS suggests that the level and strength of evidence supporting ELF-EMF exposure as a human health hazard are insufficient to warrant aggressive regulatory actions; thus, we do not recommend actions such as stringent standards on electric*

> *appliances and a national program to bury all transmission and distribution lines. Instead, the evidence suggests passive measures such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. NIEHS suggests that the power industry continue its current practice of siting power lines to reduce exposures and continue to explore ways to reduce the creation of magnetic fields around transmission and distribution lines without creating new hazards."*

Research over several decades by national and international panels is inconclusive regarding potential public health risks from exposure to power line EMF. The existing data do not provide sufficient evidence to conclude that EMF causes cancer. No EPA or New Mexico State guidelines or regulations relate to EMF levels from electrical transmission lines, and no defined or adopted NEPA standards define health risk from EMF.

Non-EMF

The following non-EMF power field issues are associated with electrical transmission lines: interference with radio, television, and electronic equipment; interference with cardiac pacemakers; and induced currents and shock hazards.

Interference with Radio, Television, and Electronic Equipment

Electric fields associated with transmission lines do not generally interfere with electronic equipment in homes or businesses because the equipment is shielded by building walls. However, magnetic fields are able to penetrate building walls and, therefore, have the potential to interfere with electronic equipment. The degree of interference by magnetic fields is dependent on the sensitivity of the equipment. PNM and APS have no record or knowledge of complaints involving interference with radio, television, or electronic equipment associated with the transmission lines (APS 2012d). If a complaint is received, it is routed to the appropriate department for assessment and investigations are conducted on a case-by-case basis **(**APS 2012d; PNM 2012).

On June 12, 2009, over-the-air analog television broadcasts ceased, and all over-the-air broadcasts converted to digital broadcasts. These digital broadcasts are assigned to the UHF band, which is the frequency range not affected by transmission line noise due to the noise attenuation at these higher frequencies. Thus, digital television will not experience the interference problems that analog television had the potential of experiencing.

No specific limits on high-frequency emissions from electric power facilities have been developed. However, the Federal Communications Commission has promulgated regulations specifying that transmission lines be operated such that no harmful interference is produced (FCC Regulations, Section 15.25).

Interference with Cardiac Pacemakers

The electrical fields associated with transmission lines have the potential to interfere with cardiac pacemakers. Two general types of pacemakers exist: asynchronous pacemakers, which pulse at a predetermined rate; and synchronous pacemakers, which pulse only when the sensing circuitry of the device determines that pacing is necessary. Asynchronous pacemakers are generally immune to interference because they do not have sensing circuitry and are relatively uncomplicated. Synchronous pacemakers can be affected by electrical fields between 2 and 9 kV per meter, which may cause an erroneous signal in the pacemaker's sensing circuitry, but prolonged asynchronous pacing is not considered a significant concern.

Induced Currents and Shock Hazards

The magnetic fields generated by transmission lines can induce currents and voltages in conductive objects such as metal fences, automobiles, and metal roofs or buildings that are close to and run parallel

to the transmission line. The induced currents in these objects can result in a small electrical shock or a perceptible current when contacted by humans or animals. These small shocks are a nuisance, but do not cause physiological harm. The magnetic field level is a function of the current level in the transmission line, which in turn is a function of the line loading.

Induced currents can also adversely affect pipelines located in the vicinity of and parallel to electrical transmission lines. Stray electrical currents, primarily AC, from overhead electrical lines can affect the integrity of pipeline coatings. No record of issues involving induced current or shock hazard complaints is associated with the PNM or APS transmission lines (APS 2012d; PNM 2012).

Risk to Small Aircraft

Power lines can be a risk to aerial agricultural applicators, aerial firefighters, and other small aircraft. Pilots familiar with the area and who know the location of the transmission lines have a decreased risk. Training for pilots, particularly those who work near power lines such as transmission line and pipeline patrol pilots, includes increasing their situational awareness for such hazards as power lines (Helicopter Association International 2009). Maps that include locations of power lines are also helpful in reducing risk. A review of the “Arizona Aeronautical Chart 2008,” Arizona Department of Transportation, Aeronautics Division indicates the charts generally show the transmission line locations for the transmission lines associated with the Project. As discussed in Section 4.9, Land Use, Shiprock Airstrip and Farmington Regional Airport are the nearest airports to the Project Area. In addition, APS and PNM transmission lines are constructed and maintained to comply with Federal Aviation Administration (FAA) rules and regulations for the protection of low-flying aircraft. Marker balls are in place as required by the FAA and increase the visibility of transmission lines for aircraft. The transmission line support structures are lower than the FAA height requirement for lighting or marking.

Worker and Public Safety Programs

Typical risks encountered when working on or near transmission lines include exposure to electrical shock, heat stress, and chemicals, as well as the increased chance for accidents due to falls and working directly with or in proximity to large equipment. For the transmission lines, implementation and enforcement of safety policies and procedures reduce risks to electrical workers and the public within the ROW. APS has a training program that includes employees who provide production and maintenance work on the transmission lines (2012d). Required safety training is completed in numerous areas to ensure employees have the knowledge necessary to work safely. Examples of some of the safety training topics include Fall Arrest Equipment Inspection and Storage, Fall Protection, Switchyard Entry, Fire and Emergency Evacuation, Hearing Conservation, Hazard Communication, and Ladder and Stairway Safety.

APS has a public safety program to reduce risks to the public and to property from activities on or near APS facilities (APS 2012d). The objectives of the APS Public Safety program are:

- Ensure public knowledge of and compliance with the applicable electrical safety laws, regulations, codes, and standards.
- Ensure that the public and first responders are made aware of the electrical hazards relating to activities on or near APS’ electrical facilities.
- Ensure that all public safety-related incidents and activities are evaluated with respect to applicable laws, codes, regulations and standards and that timely consultation and recommendations are provided.
- Provide continuous input to administering bodies on the adequacy and applicability of codes related to APS’ facilities.

To accomplish these goals, APS has a Public Safety Electrical Safety Outreach Program[1] that reaches out to the public to:

- Describe first response initial actions where electrical facilities are present.
- Identify the main components of transmission and distribution electrical systems.
- Describe the precautions for substation emergencies.
- Describe precautions for responding to electrical emergencies related to overhead and underground power lines and equipment.
- Describe the basics of electrical current and associated dangers.
- Describe the electrical precautions for first response in emergency situations.
- Identify the dangers of electrical equipment around trees and aerial equipment.
- Describe photovoltaic systems and safe operating procedures.

Similarly, at PNM, linemen for the transmission lines attend safety training sponsored by the PNM Safety Department biannually. Training subjects include the information in PNM Health and Safety Programs, which are included in Table 4.17-1.

PNM conducts various public safety activities and communications to inform and educate the public about the risks associated with transmission lines. They include annual press releases on topics such as holiday safety, spring safety, and Balloon Fiesta safety. A large power line safety press conference is held each year during the Balloon Fiesta kickoff. PNM also uses social media sites such as Facebook to distribute their safety information and uses EnergyWorks for outreach to the public regarding safety. Monthly bill inserts are also used to communicate safety messages. In addition, PNM's Engineering Department regularly communicates applicable NESC or National Electrical Code standards to customers/interconnectors. A link on the PNM.com website called "My Safety" addresses the following topics (PNM 2012):

- If power goes out
- Household appliances
- Cords, outlets, and switches
- Breakers and fuse boxes
- Call before you dig
- Tree trimming and planting
- Power lines
- Kites
- Thunderstorms and lightning

[1] APS Public Safety Electrical Safety Brochures in English can be accessed online at http://www.aps.com/_files/mktg/PublicSafety.pdf and in Spanish at http://www.aps.com/_files/mktg/PublicSafetySPAN.PDF

Table 4.17-1 Summary of Health and Safety Programs for the Four Corners Power Plant and Navajo Mine Energy Project

Program Title	Program Summary
Navajo Mine Health and Safety Programs	
Emergency Response Plan (NTEC Document HSEC-001)	The Emergency Response Plan is designed to provide a systematic method to effectively respond to an event that involves potential or actual injuries or impacts to the environment or community. These systematic methods are designed to further eliminate or minimize the risk of potential fatalities or serious environmental or community incidents.
Surface Fire Plan (NTEC Document)	During surface mining operations, fires are a risk when coal dust comes in contact with oxygen and an ignition source. The document's purpose is to outline the processes and procedures in place to eliminate or minimize the risk of incidents associated with a surface operations fire including coal fires in stockpiles and in the unmined coal seam. Procedures include fire prevention and risk awareness training requirements for workers and the location of onsite equipment for fire response or suppression, Response procedures in the event of a fire are also included in the Navajo Mine Emergency Response Plan,
Environmental, Health, Safety and Community Event Reporting (NTEC Document WIN-NMC-HSEC-006)	This work instruction provides a systematic method for defining, reporting, and investigating Health, Safety, Environmental, and Community events so that feedback into risk management and corrective and preventive actions can be accomplished at the Navajo Mine. All employees and contractors use this procedure to report events occurring at the Navajo Mine site, following initial emergency response actions.
Overburden Blasting Management (NTEC Document WIN-NCC-PRO-002)	Blasting agents and explosives are used at the Navajo Mine site to expose the coal for mining. Overburden blasting includes the process of managing explosives from the purchasing stage through storage and use in the field and ultimately verification of successful blasts. Only trained, competent, and authorized employees and contractors must perform the transport, storage, and usage of explosives and initiating components in strictly managed and controlled environments for the security of explosive materials and protection of personnel. A more in-depth discussion of the handling and storage of these explosive materials is included in Section 4.15, Hazardous and Solid Wastes.
Pre-blast and Shot-firing Management (NTEC Document WIN-NCC-PRO-003 and WIN-NCC-PRO-004)	Pre-blast procedures detail the steps taken before setting off explosives. Shot-firing is the process of setting off explosives. Signs, blasting notice, sirens, berms, or physical barriers are used to prevent access to loaded blast areas. Additional precautions are taken when blasting occurs within 1,000 feet of mine lease boundary. Includes public access road closure requirements and procedures.
Contractor Management Program (NTEC Document PLN-NMC-COS-001)	The intent of this document is to provide an outline of the Contractor Management process and its core elements. These processes are intended to specifically decrease the commercial, health, safety, environmental, community, and legal risks that are present between two entities engaged in a business relationship.

Program Title	Program Summary
Hazardous Materials and Hazardous Waste Management System (NTEC Document WIN-NMC-ENV-017)	The intent of this work instruction is to eliminate or minimize the risk of hazardous materials and hazardous waste incidents that could result in injuries and significant environmental events including spills or releases that could migrate off site. It also includes procedures to protect workers from exposure to hazardous materials and wastes. This document incudes the policies and procedures for the proper storage, handling, and transportation of hazardous materials and hazardous waste at the Navajo Mine site. The program includes Hazard Communication (HAZCOM) and Hazardous Waste Operations and Emergency Response (HAZWOPER) training requirements, risk management procedures, a hazardous materials procurement system, spill prevention and response for offsite transportation of hazardous materials and wastes.
Personnel Protection Equipment (PPE)	PPE use is important because it is the last line of defense between an employee or visitor and a potential serious injury. The minimum PPE required on the work site is hard hat, steel-toed safety boots with metatarsal protection, reflective vests (or reflective coveralls or reflective safety shirt), and wrap-around safety glasses or safety glasses with side shields. Visitors coming on site for tours, inspection, etc., are also required to follow the minimum PPE standard. In addition to the minimum required PPE, specific tasks require additional PPE. Work which would expose workers to coal dust and inhalation hazards requires proper respiratory protection.
Navajo Mine Ground Control Plan (Document PLN-NCC-ENG-001)	This plan details the controls in place that protect personnel from the potential dangers of falls onto the ground at stockpiles, dam walls, waste rock dumps, trenches and similar locations.
Mine Site Traffic Management and Collision Avoidance (NTEC Document WIN-NMC-PRO-009)	Driving has the potential to cause accidents and injury. The intent of this document is to eliminate or minimize the risk of incidents associated with driving on site including driving on public roads within the mine site.
Surface Mobile Equipment Management with ATVs (NTEC Document PLN-NMC-PRO-001)	The intent of this program is the safe operation of ATVs to minimize the risk incidents associated with the use of surface mobile equipment.
Light Vehicle and Road Going Vehicle Management (NTEC Document PLN-NMC-PRO-002)	The intent of this program is to ensure that all Light Vehicle and Road Going Vehicles are maintained and operated safely.
On-site Light Vehicle Safety (NTEC Document WIN-NMC-PRO-011)	The movement of large equipment during mining operations poses a risk to workers driving smaller vehicles. This document specifies the required safety features for light vehicles used at surface mine sites. The scope includes company- and contractor-owned light vehicles that access the site. Privately owned vehicles used for low-risk, off-site business travel are not covered.
Drivers Certification (NTEC Document POL-NMC-HSEC-001)	This policy's intent is to provide clarity on the requirements for driver certification criteria for all employees, contractors, and visitors.
Isolation Management (NTEC Document PLN-NMC-MTC-001)	Isolation management is designed to eliminate or minimize the risk of incidents arising from the uncontrolled release of energy or hazardous materials. Phases of work, tasks, locations, machinery, vehicles, and mobile equipment requiring a permit to work, or isolation of energy sources to safely perform work (including de-energizing stored energy), must be planned and managed to protect personnel from harm.
Lifting Management Program (NTEC Document PLN-NMC-MTC-002)	This program is designed to eliminate or minimize the risk of incidents arising from any operation concerned with the lifting, suspending, or lowering of a load with a crane. Competent employees and contractors must plan and manage lifting operations using fit-for-purpose equipment in a manner that minimizes the risk of injury to personnel or damage to facilities.

Program Title	Program Summary
Working at Heights Management (NTEC Document PLN-NMC-MTC-003)	This program is designed to eliminate or minimize the risk of incidents arising from working at heights. Work at height must be minimized and managed where a potential exists to fall 2 meters or more, where a fall could result in a significant incident, or with a danger of dropped objects from the work being performed.
Isolation Locking and Tagging Procedures (NTEC Document WIN-NMC-MTC-011)	Failure to properly isolate energy sources and hazardous materials has the potential to be fatal or to result in serious long-term health effects. This document sets forth the process detail and technical requirements necessary for performing proper personal and group isolations, and applies to all activities on site, including contractor activities.
Pathogens and Viruses (NTEC Document WIN-NMC-IHH-002)	NTEC monitors for occupational health and hygiene exposures at the Navajo Mine. This process provides the data necessary for identifying and controlling industrial health and hygiene-related risks. A need for industrial health and hygiene monitoring is identified through risk assessment or regulatory requirements. This program is one of the programs developed to monitor health and safety exposures.
APS Health and Safety Programs (Includes Four Corners Power Plant and APS owned and Operated Transmission Lines)	
Fire Protection Plan	The purpose of the Fire Protection Plan is to ensure that FCPP has in place the appropriate procedures to minimize the occurrence of fires, quickly control fires that do develop, conserve property and minimize losses due to fires, investigate fire causes so as to prevent recurrence, and ensure the safety of plant employees.
General Safety	This section contains specific requirements, instructions, and guidelines for employees that establish safety expectations that help reduce accidents or close call events that may result in injury. Many of the requirements, instructions, and guidelines are derived from regulatory agencies such as OSHA or EPA.
Tailboard Conferences	This section includes the guidelines and requirements associated with pre-job tailboard conferences. The tailboard conference is used to identify and communicate a job's critical elements to the workers involved so that safety is provided for employees as well as the public. Human error related accidents typically occur when one or more individuals involved in the performance of a work assignment fail to fully understand or recognize certain elements of that work.
Personal Protective Equipment (PPE)	APS has conducted hazard assessments of all job categories to evaluate the potential for injury to various body parts and to determine the necessary PPE and clothing to protect against those injuries. This section contains the requirements for employees for use of PPE, devices, and clothing.
Hazardous Materials	This program contains specific requirements, instructions, and guidelines for employees purchasing and using hazardous chemicals. This information is made available to workers through training, access to Material Safety Data Sheets, and container labeling.
Waste Management	APS has various written programs for the proper handling of various types of waste that is generated: • Universal Waste Compliance Plan (ENV-FC03-CMP-D3-14) • Solid Waste Compliance Plan (ENV-FC03-CMP-D3-3) • Conditionally Exempt Hazardous Waste Management (EFO S1FEC) • Recycling Scrap Metal & Electronic Waste (ENV-FC03-CMP-D3-21) • Biohazardous and Medical Waste (ENV-FC03-CMP-D3-16)

Program Title	Program Summary
Tools and Rigging	This program contains specific requirements, instructions, and guidelines for employees purchasing and using hand and power tools.
Confined Space	A confined space is a space that is large enough for a person to enter the space and perform work and has a limited or restricted means for entry or exit. This program contains specific requirements, instructions, and guidelines for employees conducting activities within confined spaces.
Digging Operations	This program contains specific safety requirements, instructions, and guidelines for employees conducting digging operations.
Mobile Equipment Fleet and Shop Safety	This program contains specific safety requirements, instructions, and guidelines for employees operating APS's motor vehicle fleet and mobile equipment.
Work Zone Safety	This program contains specific safety requirements, instructions, and guidelines for employees who work outdoors. Outdoor works includes, but is not limited to performing survey work to establish ROWs, digging holes to set poles, or walking through alleyways and easements to set or read meters.
Transmission and Distribution Clearance Procedure and Switching Orders	This program contains specific requirements, instructions, and guidelines for employees for Transmission & Distribution Clearance Procedure & Switching Orders.
Grounding	A ground is a conducting connection between an electric conductor or equipment and earth or to some conducting medium that serves in the place of earth. Grounding is important to protect from accidental energizing of the system, induced voltage, and accidental contact with an energized line, lighting, and static electricity. This program contains specific safety requirements, instructions, and guidelines for employees for grounding.
Transmission/Distribution/Substation Work Practices	This program contains specific safety requirements, instructions, and guidelines for all electrical distribution and transmission personnel. These requirements, instructions, and guidelines are also applicable to personnel from other departments or divisions engaged in distribution or transmission work. These requirements, instructions, and guidelines have been compiled to help prevent electrical contact or accidents during the construction or maintenance of overhead or underground circuits and substations.
Welding Safety	This program contains specific safety requirements, instructions, and guidelines for employees involved in welding.
Work Involving Helicopters	This program contains specific safety requirements, instructions, and guidelines for employees involved in helicopter work.
Vegetation Management	This program contains specific safety requirements, instructions, and guidelines for employees in vegetation management or doing any other work required maintaining a clear ROW for our electric lines. This section's intent is to provide safe working rules in an effort toward accident prevention. It is not possible to list all hazards that might be encountered, but the use of these specific requirements, instructions, and guidelines, together with good judgment and common sense, will ensure a safe operation.
Emergency Action Plan (EAP) for the Lined Ash Impoundment (LAI) and the Lined Decant Water Pond (LDWP) at the Four Corners Power Plant	This EAP is a formal document that identifies potential emergency conditions that could develop at the LAI and LDWP, provides a plan for communication of the conditions, and specifies preplanned actions to be followed to minimize property damage and loss of life. This EAP also provides procedures and information to assist the owner in issuing early warning information of the emergency situation to responsible emergency management authorities.

Program Title	Program Summary
PNM Transmission Line Health and Safety Programs	
Fire Protection Program	PNM obtains wildfire information by monitoring media reports and websites for active fire monitoring maintained by multiple federal and state agencies. PNM monitors government agency websites for fire restrictions and closures and coordinates critical maintenance with agencies during forest and public land closures. PNM also receives email notices from agencies such as the USFS and New Mexico Department of Homeland Security and Emergency Preparedness regarding prescribed burns. In the event of fire danger to a transmission line, the company would dispatch field crews to work with fire incident managers, and could prepare for loss of a line by de-energizing the transmission line and redispatching generation on its system to manage the flow of power on its system. PNM would also be in contact with the Western Electric Coordinating Council Reliability Coordinator if fire conditions impact reliability of PNM's transmission system.
Emergency/Rescue Procedures	This program includes the emergency response and rescue procedures for PNM's transmission lines.
Safety Communication – radio and pre-job safety tailboards	PNM's policy requires employees to perform safety tailboards at every job each day. Records of these safety meetings are maintained on site.
Proper Use of Line Trucks and Mechanical Equipment	This program contains specific safety requirements, instruction, and guidelines for employees using line trucks and mechanical equipment.
Trenching and Excavation	This program contains specific safety requirements, instructions, and guidelines for employees involved in trenching and excavation.
Overhead Power Pole Framing, Setting, or Removal	This program contains specific safety requirements, instructions, and guidelines for employees involved in overhead power pole, framing, setting or removal.
Working in Energized Areas	This program contains specific safety requirements, instructions, and guidelines for employees working in energized areas.
Common Electrical Practices Including Lockout/Tagout	This program includes the procedures for locking out and tagging equipment before maintenance procedures and other safety related practices for working around electrically charged equipment,
Switching, Grounding, Tagging, and De-energizing	This program contains specific requirements, instructions, and guidelines for employees for grounding.
Fire Prevention Equipment and Protection	The program lists the fire protection equipment available in the event of a fire. It also includes procedures for fire prevention.
Material handling including toxic materials	This program includes handling, storage, labeling, and disposal requirements for various materials including toxic or hazardous materials used by PNM. A discussion of the use of and location of Material Safety Data Sheets is also included.
Vegetation management	This program includes procedures and safety measures needed when cutting trees and other types of vegetation management.
Protective clothing and equipment	This program address the risk associated with certain work processes and identifies the PPE necessary to protect workers.
Proper use of tools	This program details the proper safety precautions required for working with various tools.
Confined space	This program details the proper safety precautions required for working in confined spaces.
Proper use of barricades to protect crews and or the public	This program details the proper use of barricades to protect crews and the public.

Sources: APS 2012d; BNCC 2012k; PNM 2012

Transmission Line Safety Features

APS's 345-kV transmission lines were constructed in 1961 and the 500-kV line in 1966, in accordance with the NESC in force at the time. The NESC was prepared to protect public safety by requiring designing facilities with adequate strength to prevent or minimize failures, and to provide safety through separation, either vertical or horizontal, between the energized transmission lines and the public. NESC specifies that power lines be kept specific distances from nearby objects—including trees. NESC requires greater clearances for higher-voltage lines. For the same safety reasons, transmission line ROWs are wider than for local distribution lines. The transmission lines are constructed and maintained to comply with FAA rules and regulations. Marker balls are present on the 500-kV line at Towers 1/3, 72/1, and 179/1; marker balls are present on the 345-kV lines at Towers 1/2, 3/1, 1/4, 4/1, and 139/1.

APS maintains all transmission lines to ensure safety and reliability. Two types of inspections, aerial and climbing, are performed on the 500-kV and 345-kV transmission lines at different intervals. Aerial inspections are performed annually by helicopter to identify any immediate public safety issues. Climbing inspections are carried out every 7 years and involve a close visual inspection of each tower, tightening of hardware and repairs as needed. The lines are also inspected any time a power line trip occurs or if emergency repairs are required due to fire or lightning. The transmission lines are monitored and protected by a system of protective relays in the substations. The relays monitor the current and voltage and are programmed to rapidly de-energize the line if a line failure or other abnormal condition occurs. For example, if a conductor breaks, the protective relay system would de-energize the conductors and protect the public or emergency first responders from coming in contact with energized electrical lines. This protective relay system would also de-energize the transmission line in the event of an electrical overload to prevent damage to the conductors.

The height of the conductors above the ground is based on NESC and Western Electricity Coordinating Council (WECC) standards and is a minimum of 29 feet. The minimum conductor vertical clearance dictates the exact height of each tower structure, based on topography and requirements for safety (APS 2012d).

PNM transmission lines were constructed over 40 years ago in accordance with the NESC in force at the time. PNM has no documents that specifically refer to other national standards used at the time of construction. However, typical practice would have been to reference various American National Standards Institute (ANSI) standards for the purchase of materials (e.g., treated wood poles, porcelain insulators, aluminum conductor steel reinforced conductors), which would take into account material strengths for planned uses.

The existing transmission line relays are a combination of microprocessor-based, electronic, and electromechanical design. The typical clearing time to interrupt a fault, which is the sum of the relay operating time and breaker operation time, is between 3 to 4 cycles (0.05 to 0.067 second) (PNM 2012).

Incidents Due to Wind and Earthquakes

Transmission line structures can be damaged or fail due to natural forces such as wind and earthquakes. Failure of transmission line support structures is relatively rare and is typically due to anomalous loading conditions such as tornadoes or ice storms. Structural failure can present a physical hazard to public safety and can disrupt electrical service.

The transmission lines have been designed and built based on design codes that specify loading requirements related to wind conditions. Transmission line towers are not designed for seismic loadings because wind and ice loads produce greater forces on the structures than seismic events. Engineering calculations account for high wind conditions but do not typically consider earthquakes as transmission line structures are discrete highly flexible structures that are relatively light and would tend to move with the earth's surface. No failures related to extreme weather conditions have occurred on the APS or the PNM transmission lines (APS 2012d; PNM 2012).

Incidents Due to Fire

During Project operation, the most significant fire hazard is electrical arcing from overhead transmission lines. Electrical arcing occurs primarily in lower-voltage distribution lines that are generally strung closer to the ground and closer to trees or other types of vegetation. The fire hazard potential associated with arcing from high-voltage transmission lines is low due to greater clearances between the trees and other vegetation and the overhead transmission lines. Greater clearances are also accomplished by requiring a wider ROW for higher-voltage transmission lines. Following are descriptions of APS' and PNM's Vegetation Management Plans (APS 2012d; PNM 2012).

APS removes and prunes vegetation to provide access to the lines and structures and minimize the potential for fire damage. Routine vegetation maintenance involves the cyclical treatment of vegetation approximately every 5 to 10 years utilizing mechanical, manual, and herbicidal treatments. Vegetation may be cleared within the entire permitted ROW width, including clearing around poles, guy wires, anchors, and towers. On rare occasions vegetation maintenance outside the routine cycle is required to address emergencies or imminent threats to the transmission line's performance. Vegetation maintenance activities are sensitive to resource (cultural) and plant and animal species concerns. APS conducts aerial helicopter patrols of the transmission lines 1 to 3 times per year to identify potential problem areas, to plan maintenance schedules and to monitor effectiveness of treatment. Ground patrols may be required to follow up on any identified problem areas (APS 2012d).

PNM conducts yearly inspections of each structure on each transmission line and conducts maintenance as needed. Visual and physical inspections include vehicle (passenger and all-terrain vehicle), pedestrian, and aerial surveys. Vegetation management is conducted in accordance with the PNM Transmission Vegetation Management Plan and includes hand-cutting, mechanical clearing, and use of herbicides. Vegetation maintenance usually occurs every 4 to 5 years in pinon-juniper and forested areas and every 2 to 3 years in riparian areas (PNM 2012).

4.17.3 Changes to Public Health and Safety Affected Environment Post-2014

Two completed Federal actions may lead to changes in the affected environment: (1) the EPA has made its ruling with respect to BART to control air emissions; and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed Federal actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared in the following Section. The EPA BART determination reduces the emissions of all air contaminants from FCPP, including any hazardous air pollutants. These reductions are quantified in Section 4.1, Air Quality. Public Health impacts from the on-site storage, handling, and transportation of ammonia reagent are discussed in Section 4.15, Hazardous and Solid Wastes.

4.17.4 Environmental Consequences

This section provides an analysis of potential environmental effects on worker safety and public health that could occur under the Proposed Action and alternatives. The impact assessment includes both short-term and long-term effects. At the Navajo Mine short-term impacts could occur during construction activities and mining operations and may persist through the reclamation phase. Long-term impacts are those that would persist beyond or occur after reclamation. For the FCPP and transmission lines, short-term impacts are those that could occur immediately following approval of the lease renewals, plus the period of time associated with an increase level of work activity (i.e., a total of about 5 years). Long-term impacts are impacts that would persist beyond or occur after the 5-year period including post-closure of the FCPP.

The analysis for worker safety focuses on occupational hazards within the workplace. In typical industrial occupational settings, compliance with various policies, programs and procedures mandated by MSHA and OSHA are used to protect employees. The impact assessment methodology for worker safety includes identification of the risks associated typical work activities encountered by employees working at the Project and a review of the adequacy of occupational safety programs to protect those employees. Risks

encountered at an industrial facility such as the Navajo Mine, FCPP, and the transmission lines include exposure to dust, noise, heat stress, electrical hazards, chemical hazards, hazards associated when working above-ground, below-ground and in confined spaces, as well as the increased chance for accidents due to working directly with or in proximity to large equipment or automobiles and energized systems.

The analysis for public health focuses primarily on the human health risks from exposure to contaminants in air emissions produced by the proposed activities at the Navajo Mine and FCPP. These activities include burning coal (stack emissions), operating gasoline and diesel fired equipment (diesel particulate matter), and coal excavation and handing (fugitive dust). Other public health risks including risks to public safety are considered, but are expected to be small in comparison. Public health risks associated with hazardous materials, including the potential for public exposure to hazardous wastes, hazardous materials, or CCR is discussed in Section 4.15, Hazardous and Solid Wastes.

When assessing health impacts from air emissions, two different sets of criteria are used. One criterion is used for criteria pollutants and another is used for toxic air contaminants. The term, "criteria air pollutants," refers to those pollutants that are pervasive around urban or industrial environments including coal mining and power plants and for which health-based or national ambient air quality standards have been established. The term, "hazardous air pollutants," refers to those pollutants that occur at relatively low concentrations and are associated with carcinogenic and other adverse health effects, but for which no ambient air quality standards have been established. Below is a discussion of the two criteria:

- **Criteria Pollutants.** The impact assessment for public health is based on whether the levels of criteria pollutants would cause an exceedance of NAAQS in the Project Area. The EPA regulates the criteria pollutants by developing human health-based criteria (science-based guidelines) for setting permissible levels. Criteria air pollutants include O_3, CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and lead. Most of the criteria pollutants are directly emitted. O_3, however, is a secondary pollutant that is formed in the atmosphere by chemical reactions between NO_X and ROGs (reactive organic compounds). The significance criteria for identifying a public health concern associated with the criteria pollutants are the NAAQS (See Table 4.1-1 in Section 4.1.1.2, Air Quality for further discussion on NAAQS). The four- state region (New Mexico, Colorado, Arizona, and Utah) which includes the Project Area is in attainment area for all criteria pollutants. For particulate matter (PM_{10} and $PM_{2.5}$) the EPA (2009) has noted that toxicity associated with exposure to airborne particulate matter can vary by particulate matter composition with the implication that the NAAQS for particulate matter may not be health protective in all cases. This concern is addressed in the public health analysis of this section as it pertains to fugitive coal dust emissions.
- **Hazardous Air Pollutants (HAPs).** Title III of the Clean Air Act Amendments of 1990 identifies 188 pollutants as HAPs, the Federal term for air toxics. HAPs can be emitted from coal combustion and operation of mobile equipment. Mobile sources associated with Navajo Mine operations include diesel-powered draglines, loaders, coal haul trucks, support vehicles, and explosives detonation. Mobile sources associated with the FCPP include materials handling equipment, maintenance equipment, and support vehicles. The dominant fuel used for mobile sources at the Navajo Mine and FCPP is diesel fuel, also referred to as distillate fuel oil no. 2, along with some gasoline. DPM, which is emitted from diesel-powered equipment, is considered a carcinogenic air toxic (DOI and BIA 2007) and is addressed in this section.
- **Analytical Approach.** Three types of predictive modeling studies were conducted to evaluate effects to public health: 1) a screening health risk assessment was performed to evaluate the risk to sensitive receptors from diesel exhaust (diesel particulate matter); 2) a model of fugitive dust emissions for comparison to particulate matter NAAQS; and 3) a model of human health risk from FCPP stack emissions. Fugitive dust emission results for Navajo Mine activities were also evaluated using a risk assessment process focused on coal dust constituents. The results of the

risk assessment processes are numerical estimates of health risk that are compared to target health risk goals established by government and public health agencies.

4.17.4.1 Alternative A – Proposed Action

Navajo Mine

Worker Safety

Under the Proposed Action, no new work processes that might introduce new or increase existing safety risks to on-site workers are proposed. The existing safety programs for the Navajo Mine Permit Area would be expanded to incorporate the Pinabete Permit Area. Existing health and safety programs comply with MSHA health and safety regulations associated with the work activities at the mine and therefore adequately address the associated risks of the Navajo Mine Permit Area; therefore, impacts on worker safety from the Proposed Action and the continued operation of the Navajo Mine would be negligible.

Public Health

Public receptors within the Pinabete Permit Area include three houses which would be permanently relocated as a result of Project implementation. The location of public receptors beyond the Pinabete Permit Area and within the ROI are shown in Section 4.1 Air Quality as Figure 4.1-1

The air pollutant of primary public health concern associated with the Proposed Action at the Navajo Mine is fugitive dust containing PM_{10}. PM_{10} and $PM_{2.5}$ emission sources include blasting, overburden removal, coal extraction, transport, and handling, and general operation of mine vehicles and equipment. Operation of mine vehicles and equipment also produces emissions of other criteria pollutants, mainly CO, SO_2, NO_X, and VOCs

Criteria Pollutants

Ambient air modeling found that fugitive dust emissions would not cause a measurable change in ambient PM_{10} or $PM_{2.5}$ concentrations in San Juan County, New Mexico. San Juan County is currently in “attainment” status, and ambient air quality does not regularly exceed the NAAQS. In part to assess whether compliance with these NAAQS is health protective for sensitive populations, an alternative risk analysis was also applied to particulate matter whereby coal dust metal concentrations in $PM_{2.5}$ were estimated using metal concentrations for Navajo Mine coal reported by Bunnell et al. (2010) and assuming $PM_{2.5}$ concentrations were equal to the primary NAAQS for $PM_{2.5}$ of 12 $\mu g/m^3$. Excess cancer risks and hazard quotients were calculated using EPA (2013) residential air regional screening levels (RSLs) as toxicity benchmarks.

Table 4.17-2 Risk Analysis for $PM_{2.5}$ Assuming Navajo Mine Coal Metals Composition for Fugitive Dust Emissions

Element	Coal Composition (mg/kg)	Air Concentration (µg/m^3)	RSLc (µg/m^3)	RSLnc (µg/m^3)	Risk	Hazard Quotient
Antimony	0.512	6.1E-06	NA	2.1E-01	NA	2.9E-05
Arsenic	0.272	3.3E-06	5.7E-04	1.6E-02	5.7E-09	2.0E-04
Beryllium	0.807	9.7E-06	1.0E-03	2.1E-02	9.7E-09	4.6E-04
Cadmium	0.021	2.5E-07	1.4E-03	1.0E-02	1.8E-10	2.5E-05
Cobalt	2.57	3.1E-05	2.7E-04	6.3E-03	1.1E-07	4.9E-03
Lead	9.76	1.2E-04	NA	1.5E-01	NA	7.8E-04
Manganese	10.0	1.2E-04	NA	5.2E-02	NA	2.3E-03
Mercury	0.016	1.9E-07	NA	3.1E-01	NA	6.2E-07
Nickel	2.21	2.7E-05	9.4E-03	9.4E-02	2.8E-09	2.8E-04
Selenium	1.70	2.0E-05	NA	2.1E+01	NA	9.7E-07

Chromium was not evaluated because EPA has not derived an RSL for trivalent chromium, the form of chromium expected to be present in naturally occurring bituminous coal.
RSLc = residential air regional screening level for carcinogenic effects.
RSLnc = residential air regional screening level for noncancer effects.

The risk analysis for $PM_{2.5}$ shows that the metals present in Navajo Mine coal and likely to be present in fugitive dusts at the primary NAAQS for $PM_{2.5}$ of 12 µg/m^3 would not pose an unacceptable risk to public health. As shown in Table 4-17.2, all excess cancer risks are less than the target risk level of 1×10^{-6} and all hazard quotients are less than the target hazard quotient of 1 for residential exposures. The Proposed Action would result in the same levels of O_3 precursor emissions as the existing operations. Therefore, no substantial adverse public health consequences from criteria air pollutants would occur for the Proposed Action, and the NAAQS are an appropriate significance criterion.

Hazardous Air Pollutants

The population living in the vicinity of the mine is widely dispersed, and the effects of mining are relatively short term at any particular location, which suggests that public health impacts from operation of diesel-powered equipment have been, and would continue to be minimal. To confirm this, a screening health risk assessment was performed as part of the air quality analysis. Below is a summary of the results of the screening health risk assessment for the Navajo Mine.

Diesel Particulate Matter or DPM, which is part of a complex mixture that makes up diesel exhaust, is considered a hazardous air pollutant by the EPA. At the mine, larger and more persistent sources of DPM could potentially present a health risk to nearby sensitive receptors. An example of this situation would be mining operations where large diesel-powered equipment and vehicles are used in active areas for extended lengths of time such as months or a year.

In order to evaluate this potential risk a screening-level HRA for DPM was performed using conservative methodology (EPA 1992b) for maximum mining activity levels and timeframes against the target risk levels. The actual impacts would be lower than these model results; because the conservative model found that the DPM emissions were within the target risk levels, no attempt was made to refine the analysis with lower, more realistic, exposure values. Results of the screening HRA are presented in Table 4.17-3 for two scenarios:

1. *Alternative Case 1.* Two years coal extraction and loading operations in Area IV; activity in same general location (zone) impacting a receptor 0.5 mile (1,600 meters) away; DPM emission rate of 28 pounds per day; wind blowing from source toward receptor 30 percent of the time (diurnal pattern).
2. *Alternate Case 2.* Same as above, but one year duration.

AERSCREEN, the screening version of the AERMOD dispersion model developed by the EPA (2011c), was used to determine worst-case ambient concentrations of emissions. For DPM, an organic air toxic with published emission factors and unit risk values (OEHHA 2009), cumulative cancer risk was determined for the nearest receptors, 1,600 meters away from mining activities, for working periods of 2 years and 1 year. Thus, the 70-year unit risk value for DPM was corrected to reflect these actual lengths of time. AERSCREEN predicts "worst case" 1-hour, 3-hour, 8-hour, 24-hour, and annual concentrations – without the need for site-specific hourly meteorological data – that are equal to or greater than generated by AERMOD; however, the degree of conservatism varies depending on the application.

Table 4.17-3 Diesel Particulate Matter Health Risk Assessment

DPM Screen Parameter	Units	Alternate Case 1	Alternate Case 2
Onsite Emission Rate	lb/day g/sec	28 1.47E-01	28 1.47E-01
Receptor Distance	meters	800	800
Modeled Hourly Concentration	$\mu g/m^3$	8.1	8.1
Corrected Annual Concentration	$\mu g/m^3$	0.81	0.81
Unit Risk Value (70-year MEI)	$(\mu g/m^3)^{-1}$	3.00E-04	3.00E-04
Chronic Reference Exposure Level	$(\mu g/m^3)$	5	5
Activity Duration	days	730	365
Wind Direction	frequency	0.30	0.30
Exposure Correction[1]	fraction	8.6E-03	4.3E-03
Cancer Risk	probability per million	2E-06 2	1E-06 1
Significance Threshold	probability per million	1E-06 – 1E-04 1 - 100	1E-06 – 1E-04 1 - 100
Noncancer Hazard Quotient	unitless	0.16	0.16
Noncancer Hazard Threshold	unitless	1	1

[1]Exposure Correction is 2 yrs/70 yrs times 0.3

The results of the screening HRA show that the risk due to inhalation of DPM at the receptor is estimated to be about 2 in a million for the first alternative case, and about 1 in a million for the second alternative case. These risk estimates fall well within the EPA's National Contingency Plan (NCP) risk range for making risk management decisions (40CFR Part 300). The noncancer hazard quotient of 0.16 is less than the noncancer hazard threshold of 1. Therefore, the results of the analysis indicate that effects of particulate emissions during mining would not pose a major health risk to sensitive receptors (e.g., residents) located downwind of the mine.

Four Corners Power Plant

Worker Safety

Under the Proposed Action, the SCR installed on Units 4 and 5 would require the transportation and storage of ammonia at the FCPP. Depending on the type of ammonia used, regulatory requirements exist for the storage, use and transportation. These requirements and potential impacts of exposure to ammonia are evaluated in Section 4.15 and determined to be minor under the recommended urea form of ammonia. No other new work processes that might increase safety risks to on-site workers are proposed. Existing health and safety programs comply with MSHA and OSHA regulations and are adequately implemented to address the associated risks of the FCPP; therefore, impacts on worker safety from the Proposed Action and the continued operation of the FCPP would be negligible.

Public Health

Criteria Pollutants

In addition to stack emissions, modeling of fugitive dust emissions from road traffic, materials handling, and mining operations determined that the Proposed Action would not cause local exceedances of NAAQS for PM_{10} (respirable particulate) and $PM_{2.5}$ (fine particulate). Attainment of primary NAAQS is protective of public health, including sensitive receptors, as described above under *Criteria Pollutants*; therefore, impacts in the short- or long-term operation of the FCPP and NM are estimated to be negligible. (AECOM 2013d).

Hazardous Air Pollutants

Three types of predictive modeling studies were conducted to evaluate effects to public health: 1) a screening health risk assessment was performed to evaluate the risk to sensitive receptors from diesel exhaust; 2) a model of fugitive dust emissions for comparison to particulate matter NAAQS; and 3) a model of human health risk from FCPP emissions. The section summarizes the results of the analysis of potential health risks from FCPP emissions.

Potential Risk from FCPP Emissions

A Human Health Risk Assessment (HHRA) was performed to evaluate the health effects of Hazardous Air Pollutant emissions from FCPP Units 4 and 5 (AECOM 2013d). The emissions characterization, dispersion, deposition, and fate and transport modeling conducted for the HHRA also supports the Deposition Modeling Study for the Ecological Risk Assessment (ERA).

The HHRA was conducted according to the Human Health Risk Assessment Protocol (protocol) established by the EPA (2005b) for hazardous waste combustion facilities, which is also considered appropriate for coal-fired power plants. As such, the HHRA includes the five standard steps of risk assessment:

1. *Hazard Identification.* Selects the compounds of potential concern (COPC), also referred to as “target compounds”, both organic and inorganic.
2. *Dose Response Assessment.* Reviews the published risk factors developed by regulatory agencies to account for carcinogenic and noncarcinogenic (acute and chronic) health effects of chemical exposure.
3. *Exposure Assessment.* Involves modeling the dispersion, deposition, and fate and transport of COPCs in the environment and various pathways (i.e., inhalation, ingestion, absorption) by which individuals may be exposed.

4. *Risk Characterization.* Involves combining results of the dose response and exposure assessments to determine potential health risk.
5. *Uncertainty Assessment.* Provides a qualitative discussion of the factors that affect the risk estimates and how uncertainty in those factors could affect the veracity of risk estimates.

The protocol recommends three exposure scenarios for persons living in the vicinity of a source: 1) typical residential exposure; 2) farm products consumption exposure (beef, pork, chickens, eggs, milk; although sheep are not included, their uptake factors would be encompassed by these animals recommended by EPA for these analyses); and 3) fish consumption exposure. These scenarios consider the potential exposure of adults and children through direct and indirect exposure pathways. The exposure pathways include inhalation of compounds emitted from stacks and dispersed into ambient air (a direct pathway) and ingestion of trace compounds that enter the food chain through plant uptake and animal ingestion (an indirect pathway).

Compounds enter the food chain through deposition from air to soil, deposition on crops and forage, and deposition into watersheds and their associated waterbodies. The HHRA used conservative default exposure assumptions recommended by EPA unless appropriate site-specific exposure parameters were available. For example, the HHRA applied ingestion rates of locally caught fish based on local advisories for fish consumption instead of default values. Also, a supplemental analysis was conducted to evaluate the maximum incremental contribution of FCPP emissions to blood-borne lead levels in children using the EPA's Integrated Exposure Uptake Biokinetic Model.

Selection of Chemicals of Potential Concern (COPCs) was based on the following two previous studies conducted by AECOM for the Electric Power Research Institute (EPRI). "Updated Hazardous Air Pollutants (HAPs) Emissions Estimates and Inhalation Human Health Risk Assessment for U.S. Coal-Fired Electric Generating Units" (EPRI 2009) and "Multi-Pathway Human Health and Ecological Risk Assessment for a Model Coal-Fired Power Plant" (EPRI 2011).

For atmospheric dispersion modeling using EPA's AERMOD program, the HHRA evaluated the following COPC emissions from Units 4 and 5:

- 2,3,7,8-TCDD, equivalents
- Acrolein (C_3H_4O)
- Antimony (Sb)
- Arsenic (As)
- Barium (Ba) compounds
- Benzene (C_6H_6)
- Benzo(a)pyrene, equivalents
- Beryllium (Be)
- Cadmium (Cd)
- Chlorine (as Cl_2)
- Chromium (Cr)
- Cobalt (Co)
- Hydrogen chloride (HCl)
- Hydrogen cyanide (HCN)
- Hydrogen fluoride (HF)
- Lead (Pb)
- Manganese (Mn)
- Mercury, total (Hg)
- Naphthalene ($C_{10}H_8$)
- Nickel (Ni)
- Selenium (Se)
- Silver (Ag)
- Sulfuric acid (H_2SO_4)
- Zinc (Zn)

Selection of these 24 COPCs was based on two studies conducted by AECOM for the EPRI in 2009 and 2011. In the 2009 study, the relative inhalation risk associated with all HAPs known to be present in coal combustion emissions were evaluated for each coal-fired electric generating unit in the United States, including FCPP Units 4 and 5. The 2011 study added several HAPs for evaluating multipathway risks from a hypothetical coal-fired power plant. The HHRA includes these as COPCs along with sulfuric acid mist, a byproduct of SCR operation (AECOM 2013d).

The HHRA used conservative methodology to analyze risks posed by the COPCs as prescribed in the protocol supplemented with site-specific information about receptors, land use, water bodies, and recommended maximum rates of fish ingestion. Calculated results were evaluated against EPA not-to-exceed risk thresholds ranging from 10^{-4} (1 in 10,000) to 10^{-6} (1 in 1,000,000) for lifetime (70-year) cancer risk and 1 (unity) for noncancer Hazard Index (EPA 2005b).

The results of the multipathway HHRA predicted that for 25 years of future operation of FCPP, none of the estimated cancer risks exceed the strictest risk threshold of 1 in a million. For noncancer effects, the HHRA reported all Hazard Indices were below the threshold Hazard Index of 1 and the estimated blood lead concentrations were well below the CDC target blood lead concentration of 5 µg/dl. Therefore, the HHRA concludes that operation of FCPP over the next 25 years would not have a major impact on human health in the vicinity of FCPP. The HHRA also states that given the degree of conservatism purposefully built into the risk assessment methods and thresholds, this conclusion is highly protective of public health (AECOM 2013d). Specifically, the results are as follows:

- Average case long-term cancer risk would not exceed 6×10^{-9} for adults and 2×10^{-9} for children and chronic Hazard Index would not exceed 0.01 for adults and children.
- Intermediate case long-term cancer risk would not exceed 1×10^{-7} for adults and 5×10^{-8} for children and chronic Hazard Index would not exceed 0.04 for adults and 0.05 for children.
- Worst case long-term cancer risk would not exceed 2×10^{-7} for adults and 8×10^{-8} for children and chronic Hazard Index would not exceed 0.7 for adults and 1 for children.
- Short-term average acute Hazard Index would not exceed 0.05 for adults and children.
- Short-term maximum acute Hazard Index would not exceed 0.1 for adults and children.
- Infant exposure to dioxins and furans through breastfeeding would not exceed 0.052 percent of the target average daily dose (permissible maximum).
- Child blood lead content would not exceed 0.0013 percent of the Centers for Disease Control (CDC) recommendation (permissible maximum).

These effects are minor.

Public Health impacts from the on-site storage, handling, and transportation of ammonia reagent, as well as potential for accidental release from the ash impoundments at FCPP are discussed in Section 4.15, Hazardous and Solid Wastes.

Transmission Lines

No new transmission line construction is proposed as part of the Project nor are any changes anticipated in the frequency or type of maintenance activities to be conducted along the transmission corridor.

Worker Safety

No new or increased work activities are proposed for the transmission lines under the Proposed Action Alternative; therefore, there are no impacts to worker safety.

Public Health

The transmission lines meet NESC design requirements which protect public safety by requiring designing transmission lines with adequate strength to prevent or minimize failures, and to provide safety through separation between the energized transmission lines and the public and so the transmission lines are unlikely to be damaged or fail in the event of high wind or an earthquake. Also, the Project would not result in any change in operating procedures which could lead to a change in EMF or Non-EMF impacts. Therefore, there would be no impacts to public safety from continued operation of the transmission lines.

4.17.4.2 Alternative B – Navajo Mine Extension Project

Navajo Mine

Similar to the Proposed Action, under Alternative B, no new work processes that might increase safety risks to on-site workers are proposed. NTEC's existing safety programs would be expanded to incorporate the mining of Area IV South. Existing health and safety programs adequately address the associated risks of the Navajo Mine area; therefore, impacts to worker safety from Alternative B and the continued operation of the Navajo Mine would be the same as described for the Proposed Action.

Four Corners Power Plant

Under Alternative B, the BIA would approve the lease amendment for the FCPP, and the FCPP would operate as described under the Proposed Action. Therefore, impacts would be the same as described for the Proposed Action.

Transmission Lines

Under Alternative B, the transmission line ROWs would be approved and would continue to be operated and maintained as described under the Proposed Action. No changes are proposed. Therefore, as described for the Proposed Action, no impacts would occur.

4.17.4.3 Alternative C – Alternative Pinabete Mine Plan

Navajo Mine

Similar to the Proposed Action, under Alternative C no new work processes that would increase safety risks to onsite workers are proposed. The existing safety programs would be expanded to incorporate the mining of Area North and Area South. Existing health and safety programs adequately address the associated risks of the Navajo Mine area; therefore, impacts to worker safety from Alternative C and the continued operation of the Navajo Mine would be the same as described for the Proposed Action.

Four Corners Power Plant

Under Alternative C, the BIA would approve the lease amendment for the FCPP and the FCPP would operate as described under the Proposed Action. No changes are proposed. Impacts would be as described for the Proposed Action.

Transmission Lines

Under Alternative C, the transmission line ROWs would be approved and would continue to be operated and maintained as described under the Proposed Action. No changes are proposed. As described for the Proposed Action, no impacts with regard to health and safety would occur.

4.17.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete permit application and renew the SMCRA permit for the Navajo Mine permit. The Navajo Mine would operate as described under the Proposed Action. Impacts would be the same as described for the Proposed Action.

Four Corners Power Plant

Under this alternative, the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The 10% reduction in surface area of the DFADAs would result in the same potential impacts as described for the Proposed Action. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

Under Alternative D, the transmission line ROWs would be approved and they would continue to be operated and maintained as described for the Proposed Action. As such, impacts would the same as described for the proposed action.

4.17.4.5 Alternative E – No Action Alternative

Navajo Mine

Under the No Action Alternative, mining would stop when the ROD is issued in 2015. Mining activities which require health and safety programs would no longer be performed after closing the mine under the No Action Alternative thereby contributing a negligible improvement of long-term (beyond dismantling and restoration activities) public health and safety. Impacts to Public Health may increase prior to the anticipated mine closure from an increase in mining activity due to the anticipated mine closure. This impact would be related to an increase of equipment usage and coal dust. This impact to public health would be temporary and short-term.

Four Corners Power Plant

Under the No Action Alternative APS would shut down Units 4 and 5 in 2016 when the current lease expires and EPA's BART rules goes into effect. The FCPP would be decommissioned and held for future use. In addition to the five units, all three switchyards would also be decommissioned. Several potential future uses of the site are possible. It could continue as an energy generation site with several potential technology scenarios. The infrastructure could also be demolished and the site redeveloped for industrial, commercial, or residential uses. It is entirely speculative at this time to predict the likely alternative future uses for the site. APS has not yet prepared a decommissioning plan. Any decisions regarding the future uses must be with the concurrence of the other owners. Currently the site is held undivided by all of the owners; future uses may therefore require subdivision of the property. Any such uses would be subject to environmental review at either the tribal or federal level, including potentially under NEPA, at the time they are developed and proposed.

Short-term impacts on worker safety and public health during decommissioning would be the same as the Proposed Action. Long-term impacts would be beneficial because no mining activities that could contribute to worker safety or public health issues would occur.

Transmission Lines

Under the No Action Alternative, the ROWs for the four subject transmission lines would not be approved. Since the subject lines primarily transmit power from the FCPP, under the No Action Alternative, the power source for the transmission lines would be removed. The lines would either be decommissioned and dismantled, or left in place. As with the FCPP, decommissioning and dismantling activities would

need to be coordinated with the Navajo Nation and the BLM such that the area meets the specific needs of the planned reuse. Compliance with all environmental laws and regulations would occur throughout the demolition process.

Worker safety impacts would be slightly higher than the Proposed Action during decommissioning activities if the transmission lines are removed due to increased worker activity such as tower and power line removal. Because these activities would occur in compliance with all environmental laws and regulations, these impacts would be expected to be negligible to minimal and short-term. Beyond decommissioning and dismantling activities there would be no impact under the No Action Alternative to Worker Safety. There would be no impacts to Public Health under the No Action Alternative.

4.17.5 Health and Safety Mitigation

The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific mitigating measures for certain environmental impacts, standard operating procedures that reduce or avoid environmental impacts, and best management practices for specific activities. These are described in Section 3.2.6.17. These measures are part of their application materials and are enforceable through permit or lease conditions. In addition, the Project Applicants must comply with additional protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section for each resource category. Where the environmental analysis in this EIS recommends additional protective measures, over and above the applicant proposed measures and regulatory compliance, they are listed below as specific mitigation measures.

The Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects to public health and safety. Therefore, no additional mitigation is recommended.

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4.18 Cumulative Effects

This section assesses the cumulative effect of the project-specific effects of the alternatives analyzed together with past, present, and reasonably foreseeable projects. Although project-specific effects may be minor, when taken together with past, present, and reasonably foreseeable effects of other projects the effects may be cumulatively major. The Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA define cumulative impacts as those impacts "on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7).

Past projects are typically accounted for as part of the existing, or "baseline", environment, although in some cases specific past projects may be identified (CEQ 2005). In general, the environmental analysis required under NEPA is forward-looking, in that it focuses on the potential impacts of the proposed action that an agency is considering. This analysis includes past actions as the existing environment, and includes site-specific information regarding past action in the vicinity of the FCPP and the Navajo Mine.

The CEQ developed a guidance document, *Considering Cumulative Effects under the National Policy Act* (CEQ 1997), and the EPA augmented this guidance in 1999 with *Consideration of Cumulative Impacts in EPA Review of NEPA Documents* (EPA 1999). Neither document offers a checklist for conducting a cumulative impact analysis, but they provide significant guidance to such an analysis. This cumulative impact analysis follows these two guidance documents to the extent applicable.

Both guidance documents stress the importance of scoping to the cumulative impact analysis section. In this analysis, public scoping identified issues and projects to be considered. The scoping was enhanced by conducting extensive public agency scoping among the cooperating agencies. The scoping helped to establish the geographic scope, the time frame for each action and the analysis, and other actions and projects that may affect the resources of concern. This enhanced scoping effort produced the list of projects to be considered in the cumulative impact assessment.

The specific geographic scale of the cumulative impact analyses depends on the resource under consideration. In general, the study area for cumulative effects differs for the specific resource under consideration; for example, for water quality, the appropriate scale is the watershed, for air quality, the appropriate scale is the air shed; for socioeconomics, the appropriate scale is the affected Tribal lands, county, and state.

The type of impact for each project under consideration is also central to the analysis. To be considered for cumulative effects, the other projects must have effects on the environment, and those effects must be of a similar type to that for the proposed action and alternatives. By its nature, a cumulative impact assessment evaluates effects that may be individually minor, but cumulatively major. However, the integration of the effects must be within each resource category. To make this portion of the analysis clear, each resource category is considered specifically.

Finally, the time period of the analysis and the timing of impacts of individual projects control cumulative impacts. The time period of the analysis includes the proposed lease period (to 2041) and the reclamation period for the Pinabete Permit area of the Navajo Mine. For the timing of impacts of individual projects, the life cycle of a project is the key factor; for example, a simple life cycle could be construction, followed by operations, followed by termination activities. For each element of the lifecycle, the impacts may differ in type and intensity. The cumulative impact analysis must recognize the temporal variation in the effects of individual projects prior to quantifying the integrated impacts.

4.18.1 Criteria for Project Selection

Considering the CEQ guidance, an initial list of projects, and actions, and existing facilities in the Four Corners region was developed. This list was augmented during scoping and with input from the cooperating agencies. The list was refined based on the geographic scope, temporal scale, and type of impact that may occur, compared to the Proposed Action and alternatives.

The projects/actions presented in Table 4.18-1 and Figure 4.18-1 below meet both the temporal and spatial criteria to be considered in the cumulative analysis. A project would meet the temporal criteria if that action has already occurred, is ongoing, or is "reasonably foreseeable" within the timeframe of the analysis (2041, plus the reclamation period for the Pinabete permit). Reasonably foreseeable projects are those that are funded for future implementation, have all relevant permits and approvals, or are included in firm near-term plans that would be implemented during the Proposed Action. Since the Proposed Action would extend operations of the FCPP and Navajo Mine through 2041, the list includes all reasonably foreseeable projects that have the potential to be executed within this long-term time frame. Types of actions with firm near-term plans include:

- Actions for which NEPA documents are in preparation or finalized;
- Actions in a detailed design or planning phase;
- Actions listed in formal NOIs published in the Federal Register or State publication clearinghouses;
- Actions for which enabling legislation has been passed or a Memorandum of Understanding has been signed; and,
- Actions that have been submitted to Federal and State regulators to begin the permitting process (i.e. land use/ROW applications).

Projects and actions that meet the long-term criteria for inclusion in the cumulative effects analysis include all existing projects, projects with near-term plans, as stated above, and projects that have plans to operate at any time during the timeframe of the Proposed Action.

A project would meet the spatial criteria if that action could have an environmental effect in same region of influence as the Proposed Action. Considering that environmental effects are manifested in various ways depending on the resource category, the cumulative study area for each resource was developed specifically for that resource's potential area of effect. For example, air emissions can travel long distances, whereas noise would travel shorter distances.

4.18.2 Projects Considered in the Cumulative Effects Analysis

After a review of existing and proposed projects in the relative vicinity of the FCPP and Navajo Mine, the following types of projects could have environmental consequences that are similar to the Proposed Action, and therefore have the potential for cumulative impacts:

1. Energy Generation and Transmission Projects
2. Oil & Gas Projects
3. Mining Projects
4. Transportation Projects
5. Water-Related Projects
6. Other Development Projects

Table 4.18-1 provides a comprehensive list of these project types in the vicinity of the proposed Project and includes a brief description of each project. The table also provides a rationale for why each project is either carried forward or excluded from the cumulative effects analysis.

Table 4.18-1 Projects Considered in the Cumulative Effects Analysis

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Energy Generation and Transmission Projects				
San Juan Generating Station (SJGS)	Existing	SJGS is operated by PNM and consists of four coal-fired, pressurized units that generate about 1,800 gross megawatts of electricity. SJGS went online in 1973. It is the seventh-largest coal-fired generating station in the West, and is PNM's primary generation source, serving 58 percent of the power needs of PNM customers. The regional haze provision of the Clean Air Act requires the San Juan Generating Station to reduce NO_x emissions by September 2016 through the installation of Best Available Retrofit Technology, or BART. Although the State and EPA are in court to determine the specific BART, the timeline for compliance remains 2016. PNM announced October 16 at a Farmington City Council meeting that two units of the plant would close in 2017, and the remaining two units would be shut down by 2053 (Daily Times, October 16, 2012).	About 15 miles northwest of Farmington, NM	This is an existing generating station, and compliance with BART would occur within the same timeframe as the Proposed Action and alternatives. Therefore, for the purposes of this cumulative effects analysis, the facility as in compliance with BART is considered in the cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Navajo Generating Station (NGS)	Existing	NGS is a coal-fired power plant with a capacity of 2,250 megawatts from three 750-MW units. NGS serves electric customers in Arizona, Nevada, and California. It began producing commercial power in 1974. The power plant is served by coal mined at Peabody's Kayenta mining operations (see below under Mining), which is located 50 miles to the east of NGS and hauled by the Black Mesa and Lake Powell Railroad. SRP and Peabody have submitted applications to the Bureau of Reclamation, OSMRE, and other agencies to continue operations of the power plant and mine through 2044. If the approvals are not granted, the power plant would shut down in 2019.	About 5 miles east of Page, AZ	This is an existing generating station. For the purposes of this cumulative analysis, this project is assumed to continue operations through 2044.
Escalante Generating Station	Existing	Escalante Generating Station, located in Prewitt, NM, is a single-unit, 250-megawatt, coal-fired power plant, constructed in 1984. Escalante Station is owned and operated by Tri-State Generation & Transmission Association, a cooperative. Western Fuels Association (WFA) purchases coal from the Lee Ranch Mine and operates the Escalante-Western Railway to transport it to the Escalante Station. WFA provided 1.1 million tons of coal in 2005.	Prewitt, NM, 27 miles northwest of Grants, NM	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Centennial West Clean Line	Proposed	The Centennial West Clean Line transmission line is proposed to transmit 3,500 MW of renewable energy from New Mexico and Arizona to California. Although the transmission route has not yet been determined, it is anticipated that 900 miles of high-voltage direct current overhead line will be constructed. In January 2011, Clean Line submitted an application for right-of-way across federal lands to the Bureau of Land Management (BLM). Although a Notice of Intent for NEPA analysis has not been published yet, BLM and Western Area Power Authority have been selected as co-lead agencies for the NEPA process. Construction is planned for 2015-2018.	Undetermined location in Arizona and New Mexico	The project location and details are not yet defined; therefore, even though an application has been submitted to agencies to begin the permitting process, the project may be denied or significantly modified. Any evaluation of the project would be entirely speculative. Therefore, this project is not considered further in this cumulative effects analysis.
Animas/Bloomfield Power Plant	Existing	Animas/Bloomfield Power Plant is a 51 MW cogeneration and natural gas power plant, owned and operated by the City of Farmington.	Bloomfield, NM	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Desert Rock Energy Project	Suspended	In 2006, Sithe Global Power, LCC (Sithe Global) proposed to construct a hybrid dry-cooled, coal-fired, 1,500-megawatt (mW) electrical power generating plant approximately 30 miles southwest of Farmington, New Mexico, on the Navajo Indian Reservation. Sithe Global developed the project with the Diné Power Authority, an enterprise of the Navajo Nation. A Draft EIS was prepared in June 2007. No Final EIS or Agency Decision has been released. In 2012, the President of the Navajo Nation submitted a letter to the BIA requesting the project remain active and indicated that the Nation plans to propose a new alternative at an undetermined future date. The details of the new alternative are unknown. Until this new information is received, this project is considered suspended.	Approximately 30 miles southwest of Farmington, NM	Although the President of the Navajo Nation requested that BIA retain this project as an open application, there have been no details or even concepts of the new alternative to be proposed by the Navajo Nation and Sithe. Accordingly, any analysis of this project would be entirely speculative. Therefore, this project is not considered further in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
EPE Sale of FCPP Interest to APS	Proposed	At the end of 2013, EPE and APS filed an 8-K Form with the Federal Securities & Exchange Commission that seeks approval for the sale/transfer of EPE's 7 percent stake in FCPP to APS. EPE did not enter into the Coal Supply Agreement executed between the FCPP co-owners and NTEC and intends to exit FCPP ownership entirely.	FCPP, near Fruitland, NM	This is a pending transaction that is expected to be fully executed by the time the Records of Decision are issued for this project. Therefore, this action has a formal document in place and meets the criteria as reasonably foreseeable. Therefore, this action is considered in this cumulative effects analysis.
NTEC as an FCPP Ownership Party	Possible	EPE is selling its 7 percent ownership stake in FCPP and per the Coal Supply Agreement between APS and NTEC, NTEC has first right of refusal on purchasing this interest. It is possible that NTEC becomes an ownership party in FCPP.	FCPP, near Fruitland, NM	This scenario exists as a possibility, but APS does not expect any sort of possible transaction until after the Records of Decision are published for this environmental review. There are no formal applications or business agreements to reference to determine if this action is reasonably foreseeable. Therefore, this possibility is considered speculative and not considered further in this cumulative analysis.
Comanche Generating Stations (CGS)	Existing	CGS is a cogeneration 1,410 MW power plant owned by Xcel Energy. Two of the power plant's units were constructed in the 1970s. Unit 3 was approved in 2004, constructed in 2005, and became operational in 2010.	Pueblo, CO	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Navajo Transmission Project (NTP)	Proposed	The NTP, proposed by the Diné Power Authority (an enterprise of the Navajo Nation), would involve the construction of 470 miles of 500kV alternating current transmission lines. The line would connect the Four Corners area to the Las Vegas area, with an interconnection point north of Flagstaff to allow access to the metropolitan Phoenix market. NTP received a Record of Decision (ROD) and Grant of Rights-of-Ways from the Bureau of Land Management (BLM) for Segments I and II on September 29, 2008. The Bureau of Indian Affairs (BIA) issued a similar ROD for the Navajo Nation Trust Lands in Segments I and II on October 8, 2008. However, both RODs have been rescinded. The project is currently on hold.	NM, AZ, NV	Although an EIS was prepared for this project, both records of decision have been rescinded and it is uncertain of the timeline of any future decisions by BIA or BLM, therefore this project is not considered further in this cumulative effects analysis.
New Mexico Gas Co. Transmission Line Extension Project	Proposed	Gas services would be canceled for residents in rural San Juan County. New Mexico Gas Co. announced that it can extend transmission lines to the majority of those losing service. The New Mexico Public Regulation Commission (PRC) held a public meeting in Farmington in May 2012. At the public meeting, various options were discussed to ensure that rural residents maintain power, but no conclusions were reached. No formal plans are publically available. The transmission line extension project would result in a rate increase and is subject to PRC approval.	San Juan County, NM	This project does not meet the criteria for a “reasonably foreseeable” project and is therefore not considered in the cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Ute Mountain Ute Power Generation Facility	Proposed	The Ute Mountain power generation facility would include new coal-bed methane and oil and gas wells. The Ute Mountain Indian Tribe has filed a water rights claim with the Eleventh Judicial District Court and is currently adjudicating water rights claims on the San Juan River. The tribe claimed between 7,300 and 9,300 acre-feet of water. It is unknown when a decision regarding water rights will be made.	San Juan Basin, CO	This project does not meet the criteria for a “reasonably foreseeable” project and is therefore not considered in the cumulative effects analysis.
Milagro Power Plant	Existing	The Milagro power plant is a natural gas power plant that consists of two 61 MW units and is owned and operated by William Field Services. The first 61 MW unit was installed in 1981 and the second was installed in 1996.	Bloomfield, NM	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Cimarron Solar Facility	Existing	The Cimarron Solar Facility is a large-scale solar photovoltaic plant located in Colfax County, NM. It is owned by Southern Power and has a 30-MW capacity. Electricity generated by the plant serves a 25-year power purchase agreement with Tri-State Generation and Transmission Association and serves consumers across Colorado, Nebraska, New Mexico and Wyoming.	Colfax County, NM	This is an existing solar facility with a purchase agreement in place that extends to 2035. This facility is considered in the cumulative effects analysis.
Algodones Solar Facility	Existing	The Algodones solar facility is a 25-kilowatt solar generating station operated and owned by PNM. Through its customer-owned solar photovoltaic program, PNM purchases renewable energy certificates from participating customers at a rate of 13 cents every time their interconnected solar PV systems generate a kilowatt-hour of electricity. There are currently 59 customers enrolled in the program, for a combined capacity of 113 kilowatts (AC) of solar energy.	Algodones, NM	This facility is located outside of the spatial scope of the cumulative impacts analysis and is therefore not considered.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Coronado Generating Station	Existing	The Coronado generating station is a coal-fired power plant, owned and operated by Salt River Project. It consists of two units that together produce 773 MW. Unit 1 was constructed in 1979 and the second unit was constructed in 1980.	Apache County, AZ	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Springerville Generating Station	Existing	The Springerville generating station is a coal-fired power plant, owned and operated by Salt River Project. It consists of four units. The first two units each produce 380 MW and were installed in 1985 and 1990, respectively. The third and fourth units each produce 400 MW and were installed in 2006 and 2009, respectively.	Apache County, AZ	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Fountain Valley Power Plant	Existing	The Fountain Valley Facility is a 240-MW simple cycle, natural gas-fired, peaking facility.	El Paso County, CO	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Front Range Power Plant	Existing	The Front Range Power Plant is a 480 MW combined cycle, air-cooled condenser plant that consists of two General Electric (GE) 7FA combustion turbines, two Vogt-NEM three pressure HRSGs and one Alstom steam turbine. Operations began in 2003.	El Paso County, CO	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Martin Drake Generating Station	Existing	The Martin Drake Generating Station is a coal-fired power plant owned and operated by the City of Colorado Springs. It consists of three units with a total capacity of 257 MW. The units were installed in 1962, 1968, and 1974	El Paso County, CO	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Nucla Generating Station	Existing	Nucla Generating Station is a coal-fired power plant owned and operated by Tri-State Generation and Transmission. It consists of four units, three 12 MW units and one 79 MW unit, for a total capacity of 114 MW. The 12 MW units were all installed in 1959 and the 79 MW unit was installed in 1991.	Montrose County, CO	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Bluffview Power Plant	Existing	The Bluffview Power Plant consists of a single natural gas turbine that produces a total of 60 megawatts.	San Juan County, NM	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Delta-Person Generating Project	Existing	Established in 2000, the Delta-Person Generating Station is owned and operated by Delta Power LLC and John Hancock Insurance. The facility consists of a single natural gas turbine that produces 132 megawatts.	Bernalillo County, NM	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Reeves Generating Project	Existing	Established in 1958, the Reeves Generating Station is owned and operated by PNM and consists of three natural gas turbines that produce a total of 154 megawatts.	Bernalillo County, NM	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Valencia Power Plant	Existing	Established in 2007, the Valencia Power Plant is owned by Southwest Generation and consists of two natural gas turbines that produce a total of 319 megawatts.	Valencia County, NM	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
San Juan Basin Energy Connect Project	Proposed	Tri-State Generation & Transmission Association is proposing to construct a 245-kV transmission line from the Shiprock substation located near Waterflow, NM to the Iron Horse substation located near Ignacio, CO. The proposed transmission corridor is approximately 65 miles. The purpose of the project is to reinforce energy transmission in the San Juan Basin. An EIS is currently being prepared for this project, and the BLM is serving as the lead federal agency. Tri-State is requesting right-of-way (ROW) grants from the BLM and the BIA. The BLM initiated scoping in October 2009 for the proposed EA. Scoping revealed that an EIS would be more appropriate, so additional scoping meetings for the EIS were held in March 2011. It is anticipated that the EIS will be released in the Fall of 2013. Construction is planned to commence in mid-2014, and the transmission line is scheduled to be operational by the end of 2015.	Waterflow, NM to Ignacio, CO	This project meets the criteria for consideration in the cumulative effects analysis.
Energy Utility Corridor Planning	Planned	The final programmatic EIS to designate energy corridors in 11 western states was published in 2008 by an interagency project management team (DOE, BLM, USFS, and DOD) to identify energy utility corridors for the implementation of Section 368 of the Energy Policy Act of 2005 (designation of West-wide energy corridors). No Record of Decision has yet been published. Only one new energy corridor in San Juan County was analyzed in the study – 80-273 – running north-south from San Juan National Forest in Colorado, through the southern Ute Reservation, and into San Juan County, NM, terminating at approximately Zia Pueblo, New Mexico.	Various locations throughout the western US	This project meets the criteria for consideration in the cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Sunshine Wind Project (Hopi)	Planned	The Hopi Tribal Council and the Coconino County Planning & Zoning Department approved the project. The proposed Sunshine Wind Park in eastern Coconino County is the most fully developed and market-ready wind project in Arizona. Approximately 40 wind turbines would be installed and provide 60 megawatts of generating capacity. The wind park was targeted for development in 2007, and turbines would be sited on a combination of Hopi private fee lands and private ranch lands (Bar-T-Bar Ranch and other private lands); however, the project was delayed due to purchase issues with APS, a viewshed lawsuit by a nearby landowner, and rising costs of materials.	35 miles east of Flagstaff near the Meteor Crater exit along I-40	Although project implementation has been delayed, it is foreseeable that the project would be implemented during the timeframe of the proposed project. Therefore, this project meets the criteria for consideration in the cumulative effects analysis.
Other FCPP Transmission Lines (not included in Proposed Action)	Existing	APS operates the FC-Pillar transmission line, a 230-kV line that spans 102 miles. The ROW for this line was approved in 2012. In addition, two other transmission lines transmit power generated by the FCPP; the FC-Shiprock 345-kV line operated by the Western Area Power Association, which runs 6.1 miles to Shiprock and PacifiCorp's 345-KV line, which runs 30.6 miles to the northwest. The easement for the power of the Western Area Power Association line on Navajo land expires in 2019. The remaining portion of this transmission line, as well as all of the PacifiCorp line, is within a perpetual ROW.	Extending to the northwest and southeast from the FCPP	These are existing transmission lines that would be operational during the timeframe of the Proposed Action and alternatives and therefore are considered in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Oil and Gas Projects				
Western Oil & Gas Proposed Drilling	Planned	Western Oil and Gas has proposed approximately 600 natural gas wells in eastern Burnham Chapter extending north into Upper Fruitland and Nenahnezad/San Juan Chapters. The installation of each well would require well pads (approximately 50 by 50 feet each) and construction areas, in addition to access roads, pipelines, or distribution power lines as needed (for productive wells). The BIA is currently performing NEPA review for this project and an Agency Decision is expected in 2013.	NAPI area, Navajo Reservation, NM	This project meets the criteria for consideration in the cumulative effects analysis.
Oil & Gas Development on BLM Lands - Farmington Field Office	Planned	The Resource Management Plan for the lands managed by the BLM Farmington Office includes development of 9,942 new oil and gas wells from 2003 and 2023 in the San Juan Basin, allowing for about 16,100 acres of long-term disturbance.	San Juan County, NM	This project meets the criteria for consideration in the cumulative effects analysis.
Oil and Gas Development - Tres Rios Field Office	Planned	According to the Final EIS on the San Juan Land and Resource Management Plan (2013), approximately 1.65 million acres of USFS and BLM managed land, as well as an additional 0.91 million acres of private land, in the San Juan Basin would be made available to oil and gas leases during the project period. A Final EIS analyzing impacts was released September 2013. The Final EIS states that approximately 2,900 new wells may be drilled within all jurisdictions in the planning area over the next 15 years.	Tres Rios Field Office La Plata and Montezuma Counties, CO	This project meets the criteria for consideration in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
San Juan Refinery, Bloomfield	Existing	Giant owns and operates the Bloomfield oil and gas refinery, located on 285 acres near Farmington, New Mexico. The total approximate refining capacity of the refinery is 16,600 bpd. A locally produced, high-quality crude known as Four Corners Sweet is the primary feedstock, although the supply is supplemented, as necessary, with other feedstocks from within and outside the Four Corners area. Crude oil supply to the refinery comes primarily from the Four Corners area and is either collected by Giant's pipeline network or delivered by truck transports to pipeline injection points and/or refinery tankage.	Bloomfield, NM	This is an existing facility that would operate during the timeframe of the proposed project and is therefore considered in this cumulative effects analysis.
San Juan River Gas Plant	Existing	The San Juan River gas plant is a natural gas treatment plant owned by Western Gas Resources and located near Fruitland, New Mexico. The San Juan River Gas Plant consists of several units; a purification plant, a natural gasoline plant, a compressor station, and a dehydration unit. The gas plant facility includes compression, amine gas treating, liquids stabilization, Claus sulfur recovery plant, dehydration, and a cryogenic liquid recovery plant. The plant produces a lean, dry residue gas stream, a mixed natural gas liquid stream (NGL) and a liquid sulfur stream. The liquid products contain ethane, propane, butanes, pentanes and heavier components. The plant handles regulated flammables such as ethane, propane, mixed butanes and mixed pentanes. The plant uses an amine process to remove carbon dioxide and hydrogen sulfide but does not contain threshold quantities of any materials classified as toxic.	Located about 10 miles west of Farmington, NM	This is an existing facility that would operate during the timeframe of the proposed project and is therefore considered in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Transwestern Pipeline Company's Phoenix Expansion Project	Existing	Construction is currently underway on the Phoenix Expansion Project, which expands the Transwestern Pipeline Company's natural gas pipeline system by approximately 260 miles from its mainline in Yavapai, County, Arizona to delivery points in the Phoenix metropolitan area market. As part of the overall project, Transwestern is building approximately 25 miles of pipeline l parallel to its existing San Juan Lateral, in San Juan County (FERC 2006). The San Juan Lateral extends from San Juan County, New Mexico, to connect with Transwestern's mainline in McKinley County, New Mexico, and is located approximately 15 miles or further from the study area.	San Juan County, NM	This project is currently underway and would be operational during the timeframe of the proposed project. Therefore, it is considered in this cumulative effects analysis.
Oil and Gas Development (BLM Farmington Office)	Planned	The ROD for the Farmington Final EIS indicates the potential development of 9,942 new oil and gas wells on lands managed by the BLM Farmington Office.	San Juan, McKinley, and Rio Arriba Counties, NM	This project meets the criteria for consideration in this cumulative effects analysis.
Southern Ute Indian Tribe (SUIT) Development of Fruitland Coal Bed Methane	Planned	Current basin-wide Fruitland coalbed spacing allows one gas well per 320 acres. Infill applications for specific areas have been approved by the COGCC, allowing an optional second Fruitland coal bed gas well on each 320-acre spacing unit. Infill drilling within 320-acre spacing units is currently occurring and may be a future trend basin-wide. If oil and gas operators and regulators continue to see sufficient economic merit and legal justification to perpetuate the current trend of drilling optional infill wells on existing 320 acre spacing units, 1000 additional infill Fruitland coal bed methane wells (350 north of the Ute Indian Reservation) could be drilled in the Colorado portion of the San Juan Basin.	San Juan Basin, CO	Approval of infill applications that would allow additional wells meets the criteria for consideration in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Mid-America Pipeline	Existing	BLM approved a proposed natural gas liquids pipeline project in 2005 and granted ROWs and temporary use permits for 12 pipeline sections that were constructed by the Mid-America Pipeline Company. Parallel sections of pipeline total 202 miles along an 840-mile route between Granger and Wamsutter areas in Wyoming, and Hobbs, New Mexico. The pipelines are 8 to 16 inches in diameter, buried, steel, and carry natural gas liquids. Existing ancillary facilities, including pump stations, were expanded to have more capacity.	Passes through San Juan County, NM [to pass through Huerfano, NM, 30 miles east of the project site]	This is an existing pipeline and meets the criteria for consideration in this cumulative effects analysis.
Ciniza Refinery	Existing	Giant owns and operates the Ciniza refinery. The total approximate refining capacity of the refinery is 26,000 bpd. A locally produced, high-quality crude known as Four Corners Sweet is the primary feedstock. Crude oil supply to the refinery comes primarily from the Four Corners area and is either collected by Giant's pipeline network or delivered by truck.	Near Gallup, NM	This is an existing refinery and meets the criteria for consideration in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Mining				
San Juan Coal Company, San Juan Mine	Existing	This is an active underground mine and is the exclusive supplier of coal to the SJGS. Surface mining at San Juan reached a depth in the early 2000s that represented an economic limit, but underground mining is feasible and the coal supply contract with SJGS extends through 2017. It is expected that the contract will be renewed for 25 years in 2017.	15 miles west of Farmington, NM	This is an existing mine and would be operational during the early timeframe of the proposed project. No application has yet been submitted for a SMCRA permit renewal for the San Juan Mine. Therefore, operations beyond 2017 are speculative, but the existing operations are accounted for as part of the existing environment.
Kayenta Mine Complex Permit Revision (Peabody Western Coal Company)	Existing	The Kayenta Mine Complex (KMC) permit area is located on about 44,073 acres of land leased within the boundaries of the Hopi Tribe and Navajo Nation tribal trust lands in northern Arizona, about 15 miles south of the town of Kayenta, in Navajo County. The KMC operation produces about 8.2 million tons of coal per year. The coal is delivered by electric railroad 78 miles northwest to the NGS near Page, in northern Coconino County, Arizona. PWCC has submitted a permit revision application to OSMRE, proposing modifications to the life of mine plan (LOM) plan for the KMC. The permit revision would approve a revised LOM plan that addresses all of the leased tons and reserves under the existing permit, would incorporate the existing support facilities under a single permit, and would abandon future plans to mine coal reserves in the area that was previously operated as the Black Mesa Mine. Approval of the proposed permit revision application would not change the mining methods or average annual production rate of the Kayenta Mine.	KMC is located on land within the boundaries of the Hopi and Navajo tribal trust lands in northern Arizona, near the town of Kayenta, in Navajo County (about 125 miles northeast of Flagstaff, Arizona).	This is an existing mine. For the purposes of this cumulative analysis, we consider the proposal to continue operations through 2044.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
El Segundo Mine	Existing	The El Segundo Coal Mine opened in 2008 and is owned and operated by Peabody Energy. The mine shipped 8.4 million tons of coal in 2012 and is considered highly productive due to a low overburden ratio. The mine occupies two sub-watersheds, separated by the continental divide, and ultimately drains into the Chaco River.	The El Segundo Mine is located approximately 70 miles southeast from the southern boundary of the Navajo Mine.	This is an existing mine and meets the criteria for consideration in this cumulative effects analysis.
San Juan Coal Company La Plata Mine	Past	From 1986 through 2002 the La Plata mine also supplied coal to the San Juan Generating Station. The mine ceased operation in 2002 and reclamation continued through 2005.	State Highway 170, La Plata, San Juan County, NM	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
McKinley Mine (Pittsburgh & Midway Company)	Past	McKinley Mine is located between Gallup, NM and Window Rock, AZ and was owned and operated by the Pittsburgh and Midway Company. The mine closed in 2009. Initial reclamation activities began in 1980 and are in the final phases of completion.	Navajo Reservation, Four Corners area	This is a past project and is considered in the cumulative effects analysis of this project.
Chimney Rock Mine	Past	OSMRE issued a SMCRA permit for this historic surface coal mine that no longer operates. Mining activities were conducted from 1976 to 1985. The final bond release was issued in 2005.	Approximately 30 miles due east of Durango, CO, near the Piedra River.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
Coal Gulch Mine	Past	OSMRE issued a SMCRA permit for this historic surface coal mine that no longer operates. Mining activities were conducted from 1978 to 1998. The final bond release was issued in 2010.	Approximately 5 miles southwest of Durango, CO.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
Carbon Junction Mine	Past	OSMRE issued a SMCRA permit for this historic surface coal mine that no longer operates. Mining activities were conducted from 1983 to 1990. Reclamation was completed in 2008, but the final bond release has not yet been issued.	Approximately 15 miles southwest of Durango, CO.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Peacock Mine	Past	OSMRE issued a SMCRA permit for this historic underground coal mine that no longer operates. Mining activities were conducted from 1905 to 1981. Reclamation was completed in 1996, but the final bond release has not yet been issued.	Approximately 18 miles southwest of Durango, CO, near the San Juan Arroyo.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
National King Coal Mine	Existing	OSMRE issued a SMCRA permit for this active underground mine. Mining activities were initiated in 1941 and are ongoing.	Approximately 20 miles southwest of Durango, CO.	This is an existing mining operation and meets the criteria for consideration in this cumulative effects analysis.
Blue Flame Mine	Past	OSMRE issued a SMCRA permit for this historic underground coal mine that no longer operates. Mining activities were conducted from 1950 to 1991. The final bond release was issued in 2008.	Approximately 1 mile east of Cameo, CO.	This is a past project and is beyond the potential area of effect and is not considered in the cumulative impact analysis.
Burnham Mine	Existing	OSMRE issued a non-permanent program SMCRA permit for this past surface coal mine. Mining activities were conducted from 1980 to 1984. This mine area is currently under reclamation and the final bond release has not been issued.	Approximately 1 mile southwest of Burhnam, NM, near the Chaco River	This is an existing mining operation and meets the criteria for consideration in this cumulative effects analysis.
Black Diamond Mine	Past	OSMRE issued a SMCRA permit for this historic surface coal mine that no longer operates. Mining activities were conducted from 1983 to 1993. The final bond release was issued in 2007.	Approximately 10 miles north of Farmington, NM, near the La Plata River.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
De-Na-Zin Mine	Past	OSMRE issued a SMCRA permit for this historic surface coal mine that no longer operates. Mining activities were conducted from 1980 to 1992. The final bond release was issued in 2003.	Approximately 5 miles south of Burnham, NM, near the Chaco River.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
Gateway Mine	Past	OSMRE issued a SMCRA permit for this historic surface coal mine that no longer operates. Mining activities were conducted from 1982 to 1990. The final bond release was issued in 2004.	Approximately 10 miles southeast of Burnham, NM, near the Chaco River.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
San Juan Mine	Existing	OSMRE issued a SMCRA permit for this active surface and underground coal mine. Surface mining operations were initiated in 1973 and underground mining was initiated in 2000. Mining operations are ongoing.	Approximately 8 miles west of Farmington, NM, near the San Juan River.	This is an existing mining operation and meets the criteria for consideration in this cumulative effects analysis.
BAR-D In-stream Gravel Mine	Existing	The BAR-D in-stream gravel mine extracts sand and gravel from the Animas River by means of a “vortex bar.” The developers also engineered the neighboring floodplains with flood/erosion control measures. Operations commenced in 2009 and are ongoing. The Army Corps of Engineers issued a 404 permit for this project.	Animas Valley, La Plata County, CO	This is an ongoing mine project and meets the criteria for consideration in this cumulative effects analysis.
Kayenta Mine Complex (KMC)	Part Existing/Part Past, Suspended, Proposed	This Project includes mining operations at the Kayenta and Black Mesa mines. Black Mesa mine provided coal to the Mohave generating station in Laughlin, NV Operation of the Black Mesa mine, however, was suspended at the end of 2005 when the Mohave generating station halted operation pending the installation of air quality control technology. The project also includes Black Mesa Pipeline’s proposed operation and reclamation plan for the Coal Slurry Preparation Plant at the Black Mesa mine, the reconstruction of Black Mesa Pipeline’s 273-mile long Coal Slurry Pipeline across northern Arizona to Laughlin, and the project water supply (see Black Mesa Project, project water supply).	Mining operations south of Kayenta AZ. Other components to south of Leupp, AZ, and to Laughlin, NV	This project is currently suspended and it is unknown if, and when, it may be implemented. Therefore, this project is not considered further in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Transportation				
Improvements to US160	Existing	Highway improvements on US 160 from Durango to Bayfield are currently ongoing, although the project has just begun. Improvements include resurfacing and installing additional safety features. Construction was initiated in 2011 and is slated for completion by 2014-2015.	From Durango to Bayfield, CO	Construction of the proposed project would be completed prior to the proposed project timeline but the operational changes to the highway would occur within the timeframe; therefore, these are considered in the cumulative effects analysis.
Gallup-to-Farmington Freight Rail Line	Planned	BNSF, shippers, the Navajo Nation, and economic development agencies in northwest New Mexico are considering building a potential rail line to provide freight service. This rail line is considered a long-term project, if determined feasible, and construction for this freight line would be at least a decade away.	Gallup to Farmington, NM	The feasibility of this project is still being determined and construction would not occur for at least ten years. Therefore, this rail line is considered speculative and does not meet the criteria for consideration in the cumulative analysis.
Improvements to US 491	Planned	Highway improvements have been planned for US 491 and include widening the existing 2-lane highway to 4 lanes. The new roadway is being constructed on the eastern side of the existing roadway and would be fully contained within the existing ROW (FHA et al. 2006). This project underwent NEPA review, and a FONSI was issued in 2007. Improvements to US 491 were initiated in 2007 and are currently ongoing.	US 491, 10 miles south of Shiprock, NM to Sheep Springs, NM	Ongoing construction activities would occur within the timeframe of the proposed project; therefore this project meets the criteria for consideration in the cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Water				
Animas – La Plata Project	Existing	Implementation of the Colorado Ute Settlement Act Amendments of 2000. The project is being built to fulfill the water rights settlement of the Ute Mountain Ute Tribe and the Southern Ute Indian Tribe. Fulfillment of the settlement obligations, one of which is completing the Animas-La Plata Project, would provide non-Indian water users in southwest Colorado certainty regarding their continued use of water. Storage would largely be reserved for Indian water users, but nearly 33 percent of the storage in Lake Nighthorse would be for use by non-Indian entities in the Four Corners region. Seven entities would benefit: 1) Southern Ute Indian Tribe, 2) Ute Mountain Ute Tribe, 3) Animas-La Plata Water Conservancy District, 4) State of Colorado, 5) Navajo Nation, 6) San Juan Water Commission, and 7) La Plata Conservancy District. The Navajo Municipal Pipeline, sometimes referred to as the Farmington to Shiprock Pipeline, was authorized under the Animas-La Plata Project. Construction of the pipeline was completed in 2012. The filling of Lake Nighthorse reservoir was initiated in 2010 and completed in 2011.	Approximately 3 miles southwest of downtown Durango, CO	This is an ongoing project and is considered in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Durango Pumping Plant (tied to the Animas – La Plata Project (ALP))	Existing	The Durango Pumping Plant was proposed as part of the ALP project and the water settlement with the Ute Mountain Ute Tribe and the Southern Ute Indian Tribe. These tribes have water rights that date back to 1868. Under the settlement, the Bureau of Reclamation's obligations, one of which is completing the Animas-La Plata Project, will provide non-Indian water users in southwest Colorado certainty regarding their continued use of water. The Durango Pumping Plant lifts water from the Animas River up through the Ridges Basin Inlet Conduit into Lake Nighthorse. Lake Nighthorse impounds approximately 120,000 acre-feet (AF) of water and includes an inactive pool of approximately 30,000 AF for recreational, fishery, and water quality purposes. The pumping plant is located about 200 feet from the river and includes an intake structure, a service yard, eight pumps of various sizes, and a surge chamber. Construction was initiated in 2003 and completed in 2011.	Just south of downtown Durango, CO across from Santa Rita Park	This is an existing pumping plant and is considered in this cumulative effects analysis.
Navajo Water Settlement Agreement	Existing	On April 19, 2005, the State of New Mexico and the Navajo Nation signed the Navajo Settlement Agreement (Navajo Nation - State of New Mexico, 2005). The Navajo Nation President, New Mexico State Governor, and Secretary of the Interior signed the settlement agreement in December 2010. It will resolve the claims of the Navajo Nation to the use of waters of the San Juan basin in New Mexico. The Navajo Settlement Agreement is intended to provide water rights and associated water development projects, including the proposed project, for the benefit of the Navajo Nation in exchange for a release of claims to water that potentially might otherwise displace existing non-Navajo water uses in the basin in New Mexico.	Navajo Reservation, NM	This is an existing settlement agreement and is considered in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
		Additional NEPA compliance may be needed to implement other portions of the agreement (Fruitland-Cambridge, Hogback-Cudei, conjunctive use groundwater wells, and others).		
Enlargement of Stevens Reservoir	Existing	The Stevens Reservoir underwent an expansion that included the construction of a dam and spillway. The purpose of the expansion was to raise the overall dam height 10 additional feet and enlarge capacity from 580 acre-feet to 1,775 acre-feet. Construction activities occurred from 2007 and 2008. The Army Corps of Engineers continues to implement wetlands mitigation measures to offset approximately 40 acres of wetlands impacts.	Near Pagosa Springs, Archuleta County, CO	This is an existing reservoir expansion project and the Army Corps continues to implement mitigation measures, so it is considered in this cumulative effects analysis.
Long Hollow Reservoir Development	Existing	The Long Hollow Project will create a 5,400 acre-foot reservoir to store winter runoff and floodwater that will be used to accommodate New Mexico's water right to the La Plata River. Construction for this project was initiated in July 2011 and is scheduled for completion in spring 2013. This new reservoir will result in approximately 3 miles of stream impacts and approximately 3 acres of wetland impacts that the Army Corps of Engineers is addressing through mitigation measures.	Near Red Mesa, CO, approximately 3 miles north of New Mexico State Line	This is an ongoing reservoir development project that would operate during the life the proposed project and is considered in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Jicarilla Apache Nation Navajo River Water Supply Project	Existing	This project involves the Bureau of Reclamation approving a subcontract between the Jicarilla Apache Nation (Nation) and the city of Santa Fe (City). Under the subcontract, the Nation would make available for delivery to the City at the outlet works of Heron Dam up to 3,000 acre-feet per year (acre-ft/yr) of the Nation's San Juan-Chama Project water. The term of the subcontract would be limited to 50 years beginning in 2007. The city's development of its distribution system, located near Santa Fe, is covered by a separate EIS.	Rio Arriba and Santa Fe counties, NM	This is an approved agreement and is considered in this cumulative effects analysis.
Navajo Indian Irrigation Project (NIIP) & San Juan Irrigation Projects	Existing	Irrigation water is released at Navajo Dam through diversion headworks and travels through a series of concrete-lined open canals, membrane-lined open canals, 7 tunnels, 15 siphons, and an in-line earth channel and reservoir behind Cutter Dam. Three pumping plants lift water to concrete-lined open laterals. At full capacity, the system can carry 1,800 cubic feet per second. Two open lateral systems, totaling 40.6 miles in length, convey water to the southern and eastern parts of the development. Water is distributed to the turnouts at the individual farm units through about 340 miles of underground pipe lateral systems ranging from 6 to 84 inches in diameter.	San Juan River, NM	This is an existing water project and meets the criteria for consideration in this cumulative effects analysis.
Kutz Pumping Plant	Existing	The Kutz Pumping Plant is east of New Mexico State Highway 44. It lifts water from the Main Canal to Coury Lateral, which flows southward through Block 5. Using five electric motor-driven pumps, this plant has a capacity of 200 cubic feet per second with a dynamic head of 365 feet. It was completed in 1982.	NIIP Area, San Juan County, NM	This is an existing pumping plant and meets the criteria for consideration in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Gallegos Pumping Plant	Existing	The Gallegos Pumping Plant is near where the Main Canal crosses Gallegos Canyon. It lifts water from the Main Canal to Burnham Lateral, Stage 1. It has eight electric motor-driven pumps and has a capacity of 880 cubic feet per second, with a total dynamic head of 337 feet. It was completed in 2000.	NIIP Area, San Juan County, NM	This is an existing pumping plant and meets the criteria for consideration in this cumulative effects analysis.
Moncisco Pumping Plant	Existing	Construction of the Moncisco pumping plant began operation in 2003. It lifts water into the Burnham lateral, Stage 2, and open channel lateral, which provides water for pumping plants to irrigate Blocks 10 and 11. Current design estimates call for this pumping plan to have a total capacity of 440 cfs and a total dynamic head of 168 feet.	NIIP Area, San Juan County, NM	This is an existing pumping plant and meets the criteria for consideration in this cumulative effects analysis.
Navajo Dam Power Plant	Existing	Construction of the Navajo Dam was initiated in 1962 and was originally not designed for power generation. In 1983, the City of Farmington received authorization from Reclamation to install a 32-MW hydrological power plant and switchyard. However, a US District judge ordered that construction of the Navajo Dam power plant cease. The decision cited an inadequate EIS and lack of authority to construct the plant. After conducting further environmental studies the City of Farmington successfully applied with the Federal Energy Regulatory Commission (FERC) to construct a power plant at Navajo Dam for their use. The FERC issued a license to the city of Farmington to construct the power plant in 1983, and the license expires in 2035.	Approximately 34 miles (45 miles upstream) east of Farmington, NM	This is an existing power plant that would operate during the life of the proposed lease and meets the criteria for consideration in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Hogback Diversion Dam & Irrigation Project	Existing	The Bureau of Reclamation constructed the Hogback dam in 1971. This dam diverts water from the San Juan River and provides irrigation water to the Navajo Indian Irrigation Project (NIIP). An annual diversion of 48,550 acre-feet, or the quantity of water necessary to supply a depletion of 21,280 acre-feet from the San Juan River, of surface water from the direct flow of the San Juan River at the diversion dam for the Hogback-Cudei Irrigation Project provides irrigation for 8,830 acres of land generally located along the north and south sides of the San Juan River. The dam diverts water (approximately 24,200 acre-feet annually) into the NIIP irrigation system during periods of low water flow. As part of the San Juan Recovery Implementation Program, fish access was restored at the site by removing the Cudei Diversion Dam at river mile 142 and fish passages were constructed at the Hogback Diversion Dam (river mile 159) in 2001. Recently in 2013, the Recovery Implementation Program also modified the diversion and canal system to include a fish weir wall to prevent fish from becoming entrained in the canal system.	San Juan River, near Shiprock, NM	This is an existing dam and meets the criteria for consideration in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Navajo-Gallup Water Supply Project	Existing	The Bureau of Reclamation was authorized to construct two lateral pipelines for water delivery – the San Juan and Cutter laterals. The San Juan lateral will predominantly parallel US 491 and transport San Juan River water to the Navajo Nation and the Gallup area. The Cutter lateral will serve the eastern portion of the Navajo Nation and the Jicarilla Apache south and east of highway 550. Storage tanks and re-chlorination facilities are included in the project. This project underwent NEPA review and Reclamation issued a ROD in September 2009. Pre-construction activities have been initiated, and the project is slated for completion in 2024.	US 491 and Highway 550, Navajo Reservation, NM	This is an approved water supply project that has undergone NEPA review and has been initiated. Therefore, it is considered in the cumulative effects analysis.
Fruitland-Cambridge Irrigation Project	Existing	An annual diversion of 18,180 acre-feet, or the quantity of water necessary to supply a depletion of 7,970 acre-feet from the San Juan River, of surface water from the direct flow of the San Juan River at the diversion dam for the Fruitland-Cambridge Irrigation Project for irrigation of 3,335 acres of land generally located along the south side of the San Juan River.	Along the San Juan River in Fruitland, NM	This is an existing water project and meets the criteria for consideration in this cumulative effects analysis
Municipal Water Development	Existing	Navajo Tribal Utility Authority public water systems and other wells serve residential and livestock purposes on the Navajo Reservation. Planned developments include PL 87-121 projects on the Indian Health Service's sanitation deficiency list. Many of these projects would rely on groundwater.	Navajo Reservation	This is an existing water development project and meets the criteria for consideration in this cumulative effects analysis

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Navajo Reservoir Operations & San Juan River Basin Recovery Implementation Program	Existing	Navajo Dam and Reservoir is owned, operated, and maintained by the Bureau of Reclamation. Since its original authorization in 1956, Congress has approved the use of Navajo Reservoir to fulfill a portion of the Jicarilla Settlement Act. After completion of the Navajo Unit in December 1963, the criteria for releasing water from the dam focused primarily on flood control, NIIP supplies, and water storage. However, in the 1990s, the focus of the criteria and associated pattern of releasing water from the dam changed. The new focus included the needs of the endangered fish species, such as the Colorado pikeminnow and the razorback sucker, in the San Juan River. This project underwent NEPA review in 2006, for which the Bureau of Reclamation was the lead federal agency.	Approximately 34 miles (45 miles upstream) east of Farmington, NM	This is an existing water project that underwent NEPA review and is considered in this cumulative effects analysis

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Other Projects				
Burnham Airstrip	Past	Not in service. The Burnham Chapter community would like to see it reactivated as a regional airstrip or airport for emergency services or commercial development since it is centrally located between chapters.	Near the Burnham Chapter House	This is a past project and meets the criteria for consideration in the cumulative effects analysis.
San Juan Community-Based Land Use Plan	Planned	The San Juan Chapter Community-Based Land Use Plan (2002) identifies various Navajo trust lands in the San Juan Chapter area for grazing, recreation (i.e., nature trail from San Juan River to the San Juan Chapter house) and additional protections for an existing ceremonial burial area. These lands are located approximately 2 miles southwest of the FCPP.	Approximately 2 miles southwest of FCPP, Navajo Reservation, NM	Details as to the scale and timeline for the projects described in this plan remain unclear; therefore, it would be speculative to include this project for analysis in the cumulative effects analysis.
Sanostee Prison	Existing	A prison was developed in 2013 approximately 3 miles southwest of the FCPP.	Between milepost 7 and milepost 9 of Alternative Segment B	This project was completed in 2013, prior to the release of this Draft EIS and meets the criteria for consideration in the cumulative effects analysis.
Proposed Housing (Sanostee Chapter)	Planned	The Sanostee Land Use Plan (2004) identifies a possible 100-acre housing site adjacent to the eastern side of US 491 and directly south of the proposed utility corridor/water pipeline.	US 491, San Juan County, NM	Details as to the scale and timeline for this project remain unclear; therefore, it would be speculative to include this project for analysis in the cumulative effects analysis.
Three Springs Residential and Commercial Development	Planned & Existing	The Three Springs Project includes the development of housing, commercial space, and open-space to achieve a “traditional neighborhood”. This project is comprised composed of five neighborhoods in a 620+ acre site. The Army Corps of Engineers issued a permit for these developments with a mitigation package to offset approximately 21 acres of wetlands impacts.	Just east of Durango, CO	This is an existing residential and commercial development and meets the criteria for consideration in the cumulative effects analysis. Air quality and climate change are the only resource categories that include projects at this distance away.
Shiprock Airport	Existing	A Navajo Nation Primary Airport used primarily for medical emergencies and secondarily for tribal government.	Shiprock, NM	This existing project meets the criteria for consideration in the cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Proposed Housing & Commercial Development (Burnham Chapter)	Planned	The Burnham Chapter Land Use Plan (2005) identifies two areas for potential housing development. One site is located approximately a quarter mile south of the Chapter House, and the other site is approximately 2 miles west of the Chapter House on the north side of NR5. The Land Use Plan also identifies two locations at the junction of NR5 and NR5082 for commercial development.	1 mile from the southernmost portion of Navajo Mine	Details as to the scale and timeline for this project remain unclear. However, based on the general location and nature of the activity, it is considered in the cumulative effects analysis.

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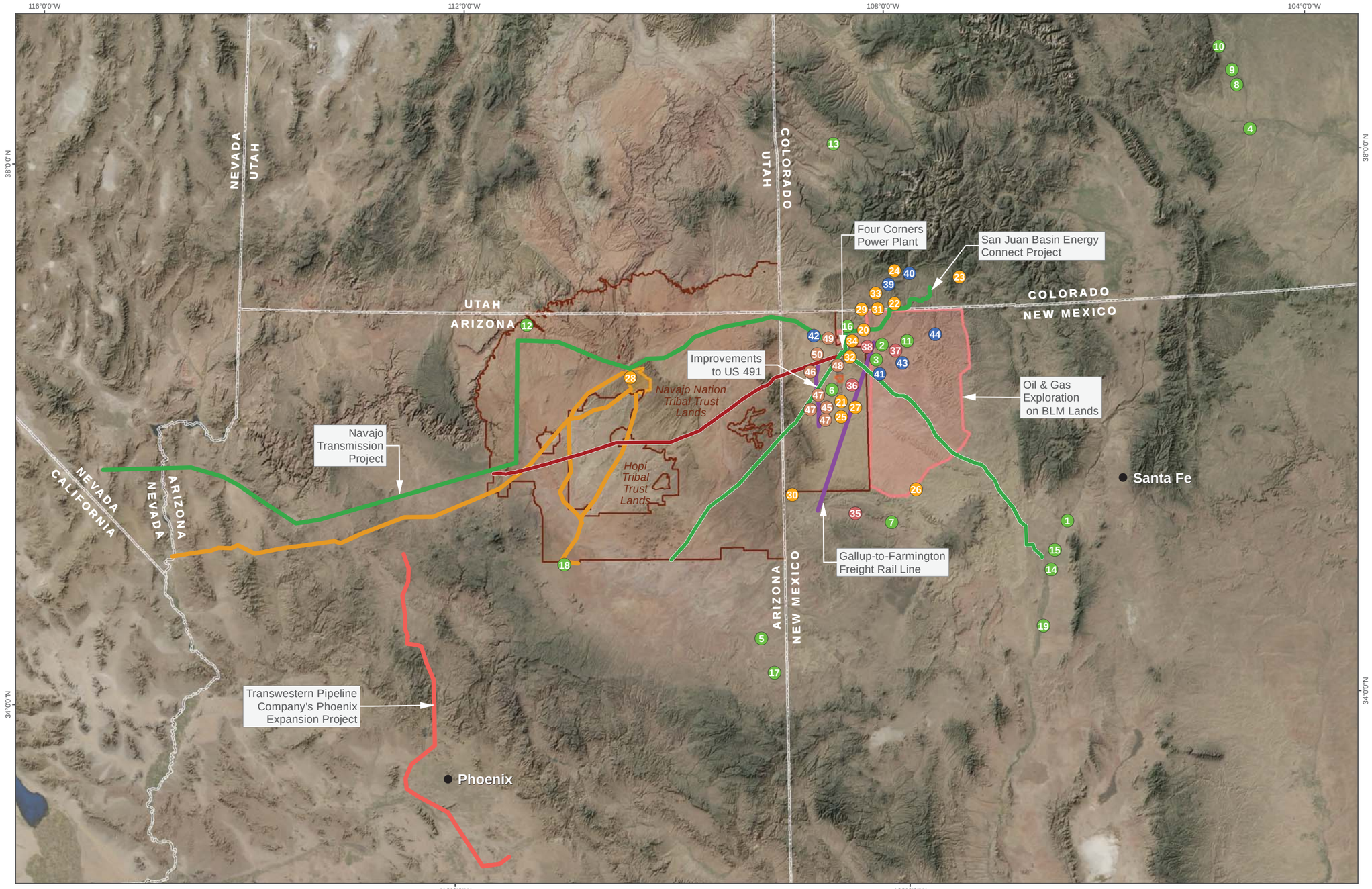
Figure 4.18-1

Cumulative Effects



PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Proposed Pinabete Mine Permit Boundary

TRANSMISSION LINES

- 345kV
- 500kV

CUMULATIVE EFFECT PROJECTS

- Energy Generation & Transmission
- Mining
- Oil & Gas
- Water
- Transportation
- Other

OTHER FEATURES

- Cities
- State Boundary
- Tribal Land Trusts

PROJECT LOCATIONS ARE APPROXIMATE

Energy Generation & Transmission

1. Algodones Solar Facility
2. Animas/Bloomfield Power Plant
3. Bluffview Power Plant
4. Comanche Generating Station
5. Coronado Generating Station
6. Desert Rock Energy Project
7. Escalante Generating Station
8. Fountain Valley Power Plant
9. Front Range Power Plant
10. Martin Drake Generating Station
11. Miligro Power Plant
12. Navajo Generating Station
13. Nucla Generating Station
14. Person Generating Project
15. Reeves Generating Project
16. San Juan Generating Station
17. Springerville Generating Station
18. Sunshine Wind Project
19. Valencia Power Plant

Mining

20. Black Diamond Mine
21. Burnham Mine
22. Carbon Junction Mine
23. Chimney Rock Mine
24. Coal Gulch Mine
25. De-Na-Zin Mine
26. El Segundo Mine
27. Gateway Mine
28. Kayenta Mine
29. La Plata Mine
30. McKinley Mine
31. National King Coal Mine
32. Navajo Mine
33. Peacock Mine
34. San Juan Mine

Oil & Gas

35. Ciniza Refinery
36. Proposed Oil & Gas Drilling
37. San Juan Refinery
38. San Juan River Gas Plant

Water

39. Animas-La Plata Project
40. Durango Pumping Plant
41. Gallegos Pumping Station
42. Hogback Diversion Dam Project
43. Kutz Pumping Station
44. Navajo Dam Power Plant

Other

45. Burnham Airstrip
46. Proposed Housing - Sanostee Chapter
47. Proposed Housing & Commercial Development - Burnham Chapter
48. Proposed Prison
49. San Juan Community-Based Land Use Plan
50. Shiprock Airport

N

0 25 50 100
Scale in Miles

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4.18.3 Effects Analysis

This section evaluates the cumulative effects of the Proposed Action and alternatives together with the past, present, and reasonably foreseeable effects of future projects, as described earlier in this section. The effects for different project alternatives, with the exception of No Project, are similar at this scale, and are not individually discussed.

4.18.3.1 Air Quality

The cumulative effects study area for air quality is the greater Four Corners region, composed of northeastern Arizona, southwestern Colorado, Navajo Nation, and northwestern New Mexico. There are 17 other energy generation facilities occurring with the study area (see Table 4.18-1 and Figure 4.18-1) that represent the other major emission sources in the Four Corners region and are thus the focus of this cumulative analysis. There are no generating facilities in southeastern Utah within an equivalent distance of 400 km (248 miles). Future operation of FCPP would emit SO_2, NO_X, PM_{10}, and $PM_{2.5}$ (also VOCs and CO) and, therefore, contribute incrementally to ambient air quality deterioration, visibility impairment, and dry and wet deposition in the region.

Table 4.18-2 accumulates these regional emissions as reported to, and published by, the EPA for the 12-year period 2000 to 2011. Also included in this table is the relative percentage of FCPP's contribution to this cumulative regional emissions inventory on a year-by-year basis. As shown, FCPP historically generated about 19 percent of the electric power and emitted 15 and 18 percent of the SO_2 and CO_2, respectively, as well as 29 percent of NO_X in the Four Corners region.

Table 4.18-3 shows the estimated future regional Part 75 emissions (SO_2 and NO_X) and composite rates for the 17 power plants. These projections for 2016 through 2026 are based on the following assumptions; however, actual future occurrences may differ from predictive estimates:

- 2014: FCPP Units 1, 2, and 3 have been shut down and regional emissions are about 3 percent greater than in 2011 (based on the 95th percentile of historic rates) and improving economic conditions;
- 2014 to 2016: APS operates FCPP Units 4 and 5 at historic 84 percent annual capacity factor, and regional criteria emissions grow due to load demand growth on underutilized capacity at an annual rate of 0.75 percent calculated from historic criteria emissions data during the 7-year baseline period (the period from 2005 to 2011 when FGD became active on Units 4 and 5);
- 2017: APS installs the first SCR on Unit 4 or 5, thus reducing annual NO_X emissions by about 6,600 tons. Annual emissions are mainly from the other operating unit, which would be retrofitted the following year. Regional load demand growth continues;
- 2018: APS installs the second SCR on Unit 4 or 5, thus reducing annual NO_X emissions by about another 6,600 tons, mainly from the other operating unit, which was retrofitted in the prior year. Regional load demand growth continues;
- 2019: APS operates Units 4 and 5 at the historic 84 percent annual capacity factor, thus reducing annual NO_X emissions by an additional 6,600 tons from pre-Project levels since both retrofitted units would be operating full-time with lowered NO_X emissions. Total average annual NO_X reduction is about 19,800 tons in future years compared to typical pre-Project levels. Regional load demand growth continues; and
- 2020 and beyond: Regional load demand growth is assumed to "top out" at about 5 percent above the historic 95th percentile, which represents a "mature" system, notwithstanding construction of new regional generating capacity in the future. Projected annual emissions for years 2027 through 2041 are assumed to be the same as year 2026 (i.e., flat extrapolation).

As shown in Table 4.18-2, FCPP emissions would comprise about 17 percent of regional SO_2 emissions and about 5 percent of NO_X emissions from electric power generation beginning in 2019, when SCR would be fully operational on Units 4 and 5. Projected percentages for years 2027 through 2041 are assumed to be the same as year 2026 (i.e. flat extrapolation).

The Four Corners area is in attainment for criteria pollutants. In addition, the FCPP will comply with EPA's BART determination to further improve the air quality of the region. Therefore the cumulative impacts of air quality are moderate and no further mitigation is required.

4.18.3.2 Climate Change

The CEQ considers climate change an inherently cumulative issue (CEQ 2010). In accordance with this directive, this analysis revisits much of the information provided in Section 4.2 but broadens the scope to discuss how the global effects of climate change could affect the Four Corners Region.

Over the past 30 years, changes in the U.S. climate have included an increase in average temperature, an increase in the proportion of heavy precipitation events, changes in snow cover, and an increase in sea level (CCSP 2008). Climate change can exacerbate stresses on ecosystems through high temperatures, reduced water availability, and altered frequency of extreme precipitation events and severe storms (CCSP 2008). However, in certain settings, climate change can also ameliorate stresses on ecosystems through warmer springs, longer growing seasons and related increased productivity (CCSP 2008).

Anticipated impacts from climate change in North America applicable to the regions crossed by the proposed Project include:

- Stream temperatures are likely to increase and are likely to have effects on aquatic ecosystems and water quality; and,
- Proliferation of exotic grasses and increased temperatures are likely to cause in increase in fire frequency in arid lands.

Decreased streamflow, increased water removal, and competition from non-native species are likely to adversely affect river ecosystems in arid lands (CCSP 2008).There are no established federal or state thresholds for determining the significance of GHG emissions; however, this assessment of the direct and indirect contributions of the proposed Project to global GHG emissions was conducted in accordance with CEQ draft guidance for GHG (CEQ 2010). This guidance established the draft criteria for purposes of NEPA analysis of 25,000 metric tpy for CO2e. The FCPP is estimated to emit approximately 10 million tpy for the life of the project. There is a general scientific consensus that the cumulative effects of GHG have influenced the ambient environment on a global scale, which is considered a major cumulative effect.

The cumulative effects study area for climate change includes northeastern Arizona, southwestern Colorado, Navajo Nation, and northwestern New Mexico. As discussed in Section 4.2, FCPP and Navajo Mine both emit GHGs and, therefore, contribute incrementally to climate change; however, these emissions comprise approximately 0.6 percent of the US GHG inventory and the national electric power sector. Mobile source emissions from the Navajo Mine although quantifiable, are relatively small compared to future power plant emissions; therefore, this discussion focuses on the contribution of FCPP to regional climate change impacts. While all projects in Table 4.18-1 would contribute some GHG emissions, the major producers of GHG emissions within this study area are the 17 power plants, as such, the amount of power produced directly relates to the amount of GHG emitted. Table 4.18-4 shows the relative contribution of future FCPP emissions to regional GHG emissions.

As part of APS's compliance with EPA's BART rule, the amount of energy generated, and therefore the amount of GHG emitted, from FCPP will be substantially reduced (26 percent) as a result of the March 2014 shut-down of Units 1, 2, and 3. Although not a part of the Proposed Action or alternatives, FCPP compliance with the BART rule will lead to a cumulative reduction in GHG emissions.

Table 4.18-2 Historic Cumulative Contribution of FCPP (Pre-2014)

Year	Historic Cumulative Generation and Emissions (17 Plants including FCPP)					FCPP Contribution		
	Generation	Sulfur Dioxide		Nitrogen Oxides		Generation Percent	SO_2 percent	NO_X percent
	MW-hrs/yr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr			
2000	79,878,600	153,800	1.75	171,700	1.95	20%	25%	27%
2001	79,286,300	152,500	1.74	166,700	1.91	21%	26%	28%
2002	78,170,000	140,000	1.62	163,200	1.89	19%	23%	25%
2003	79,909,400	135,800	1.54	160,600	1.82	21%	26%	28%
2004	82,383,400	115,400	1.27	156,100	1.72	20%	18%	26%
2005	83,957,500	100,900	1.09	156,100	1.69	20%	13%	27%
2006	86,062,900	98,300	1.04	158,200	1.67	20%	15%	28%
2007	86,819,100	100,500	1.05	154,700	1.62	18%	10%	27%
2008	84,752,100	84,700	0.91	145,400	1.56	19%	12%	28%
2009	84,175,600	62,300	0.67	133,000	1.43	20%	20%	32%
2010	86,325,900	56,100	0.59	119,200	1.25	17%	20%	33%
2011	87,944,900	53,700	0.55	116,200	1.20	17%	22%	33%
Historic Average	**85,719,700**	**79,500**	**0.84**	**140,400**	**1.49**	**19%**	**15%**	**27%**

Source: EPA 2012h

Notes:

For 17 regional electric power producers in geographic New Mexico, Arizona, and Colorado

Aggregated values rounded to nearest 100 short tons or metric tons

1 short ton = 2,000 lbs

1 metric tonne = 1,000 kg or 2,204.6 lbs

Baseline period is 2005-11 (same as FCPP)

Table 4.18-3 Future Contribution of FCPP to Cumulative Emissions (Post-2014)

Year	Historic Future Cumulative Generation and Emissions (17 Plants Including FCPP)					FCPP Contribution		
	Generation	Sulfur Dioxide		Nitrogen Oxides		Generation Percent	SO_2 percent	NO_X percent
	MW-hrs/yr	tons/yr	kg/MW-hr	tons/yr	kg/MW-hr			
2014	90,385,600	55,200	0.55	119,400	1.20	14%	18%	23%
2015	91,101,000	55,600	0.55	120,300	1.20	14%	18%	23%
2016	91,822,100	56,000	0.55	121,300	1.20	14%	18%	22%
2017	92,548,900	56,400	0.55	115,700	1.13	13%	17%	17%
2018	93,281,500	56,800	0.55	110,000	1.07	13%	17%	11%
2019	94,019,900	57,200	0.55	104,300	1.01	13%	17%	5%
2020	94,764,100	57,700	0.55	105,100	1.01	13%	17%	5%
2021	94,764,100	57,700	0.55	105,100	1.01	13%	17%	5%
2022	94,764,100	57,700	0.55	105,100	1.01	13%	17%	5%
2023	94,764,100	57,700	0.55	105,100	1.01	13%	17%	5%
2024	94,764,100	57,700	0.55	105,100	1.01	13%	17%	5%
2025	94,764,100	57,700	0.55	105,100	1.01	13%	17%	5%
2026	**94,764,100**	**57,700**	**0.55**	**105,100**	**1.01**	**13%**	**17%**	**5%**

Source: EPA 2012h, 2012i (final rule)

Notes:

Projected emissions for years 2027 through 2041 same as year 2026 (flat extrapolation assumed)

For 17 regional electric power producers in geographic New Mexico, Arizona, and Colorado

Aggregated values rounded to nearest 100 short tons or metric tonnes

1 short ton = 2,000 lbs, 1 metric tonne = 1,000 kg or 2,204.6 lbs

Table 4.18-4 Relative Regional Contribution of FCPP GHG Emissions (Future 2014 to 2041)

Year	Percent of Regional Electrical Power Generation	Percent of Regional CO_2e Emissions
2014	13.7%	12.7%
2015	13.6%	12.6%
2016	13.5%	12.5%
2017	13.4%	12.4%
2018	13.3%	12.3%
2019	13.2%	12.2%
2020	13.1%	12.2%
2021	13.1%	12.2%
2022	13.1%	12.2%
2023	13.1%	12.2%
2024	13.1%	12.2%
2025	13.1%	12.2%
2026	13.1%	12.2%
2027	13.1%	12.2%
2028	13.1%	12.2%
2029	13.1%	12.2%
2030	13.1%	12.2%
2031	13.1%	12.2%
2032	13.1%	12.2%
2033	13.1%	12.2%
2034	13.1%	12.2%
2035	13.1%	12.2%
2036	13.1%	12.2%
2037	13.1%	12.2%
2038	13.1%	12.2%
2039	13.1%	12.2%
2040	13.1%	12.2%
2041	13.1%	12.2%

Sources: EPA 2012b, d, f

Notes:

For 17 regional electric power producers in AZ, CO, Navajo Nation, and NM

2014-41 estimated values

CO_2e = carbon dioxide equivalents

4.18.3.3 Earth Resources

Geology and Soils

Although effects on geology and soils would stem from all existing and proposed earth-disturbing activities and other mining activities in the Four Corners region through the year 2041, these impacts are site-specific and would not occur on a regional level. Potential impacts such as erosion, landslides, or topsoil loss caused by activities at the Navajo Mine or FCPP are concentrated in the lease area for both of these facilities and would not contribute cumulatively to the impacts caused by construction or mining activities at other locations in the Four Corners region. Erosion caused by operations at the Navajo Mine could increase sedimentation and turbidity levels in adjacent arroyos, which discharge to the San Juan River. Potential erosion at other mines and construction sites in the vicinity also could affect water quality of the San Juan watershed, as discussed in Section 4.3 and Section 4.5. However, all mines and construction projects would be required to implement erosion control measures as part of their SMCRA permit and General Construction NPDES permit. Therefore, the cumulative effect of minor erosion at all sites would be minor because the conditions of these permits would prevent long-term adverse impacts. There would be negligible long-term cumulative impact on topography because the SMCRA permit would require all mines in the area to reclaim and restore affected areas to the approximate original contours following mining.

Paleontological Resources

The cumulative effects study area for paleontological resources is the Navajo Nation and Hopi tribal trust lands. As discussed in Section 4.3, past surveys have recorded the presence of paleontological resources in this area, including dozens of known sites within the Navajo Mine area. The Proposed Action would directly impact known paleontological resources due to ground-disturbing activities (i.e. excavation, construction). The other reasonably foreseeable future projects that propose similar ground-disturbing activities on the Navajo Reservation include 1) San Juan Basin Energy Connect Project, 2) Western Oil and Gas Drilling Project, and 3) Improvements to US 491. An adverse cumulative effect would occur if these other projects damage or destroy additional paleontological resources on the Navajo or Hopi tribal trust lands. However, the effects of the Project Action and alternatives would be minimized by implementation of the prescribed mitigation measures, and the three future projects would require environmental review and the likely development of similar mitigation measures intended to minimize the potential for adverse impacts on paleontological resources. Therefore, while there is the potential for cumulative impacts from the disturbance or destruction of paleontological resources, mitigation measures would likely minimize effects on these resources.

4.18.3.4 Archaeological/Cultural Resources

The cumulative effects study area for archaeology and cultural resources is the APE as defined in Section 4.4, which is within the traditional use areas for the Navajo Nation and Hopi Tribe. The reasonably foreseeable future actions within this study area that include ground-distributing activities include the Western Oil & Gas project, oil and gas development on BLM lands, and improvements to US 491. The study area contains numerous historic properties and cultural resources. As demonstrated on Figure 4.4-1 and in Section 4.4, much of the proposed Pinabete Permit Area is designated a TCP.

Due to the ground-disturbing activities proposed by the alternatives, historic properties, including properties of religious and/or cultural significance (i.e., TCPs) that are eligible for the NRHP, may be damaged or destroyed. Disturbance to these resources from Project activities would be limited primarily through avoidance and through mitigation where avoidance is not achievable. The avoidance techniques and mitigation measures prescribed in the Programmatic Agreements significantly lessen the potential to permanently lose or damage an identified resource. In the event that a resource would be impacted, a mitigation plan would be implemented, including but not limited to data recovery and other forms of formal documentation and curation. The mitigation measures included in the Programmatic Agreements serve to

preserve the legacy and quality of the subject artifact or physical resource. However, the cultural resources lost during project activities would contribute to the regional loss of these resources. Mitigation measures can minimize the significance of resource degradation and destruction, but the loss or damage to cultural resources from Project activities allows for a potential cumulative effect if other projects in the study area also disturb cultural resources. While it is likely that the future projects would avoid or mitigate known cultural resources to the degree practicable as required by Section 106 of the NHPA, a cumulative effect would occur if another project in the study area:

- Damages or destroys historic properties that cannot be avoided;
- Introduces visual or audible elements that would diminish the integrity of a historic property's significant historic features;
- Changes the character of the historic property's use; or,
- Changes the physical features within a historic property's setting that contribute to its significance.

If traditional use areas are affected (i.e. grazing lands lost/relocation) by another project, there is potential for a cumulative cultural effect to the Navajo and Hopi people. Historical use is a key component of preserving traditional cultural properties. If another project proposed within the study area would adversely affect other traditional use areas, there is the potential that a cumulative effect to the historical legacy use of the area. Furthermore, the loss of traditional use areas and/or practices can have lasting psychological effects on indigenous people through the permanent alteration of a way-of-life. Even if tribal members live a great distance from the area, there is a spiritual identification connection to the tribal practices that have been performed in memoriam.

4.18.3.5 Water Resources/Hydrology

The scope for the water resources/hydrology cumulative impact analysis includes both groundwater resources and surface water resources. The cumulative effects study area for groundwater is the area of the San Juan Basin within 1,000 feet of the Navajo Mine and the FCPP ash disposal areas. This limit on the study area is based on the permeability of the formations beneath the project sites and the velocity of groundwater flow, as described in detail in Section 4.5. The cumulative effects study area for surface water includes the San Juan River watershed, extending approximately 300 km to the north-north west of the FCPP and Navajo Mine, which accounts for the potential area of emissions deposition from the FCPP. Past projects are accounted for in this analysis as part of the affected environment. All existing and reasonably foreseeable projects listed in Table 4.18-1 are considered in the cumulative effects analysis for water resources.

Groundwater

Potential cumulative impacts to groundwater quantity would occur if multiple projects required the extraction of groundwater resources, thereby over-drawing aquifer resources or if potential surface and sub-surface releases from the Proposed Action or alternatives in combination with other projects considered caused an impairment of groundwater quality. As described in Section 4.5, the FCPP does not require the use of groundwater in order to continue operations. FCPP has installed extraction wells in areas of known seepage in the ash disposal area and monitoring data does show a decline in groundwater level. Continued operation of these extraction wells would therefore contribute to cumulative impacts to groundwater quantity; however any contributions are considered minor based on the anticipated extraction rates.

Past, current, and proposed mining at the Navajo Mine has resulted, is resulting, and is expected to result in a local drawdown of groundwater levels in the Fruitland Formation and in the underlying PCS. However, described in Section 4.5, the effects of drawdown would be negligible because there are no potable water wells completed in the Fruitland Formation and the PCS that could be impacted and these

units are not capable of providing a sustainable water supply (BNCC 2011a). The potential exists for other ground-disturbing projects proposed within the Navajo Nation, as well as continued operation of NAPI lands in the areas surrounding the Navajo Mine to require dewatering or groundwater extraction; however, the contribution of activities at the Navajo Mine to contribute to this cumulative effect would be negligible because Navajo Mine conducts contemporaneous reclamation concurrent with ongoing mining.

Further, although produced water extraction from existing coal bed methane operations to the east of the Navajo Mine and the reasonably foreseeable coal bed methane development project in the eastern Burnham Chapter would likely occur during the same timeframe as the proposed Project, these activities are not expected to overlap or have a cumulative effect with respect to drawdown within the NTEC lease due to the low permeability and limited produced water extraction from these deeper coal beds.

With regard to groundwater quality, as described in Section 4.5, minimal effects to groundwater quality are anticipated as a result of operation of the Navajo Mine. TDS concentrations in the alluvial groundwater flow in Cottonwood Arroyo may increase due to the contribution to the alluvial groundwater from backfill water and from irrigation return flows from full expansion of NAPI irrigation within the headwaters of Cottonwood Arroyo. NAPI irrigation return flows can leach salts from badlands upgradient of mining and from overburden materials across the Navajo Mine. Increasing TDS and sulfate concentrations have been observed in the alluvial groundwater in Chinde Arroyo due to the NAPI irrigation water return flows as well as discharges to Chaco River from Morgan Lake, operated by the FCPP. The discharge from Morgan Lake appears to have resulted in perennial flow in the Chaco River downstream of the discharge point and has apparent increases in TDS and sulfate in the alluvium downgradient of the discharge point. As noted by Myers and Villanueva (1986), the increased concentrations may be related to rising groundwater encountering sediments previously enriched with soluble salts. Both Myers and Villanueva (1986) and Thorn (1993) show a general increase in TDS and sulfate concentrations in the downstream direction in the alluvium of the Chaco River; although Thorn (1993) shows the water quality as quite variable.

Similar increases in TDS and sulfate may be expected to occur in the Cottonwood alluvium, although the TDS and sulfate concentrations will be lower than in the Chinde alluvium due to the coarser grained nature of the alluvium in Cottonwood Arroyo. Any increase in TDS concentrations in the alluvium of the Chaco River would be limited by the low groundwater flow in the alluvium from Cottonwood and Pinabete Arroyos, and Brimhall Wash (BNCC 2011a). Furthermore, the timing of the effects on the flow and water quality within the alluvium of Chaco River to any changes in the alluvial groundwater in each of the tributaries will be different, which functions to minimize cumulative effects.

Other than discharges from Morgan Lake listed above, continued operation of FCPP would have a negligible cumulative effect on groundwater quality. The potential exists for construction and operation of the ash disposal area at FCPP to adversely affect groundwater quality through the leaching of materials. However, an analysis of groundwater quality data found no statistically significant correlation between monitoring locations (proximity to ash ponds) and water quality results. Further, in areas of known historic seepage, groundwater remediation activities are underway. Therefore, while adverse cumulative effects to groundwater quality could result from the combined impacts of the projects considered in this analysis, the contribution of the Proposed Action would be minimal.

Surface Water

Potential cumulative effects to surface water resources would result if the Proposed Action would contribute to a regional impairment of surface water quality. Contributions to cumulative impacts on surface waters are expected from mining and reclamation of the Navajo Mine, the NAPI, FCPP operations, and various regional San Juan River water projects, as well as other reasonably foreseeable future projects that propose similar ground-disturbing activities on the tribal trust lands of the Navajo Nation, including 1) San Juan Basin Energy Connect Project, 2) Western Oil and Gas Drilling Project, and 3) Improvements to US 491. Similar to the Proposed Action and alternatives, each of these projects would

need to comply with the Clean Water Act and implementation of a Stormwater Pollution Prevention Plan, Erosion Control Management Plan, which include BMPs to reduce potential impacts to water quality during ground-disturbing activities. Mining activities do not contribute substantially to surface water quality impacts due to extensive regulation under SMCRA and the Clean Water Act's NPDES program. Under the NPDES program, the Navajo Mine has installed 29 downgradient retention ponds, in Areas III and IV North, to avoid and reduce impacts on surface water quality as part of the water management plan to capture or divert surface flows around active mining areas. There are not likely to be any long-term surface water impacts following bond release for reclamation of areas disturbed by mining within the Navajo Mine Permit Area or the Pinabete Permit area. Any cumulative impacts would be related to short-term sedimentation or flow changes, associated with land disturbance. Because the Proposed Action would have a negligible impact to downstream surface water quality, the cumulative impact, when added to other projects anticipated to involve ground disturbance (listed above), would also be minor.

Other than impacts associated with sedimentation and flow, surface water quality impacts are associated with deposition of metals and particulate matter emitted from the FCPP. Although modeling and ecological risk assessments for the proposed Project found that the depositional area of emissions from the FCPP is less than 50 km, 16 other power plants are located in the study area. The cumulative deposition of metals caused by emissions from the FCPP in combination with the 16 other power plants in the region could result in potentially major impacts to water quality. As discussed in Section 4.1, mercury and selenium deposition as a result of the FCPP is expected to decrease over the Project period and therefore, the FCPP contribution to potential cumulative impacts to surface water quality would also decrease proportionally over time. Therefore, while this is considered a potentially major, long-term cumulative impact, no additional mitigation measures are proposed to further reduce the FCPP contribution beyond what will occur as a result of compliance with the EPA BART Rule.

4.18.3.6 Vegetation

The cumulative effects study area for vegetation encompasses the Navajo Nation and Hopi Tribe tribal trust lands. Resource extraction and development activities that would remove native vegetation within the Navajo Nation could result in cumulatively major impacts to native vegetation types and associated habitat functions, seed variability, and biological activity and nutrient content in the soil. Potential projects considered in the cumulative effects analysis that would occur on the Navajo Nation and involve ground disturbance and vegetation removal include proposed oil and gas drilling by Western Oil and Gas, the San Juan Basin Energy Connect Project, all other mining projects within the Navajo Nation, improvements to US 491, the Animas-La Plata project, and the Navajo-Gallup Water Supply Project.

As shown in Table 4.18-5 below, implementation of all these projects would result in the removal of at least 6,622 acres of vegetation and habitat area. The Proposed Action would result in substantial long-term impacts to vegetation on the mine lease area that would be reclaimed following mining and, therefore, not contribute to any permanent cumulative effects. The Proposed Action would also result in a minor permanent impacts at the FCPP site with removal of vegetation for the fly ash pond expansion project in the area of the proposed borrow pits. In comparison to all other projects listed, the Proposed Action would represent the majority of the total expected cumulative disturbance on tribal trust lands.

Similar to the Navajo Mine, all other mining activities on the Navajo Nation would require a SMCRA permit and would have to implement reclamation activities at the end of the mining operation. Similarly, impacts of the Animas-La Plata project would be offset through compensatory mitigation. It is unknown if other development projects proposed on the Navajo Nation would be required to mitigate for impacts to vegetation and habitat area. However, the land area to be disturbed by these other projects is minimal compared to the size of the Navajo Nation, and the total amount of open space. Therefore, cumulative impacts to vegetation are considered minor.

Table 4.18-5 Cumulative Areas of Vegetation Removal on Navajo Nation through the Project Period

Project	Affected Vegetation
FCPP	1,052 acres
Navajo Mine	4,104 acres
Oil and Gas Drilling	Approximately 35 acres permanent disturbance for well pads, unknown disturbance for additional infrastructure
San Juan Basin Energy Connect Project	Intermittent disturbance along 65 miles for transmission towers and vegetation management throughout the entire ROW
Improvements to US 491	275-320 acres permanent removal (source FHA 2006)
Animas-La Plata Project	202 acres permanent removal, mitigated by purchase of 2,900 acres of equivalent habitat area (source USBR 2002)
Navajo-Gallup Water Supply Project	62.1 acres permanently removed, 31,686 acres of temporary disturbance (source USBR 2009)

4.18.3.7 Wildlife and Habitats

The cumulative effects study area for wildlife includes each species' natural range in the vicinity of the FCPP and Navajo Mine. As described in Section 4.7, the Proposed Action would result in short-term disturbance (e.g., increased noise, vegetation removal, human presence) to wildlife habitat during mining operations and construction and operational activities associated with the ash disposal areas at FCPP. Wildlife is expected to return to the mined areas once reclamation is complete. Wildlife habitat removal at the FCPP would occur until reclamation activities return the landscape to close to pre-project conditions. The total area of disturbance at FCPP is approximately 1,052 acres; however, all areas of disturbance would be located within the FCPP Lease Area and it is expected that wildlife would migrate to similar habitats nearby. Operational noise and vehicular collisions with wildlife would be commensurate with current operations at FCPP. Continued operation of the subject transmission lines would increase the long-term potential for large bird or raptor collisions and electrocution from perching on or near tower conductors. A cumulative effect to wildlife and habitat would occur in the event of substantial loss of habitat function or disruption caused by another project in addition to the effects from proposed FCPP and Navajo Mine operations.

The past, present, and reasonably foreseeable projects identified in Table 4.18-1 have affected and are expected to continue to affect wildlife through habitat loss and fragmentation and impacts from noise and human disturbance similar in type to those described in Section 4.7. Impacts would vary depending upon species' life history strategies habitat requirements and the availability of suitable habitats. Given the abundance of the available adjacent habitats, the Proposed Action is not expected to contribute appreciably to wildlife impacts resulting from past, present, and reasonably foreseeable activities because species are likely to inhabit the suitable habitat around FCPP and Navajo Mine.

4.18.3.8 Special Status Species

As discussed in Section 4.1, emissions from the FCPP result in the deposition of metals and other compounds in the surrounding area. Air dispersion models were completed to estimate the area over which these contaminants would be deposited and to evaluate the relative contribution of the plant to the concentrations of these contaminants relative to baseline conditions (EPRI 2013). The results of the deposition models indicate the emissions are dispersed less than 50 km from the FCPP. The contribution from other regional and global sources of mercury, selenium, and arsenic was also evaluated. These contaminants have the potential to adversely affect special status species both within the deposition area,

which extends beyond the FCPP lease area, and on the aquatic environment in the San Juan River downstream of Farmington. Therefore, the cumulative effects study area for threatened and endangered wildlife species is the entire deposition area. Projects considered in the cumulative effects analysis include all 17 power plants in the Four Corners region.

Two ecological risk assessments (ERAs) were conducted to evaluate potential ecological impacts associated with future emissions from the combustion of coal at the FCPP. One ERA was conducted for both terrestrial and aquatic environments within the area identified by air dispersion modeling as having a 1% future increase in soil metals concentrations above current condition (baseline) metals concentrations (AECOM 2013c). This area was defined as the deposition area, and the ERA is hereafter referred to at the Deposition Area ERA. The other ERA was conducted for the aquatic environment of the San Juan River within the deposition area and downstream of the deposition area into the San Juan River arm of Lake Powell (AECOM 2013h). This ERA is hereafter referred to as the San Juan River ERA. For both ERAs, the aquatic environment may include receptors that live in the aquatic environment as well as those that forage within the aquatic environment.

The Deposition Area ERA evaluated ecological risks within the FCPP stack emissions deposition area to representative terrestrial and aquatic species as well as to special status species, including federally listed species, under two scenarios (AECOM 2013c). One scenario evaluated potential ecological risks associated only with the proposed future 25-year project. The other scenario evaluated current conditions, which may include contributions from natural sources (e.g., metals) and non-specific historical and current local, regional, and global anthropogenic sources, including contributions from FCPP stack emissions during the past 50 years of operation. The San Juan River ERA evaluated ecological risks to representative and special status ecological receptors associated with aquatic and riparian habitats along the San Juan River, within and downstream of the deposition area and into the San Juan River arm of Lake Powell (AECOM 2013h). The San Juan River ERA also evaluated ecological risks associated only with the proposed future 25-year project and separately for current conditions, but also for several other future scenarios related to specific regional and global contributions. Modeling of air emissions, dispersion, and deposition as well as fate and transport processes for the San Juan River ERA was conducted by EPRI (2013).

Section 4.8 estimates ecological risks associated with the future operations of FCPP to target receptors, including representative terrestrial and aquatic species, as well as special status species. Although several classes of chemicals were evaluated as COPECs (metals, PAHs, dioxins/furans) in the ERAs, metals were the only class of chemicals that were shown to potentially pose ecological risks. In total, for the “Current Conditions + FCPP Contributions” scenario, the two ERAs reported 67 instances in which total hazard quotients[1] (HQs) exceeded a value of 1 indicating a potential risk to ecological receptors. For terrestrial receptors within the deposition area, total HQs greater than 1 ranged from 1.5 to 37 with boron, chromium, and vanadium presenting the highest total HQs, most frequently for terrestrial plants. These elevated total HQs were observed for representative terrestrial invertebrates, plants, birds, and wildlife as well as the federally listed Mancos milk-vetch and Mesa Verde cactus (AECOM 2013c).

Within the deposition area aquatic and riparian habitats of Morgan Lake, total HQs greater than 1 ranged from 2.3 to 190, largely due to potential barium, lead, nickel, and selenium exposures to generic aquatic receptors and fish. The highest total HQ of 190 was due to selenium exposure to generic adult life stage Morgan Lake fish. Riparian birds and wildlife also exhibited total HQs greater than one, most notably the willow flycatcher which serves as the species representative of the federally listed southwestern willow

[1] A hazard quotient (HQ) greater than 1 indicates that adverse effects to ecological receptors are likely to occur whereas an HQ less than 1 indicates that adverse effects are unlikely to occur. The magnitude of the HQ value does not indicate the severity of effects but may provide some indication on the likelihood of adverse effects occurring. The “total HQ” referred to herein is the HQ associated with both current conditions and predicted future impacts associated with the proposed 25-year project. In the ERAs, the total HQ is called the “Total Potential Risk HQ”.

flycatcher for which total HQs of 16 and 9.8 were reported for lead and selenium, respectively (AECOM 2013c).

The aquatic and riparian habitat of the San Juan River within the deposition area exhibited total HQs greater than 1 ranging from 1.5 to 132 largely due to potential aluminum, barium, copper, lead, methylmercury, nickel, selenium, vanadium, and zinc exposures to generic aquatic receptors and fish. The highest total HQs of 103 and 190 were due to aluminum and selenium exposures to generic San Juan River aquatic receptors. Similar to Morgan Lake, the willow flycatcher, which represents the federally listed southwestern willow flycatcher, exhibited elevated total HQs ranging from 1.5 to 6.7 with the highest total HQs of 5.9 and 6.7 due to selenium and methylmercury, respectively (AECOM 2013c).

In the San Juan River downstream of the deposition area and into the San Juan arm of Lake Powell, total HQs in fish exceeding 1 ranged from 1.5 to 71 depending on the particular reach of the San Juan River; no spatial pattern was observed between these reaches. Of the three COPECs evaluated in the San Juan River ERA (arsenic, mercury, selenium), only mercury and selenium exhibited HQs greater than 1. Specifically, elevated total HQs related to mercury exposure ranged from 3.0 to 3.8 for generic early life stage fish and the federally listed razorback sucker and from 1.8 to 12 for the federally listed Colorado pikeminnow. Elevated total HQs related to selenium exposure ranged from 1.5 to 71 for generic early life stage fish and generic adult life stage fish (AECOM 2013h). While selenium exposure was not directly assessed for the federally listed razorback sucker, it is reasonable to assume that these latter results may be applicable to the razorback sucker given the specific concern raised for selenium exposure to the razorback sucker.

For all metals and all ecological receptors evaluated in the two ERAs, HQs exceeding 1 were entirely due to current conditions; assessment of FCPP emissions associated with the proposed future 25-year project did not result in any HQs greater than 1. These existing conditions are the result of geological conditions, anthropogenic sources other than the project facilities, as well as the historic operation of those facilities. These findings do not mean that the FCPP will not contribute to ecological risk during the life of the proposed project, but they do indicate that such contributions would be negligible as compared to current conditions.

Current Conditions

By regulation (42 U.S.C. Part 1508.7), NEPA requires the evaluation of cumulative impacts defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (CEQ 1997).

The definition of cumulative impacts (e.g., cumulative effects) can be somewhat tentative, especially where a portion of the impact may be of natural origin; 42 U.S.C. Part 1508.7 specifically refers to cumulative impacts associated with “projects” which seems to imply anthropogenic impacts. However, from a purely ecological perspective, an organism may be at risk to adverse effects if a toxicological threshold is exceeded for a substance regardless of whether the substance is of natural or anthropogenic origin. For example, the USEPA’s soil ecological screening levels (EcoSSLs) for barium protective of plants and invertebrates are 500 and 330 mg/kg, respectively (AECOM 2013a), yet naturally occurring soil barium concentrations are reported to range up to 1,300 mg/kg in New Mexico (USGS 1981) and up to 2,000 mg/kg across the US. (USGS 1984). This suggests that plants and invertebrates may be at risk of adverse effects in areas of higher naturally occurring barium concentrations.

In both the Deposition Area ERA and the San Juan River ERA, current conditions were characterized as measured COPEC concentrations in soil, sediment, surface water, and fish tissue. It is reasonable to assume that these media concentrations integrate past and present contributions over space and time that are of natural original with those of anthropogenic origin including local, regional, and global sources as well as historical FCPP impacts over the past 50 years. While it is not possible to quantitatively discern

an accurate estimate of the contribution from each of these sources, it is possible to put the soil metals concentrations in perspective with soil metals concentration reported by the USGS for the continental US. Table 4.18-6 compares maximum soil metals concentrations recently measured within the future FCPP deposition area (e.g., current conditions) with the range of soil metal concentrations reported for the U.S.

Table 4.18-6 Comparison of Soils Metals Concentrations in the U.S. to Soil Metals Concentration in the Future FCPP Deposition Area

Metal	Range for U.S. Soils from 1961 to 1974	Range for New Mexico Soils in 1971	Maximum for FCPP Deposition Area
Barium	10 – 5,000	250 – 1,300	836
Cadmium	<0.005 - 2	-	1.27
Chromium	1 – 2,000	7.9 – 41	17
Copper	<1 - 700	2.3 – 33	35
Lead	<10 - 700	6.5 – 22	76.1
Manganese	<2 – 7,000	58 – 710	489
Mercury	<0.01 – 4.6	0.01 – 0.07	0.055
Molybdenum	<3 - 15	0.4 – 3.5	3
Nickel	<5 - 700	3.1 – 24	23
Selenium	<0.1 – 4.3	1.4 – 10	1.77
Vanadium	<7 - 500	18 – 110	42
Zinc	<20 – 2,000	13 – 100	101

Source of data for U.S.: Shacklette and Boerngen (USGS 1984).
Source of data for New Mexico: Severson and Gough (USGS 1981).
All concentrations are in units of mg/kg.

From the comparison of these data, it can be seen that recently measured soil metals concentrations within the future FCPP deposition area are generally within the range reported by the USGS for New Mexico and for the US. While regional variation in soil metals concentrations would be expected across the US, these data show that the metals concentrations currently within the deposition area (e.g., current conditions) would not be unexpected based on geological origin alone. However, it is also possible that metals concentrations measured in soils across the US by the USGS in 1984 reflect a mixture comprising both a natural geologic source as well as long-term historical anthropogenic contributions. Regardless of source, the current conditions data relates directly to past and present cumulative impacts since they integrate across time and space all local, regional, and global sources including naturally occurring metals and those released from the first 50 years of FCPP emissions that may have been deposited in the San Juan basin.

Future Conditions

In addition to evaluating impacts associated with current conditions and future FCPP emissions, the San Juan River ERA also evaluated several future scenarios related to arsenic, mercury, and selenium contributions from other sources including mercury emissions from China ranging from no change, low increase, and high increase in China mercury emissions between 2016 and 2050 (AECOM 2013h). These scenarios represent potential future changes in global mercury emissions over time, that are unrelated to the operation of the FCPP, but which could affect species in the region. As previously discussed, the combination of current conditions and FCPP-related impacts can be viewed as future cumulative impacts if contributions from other sources remain constant. If mercury emissions are expected to increase in the future, then the comparison of San Juan River fish tissue mercury and selenium HQs for “Current

Conditions + FCPP Only Contributions" and HQs for "Scenario 8 Contributions" for the Area 1 reach of the San Juan River (e.g., the deposition area) illustrates potential future impacts when the worst-case future China emissions are included in the analysis (see Table 4.18-7). These data show that including the future Scenario 8 high China mercury emissions results in a marked increase in HQs, particularly for the federally listed Colorado pikeminnow. The potential for increased China emissions in the future is discussed in more detail later in this section.

Table 4.18-7 Comparison of San Juan River Area 1 Mercury and Selenium Fish HQs for Current Conditions + Future FCPP Emissions and Scenario 8 High China Emissions

Exposure	CC + FCPP	Scenario 8
Hg Forage Fish	3.0	3.6
Hg CPM <400 mm	1.8	6.1
Hg CPM >400 mm	1.8	16
Hg RS <400 mm	3.0	4.2
Hg RS >400 mm	3.0	8.7
Se (generic fish)	1.5	0.55

CC = current conditions
CPM = Colorado pikeminnow
Hg = mercury
HQ = hazard quotient
RS = razorback sucker
Se = selenium

In developing their global deposition model, EPRI relied on predictions of future China mercury emissions incorporated in the CMAQ model. These predictions included both no change, low and high future China emissions of mercury. However, there have been a number of studies and international agreements relating to future mercury emissions that make future trends in global mercury emissions unclear. While there is concern that China mercury emissions will continue to increase over the next 25 years, a recent United Nations report showed that global mercury emissions to the atmosphere were relatively stable between 1990 and 2005 with increased emissions in Asia offset by decreased emissions in Europe and North America (UNEP 2013a). In late 2011 China released new national emissions standards to control SO_2, NO_X, and particulate emissions, which should result in mercury emissions reduction if successfully implemented (CCICED 2011). On October 10, 2013, China joined 91 other countries in signing the Minamata Convention on Mercury, also known at the Global Mercury Treaty, which includes provisions for controlling mercury releases from large-scale industrial plants including coal-fired power plants (UNEP 2013b). Nevertheless, there are also indications that increased mercury emissions from China are now offsetting more recent reductions in North America and Europe (UNEP 2013a). Therefore, based on the available information it appears to be prudent to assume a net increase in mercury deposition within the San Juan River watershed, though such an increase may be minor because of the balances between increased mercury emissions in some parts of the world and reduced mercury emissions in other parts of the world. The emissions scenarios incorporated in the model appear to provide a reasonable bounding case for increased future emissions. The San Juan River ERA reports that based on the results of the air modeling and watershed modeling (EPRI 2013) there would be little difference between the three China scenarios.

In summary, regardless of the source of emissions, metals concentrations under current conditions alone appears to pose a risk to ecological receptors within the deposition area as well as in the San Juan River downstream of the deposition area. Because of the considerable uncertainty in predicting future regional and global metals emissions, future cumulative impacts to ecological resources may be best described by

bounding potential impacts within the range of HQs reported for “Current Conditions + FCPP Only Contributions” and “Scenario 8 Contributions”. Even at the lower range of HQs that assume status quo current conditions in combination with future FCPP emissions, several highly elevated HQs (e.g., HQ of 190 for selenium exposure to generic San Juan River aquatic receptors; HQs as high as 12 for mercury exposure to Colorado pikeminnow in the San Juan River; HQs as high as 71 for selenium exposure to early life stage fish in the San Juan River) indicate the potential for adverse effects to individual receptors, as well as potential for population level effects. Cumulative impacts associated with past, present, and future conditions may be substantial regardless of whether China mercury emissions increase in the future, but this risk would remain with or without the future operation of FCPP, and as indicated in the ERAs, its future operation would not meaningfully increase those risks. Therefore the contribution of future FCPP operations would not be cumulatively substantive with respect to these ecological risks.

As a result of the past, present, and reasonably foreseeable emissions from power plants in the region, as well as other sources of emissions (e.g., coal burned in private homes), the potential exists for cumulatively major impacts to aquatic species, such as the pike minnow and razorback sucker. However, as modeled in the two ERAs described above, the contribution of FCPP to this potential cumulative effect would be significantly less than historic conditions, and still represent a decline over baseline emissions. Consequently, the long-term contribution of FCPP to cumulative impacts to threatened and endangered species is considered moderate.

4.18.3.9 Land Use and Transportation

The cumulative effects study area for land use and transportation is the immediate project area and Navajo Nation tribal trust lands because potential impacts such as relocation of housing, temporary loss of grazing land, loss of access to grazing, and a slight increase in traffic caused by activities at the Navajo Mine or FCPP would be concentrated in or near the lease area. Cumulative effects would occur if other resource extraction or development activities occurred on Navajo lands within the same time period that caused a greater loss of acreage for grazing or resulted in even greater traffic increases on local roadways. The Proposed Action would not result in any majorly adverse effects to existing land use; therefore, there would be no contribution of the project to any cumulative effects in this regard. Potential projects considered in the cumulative effects analysis that would occur on the Navajo Nation include San Juan Generating Station, Navajo Generating Station, proposed oil and gas drilling by Western Oil and Gas, the Animas-La Plata project, the Navajo Indian Irrigation Project, the Hogback Diversion Dam Project, the Navajo-Gallup Water Supply Project, and the Hogback-Cudei Irrigation Project.

The Proposed Action would result in a minor increase in traffic during construction activities associated with Burnham Road reconstruction, as well as minor long-term increases in truck traffic (2-4 truck trips per day) as a result of delivery of ammonia to the FCPP. Although other existing or planned projects would occur on the Navajo Nation during the project period, and the increase in traffic flows to the FCPP and surrounding area could increase dust, noise, and light pollution, the contribution of continued operations at the Navajo Mine and FCPP to any cumulative traffic impacts would be negligible because they would assumedly go unnoticed.

With regard to loss of grazing areas and access to grazing lands, operation of the Navajo Mine and subsequent long-term removal of grazing land, in conjunction with other development projects (i.e., oil and gas development on tribal trust lands) could diminish the livelihood and cultural heritage of grazers and residents. This cumulative loss of grazing lands would result in an adverse cumulative impact until the land is reclaimed and returned grazing. Although the Navajo Mine would be required to compensate any residents for loss of grazing land as part of its lease with the Navajo Nation which would reduce its contribution to cumulative effects, it is unknown if compensation would be required by other proposed projects.

4.18.3.10 Socioeconomics

The area of analysis for socioeconomics is McKinley County, San Juan County, the City of Farmington, Navajo Nation Tribal Trust Lands and Hopi Tribal Trust Lands. The State of New Mexico is also considered in the analysis to offer a comparison between how the alternatives and reasonably foreseeable future actions would affect the local and state economies. As described in detail in Section 4.10, the regional economy is composed primarily of educational services and healthcare and social assistance industries; construction industry; the public administration industry; the arts, entertainment, recreation, accommodation and food services industries; and the retail trade industry. There would be an adverse cumulative effect if the Proposed Action or alternatives affected the region's employment, income, public revenue, social welfare, and/or demographic composition.

The following future projects could be implemented and/or developed in the area of analysis within a reasonably foreseeable future timeframe: San Juan Basin Energy Connect Project, Western Oil & Gas Project, Oil & Gas Exploration on BLM Lands, SUIT, and Improvements to US 491. It is worth noting that lasting economic effects from past projects, such as the closure of the McKinley and La Plata mines, are captured in the project-specific analysis as part of the existing environment.

The only alternative expected to have an adverse effect on the regional economy is the No Action alternative. All other action alternatives are not expected to result in major alterations to the demographic, social welfare, or economic conditions when assessed against forecasted baseline conditions (i.e., 2016 conditions). However, the No Action alternative would result in the loss of approximately 2,069 jobs (see Table 4.10-22). This loss of jobs would add to the already high unemployment rate (approximately 51 percent) in the Navajo Nation as 413 direct jobs at the Navajo Mine and 380 direct jobs at the FCPP are occupied by tribal members. Secondary and induced effects (i.e. the downsizing or closure of businesses that support project operations) as result of the closure of FCPP and the Navajo Mine are captured in the direct effects analysis provided in Section 4.10. All other projects proposed for development in the area of analysis are not expected to reduce, but rather increase, employment opportunity or economic benefits. Therefore, while the closure of FCPP and Navajo Mine would directly affect regional economic conditions, other future projects would positively contribute to the region's economic vitality and not result in a detrimental cumulative effect.

Additionally, the implementation of the No Action alternative would allow for future reclaimed lands to be repurposed, albeit for grazing or other uses. While minor in comparison to the adverse effects of closing FCPP and Navajo Mine, this change in land use would allow for beneficial economic opportunity to be realized in the future.

4.18.3.11 Environmental Justice

The area of analysis for Environmental Justice is includes all of San Juan County, NM and tribal areas (the Navajo and Hopi Reservations), the same area as considered in the project-specific effects analysis. Within the area of analysis, members of the Navajo Nation and Hopi Tribe are considered a minority and, where applicable, low-income population. As described in Section 4.11 and Section 4.10, the Alternatives could result in moderate potential environmental justice impacts to hazardous/solid wastes and visual resources, but also provide economic benefits (i.e. jobs, income) to the Navajo Nation.

Other future projects in the area that contribute to potential effects for hazardous/solid waste and visual resources include the 1) San Juan Basin Energy Connect Project, 2) Western Oil and Gas Drilling Project, and 3) Improvements to US 491. The continued presence of the transmission lines energized by FCPP would create a lasting visual effect in the study area, including for the No Action Alternative which could allow for the transmission facilities to be left in place to continue to provide transmission, but wheel power from another energy generation source than FCPP. The San Juan Basin Energy Connect Project proposes to install a 245kV transmission line from Shiprock to Ignacio, CO, where a small portion of the transmission line would reside on Navajo Nation tribal trust lands. The installment of additional

transmission facilities within the study area may contribute to a disproportionate cumulative effect to visual resources on tribal trust lands, if power generated/transmitted on Navajo Nation tribal trust lands continues to be delivered to communities off Navajo Nation tribal trust lands in urban centers (i.e. Phoenix, Albuquerque). US 491 is an existing road scheduled for improvements so there are not expected to be additional visual effects resulting from these proposed activities. None of these projects is anticipated to produce hazardous waste or an amount of solid waste that would affect capacity at local landfills; therefore, no cumulative effect is anticipated to occur to these resources.

The No Action Alternative would result in the loss of up to 2,069 jobs in the study area, which would constitute a major long-term adverse effect to the Navajo Nation. The projects discussed above would likely create jobs and other economic benefits, therefore these projects would not contribute adversely to a cumulative socioeconomic effect.

4.18.3.12 Indian Trust Assets

The cumulative effects study area for ITAs is the Navajo Nation and Hopi Tribe Tribal Trust Lands. As discussed in Section 4.12, project-specific effects to mineral, land, water, cultural and grazing/hunting/gathering ITAs as result of the alternatives would be minor and/or beneficial. DOI/BIA reviews each proposed trust-related project with the intent to approve only those projects found beneficial to the Tribe and do not create a liability for the US (see Section 4.12.2). Therefore, other DOI/BIA approved projects that involve ITAs on the Navajo tribal trust lands are assumed to have a beneficial or minor effect. The only other project that is occurring on Navajo tribal trust lands and directly involves ITAs is the Western Oil & Gas project. Western Oil & Gas propose to develop 600 natural gas wells in the Burnham, Upper Fruitland, and Nenahnezad/San Juan Chapters. Per DOI/BIA trust policy, the Navajo Nation is expected to receive fair compensation for utilization of energy resources (i.e., natural gas royalties) and potential effects to physical ITAs (i.e., cultural, natural resources) will be limited through the application of mitigation/preventive measures developed during the environmental review process. When effects from the Western Oil & Gas project are aggregated with the effects resulting from the Alternatives, cumulative effects to ITAs are considered minor.

4.18.3.13 Visual Resources

The cumulative effects study area for visual resources is the immediate project area (for impacts occurring in the proximate vicinity of FCPP and Navajo Mine) and the Four Corners region (for effects that affect the greater visual setting of the region). There would be an adverse cumulative effect if the Proposed Action or alternatives would contribute a direct effect to the subject viewshed and other future projects also affected the area's scenic quality. With regard to direct impacts, the Navajo Mine would have moderate to high impacts on visual resources within the immediate project area, which would be reduced through the application of reclamation as per the SMCRA permit. The San Juan Basin Energy Connect Project would construct transmission towers and lines within the same viewshed as the mine. These new facilities would introduce a new linear feature in the landscape, directly affecting the scenic quality in the area. Therefore, there would be a major cumulative effect while mining operations are occurring, but this effect would cease to be an issue once the mine is reclaimed back to the original landscape.

Indirect effects on visual resources include reduced visibility and increased haze in the region as a result of emissions from various projects and facilities. As described in detail in Section 4.1, visibility and haze conditions have improved over the last decade, presumably as a result of increased regulation and compliance. Since all facilities considered in this cumulative effects analysis would be required to abide by all federal and state air quality regulations, it is anticipated that any adverse cumulative effects to visual resources would be negligible.

4.18.3.14 Noise and Vibration

The cumulative effects study area for noise and ground-borne vibration includes all proposed construction and development projects in and around the FCPP, Navajo Mine lease area, and transmission lines through the year 2041. Potential noise and ground-borne vibration caused by activities at the Navajo Mine or FCPP are localized to the lease area and would not contribute cumulatively to the impacts caused by construction or mining activities at other locations in the Four Corners region. Noise and ground-borne vibrations result from mining and construction projects, as well as transit, and everyday activities (i.e., lawn-mowers). Blasting, coal removal, and reclamation mining activities could produce noise and ground-borne vibration for residents living within 1 mile of the mine lease area, which can cause annoyance and damage to structures. Other reasonably foreseeable future construction projects that would expose the same receptors to noise and vibration at the same time as mining activities could further exceed thresholds; however, the only project occurring within the 1 mile radius is the existing Sanostee Prison and this operation is not expected to contribute major noise or vibration effects for sensitive receptors in addition to the project-specific effects produced from mining activities.. Furthermore, OSMRE requires NTEC to routinely measure the vibrations associated with their mining activity at nearby receptors to ensure that vibrations do not exceed established thresholds. In addition, as addressed in Section 4.14, a number of measures would be in place at the mine to decrease impacts, such as construction of noise barriers and use of noise mufflers on equipment. Therefore, cumulative impacts with regard to noise and vibration would be negligible.

4.18.3.15 Hazardous and Solid Wastes

The cumulative effects study area for hazardous and solid wastes includes all major permitted mine sites and generating stations in the Four Corners region through the year 2041. Cumulative effects that could occur with regard to hazardous and solid waste include the generation of such wastes that exceed the capacity of local permitted landfills. All facilities included within this cumulative effects analysis would be required to dispose of hazardous waste in accordance with all state and federal regulations. Furthermore, as discussed in Section 4.15, multiple solid waste landfills are present within the Four Corners region with the capacity to accommodate the generated waste.

The potential impacts from an accidental release of hazardous or solid waste from the mine lease area, FCPP, or transmission line operators would be limited to the release area of the specific material and would not contribute cumulatively to the impacts caused by other hazardous waste generating or managing facilities at other locations in the Four Corners region. An accidental release of hazardous or solid waste has the potential to damage infrastructure and harm individuals nearby and is dependent on the substance and its quantity. There is no relationship between the potential accidental release of hazardous or solid waste at a nearby project and an accidental release of hazardous or solid waste at the proposed project site. All existing and new hazardous waste generators and managers are required to comply with federal, state, and local laws limiting the quantities of hazardous materials available along with their transportation, handling, storage, and emergency response in the event of an accidental release to limit the impact to nearby receptors.

With specific reference to mining and generation stations, cumulative effects could occur as result of disposal of coal combustion residues either in ash ponds or as part of reclamation activities at the mines. As listed in Table 4.23-1, three other coal-fired power plants are located in the Four Corners region. Two of the three, San Juan Generating Station and Navajo Generating Station, are of similar capacity as the Four Corners Power Plant. Therefore, it is anticipated that a similar volume of coal combustion residues would be generated at these plants and require disposal or impoundment. The third source, Escalante Generating Station, only produces 250-MW and therefore, is expected to produce a much smaller volume of coal combustion residues. As described in Section 4.15, the EPA is currently considering whether to manage coal combustion residue as either a Subtitle C hazardous waste or a Subtitle D solid waste. EPA is anticipated to issue a Final Rule on coal combustion residue sometime in 2013. All of the generating stations and mines included in this cumulative effects analysis would be required to comply with EPA's

Final Rule. Due to the unknown nature of the off-site contamination from historical coal combustion residue storage, the potential impacts from storage of coal combustion residue at the FCPP and Navajo Mine are moderate to major and long term. The generating stations and mines considered in this cumulative effects analysis are also within the San Juan Basin and any sort of leaching as result of ash disposal could affect the same groundwater basin, resulting in moderate to major cumulative impacts when combined with the effects from FCPP and Navajo Mine operations.

4.18.3.16 Recreation

The cumulative effects study area for recreation includes the immediate project area and the Four Corners region, within approximately 15 to 20 miles of the Project Area. The Project would neither directly impact nor indirectly alter the recreational experience at any public recreation areas in the region, so it would not cumulatively contribute to impacts caused by other projects in the Four Corners region. Public access restrictions to the Permit Areas would have the potential to displace dispersed recreational opportunities within the Navajo Mine and Pinabete Permit areas, such as trapping, hunting, fishing, and hiking activities. However, these impacts would be negligible and limited to the permit areas, so they would not contribute to cumulative impacts in the area.

4.18.3.17 Public Health and Safety

As described in Section 4.1, mobile source emissions and fugitive dust emissions associated with Navajo Mine are minor in comparison to stationary source emissions from FCPP. In addition, the geographic area affected by fugitive dust is in the immediate vicinity of the Navajo Mine, and as such there would be no overlap with other dust sources. Therefore, the cumulative impacts of health and safety focuses on the potential public health impacts associated with air emissions from the FCPP. The cumulative effects study area for Public Health and Safety is therefore the measured plume area of FCPP emissions.

As described in Section 4.17 the HHRA process followed the Human Health Risk Assessment Protocol (HHRAP) procedures established by the EPA for hazardous waste combustion facilities (EPA, 2005a). The EPA's HHRAP recommends that three human exposure scenarios that represent individuals or groups who live in the vicinity of a facility be considered. The recommended scenarios include: a) residential exposure; b) farming exposure; and c) fish consumption exposure. These exposure scenarios consider the potential exposure of both adults and children through direct and indirect pathways associated with these scenarios. The potential exposure pathways include inhalation of compounds emitted from the stack (a direct exposure pathway) and incidental ingestion of trace compounds that enter the food chain. The COPCs enter the food chain through deposition from the air to soil, deposition on plants, or deposition to water bodies and their associated watersheds in the vicinity. The HHRA considered consumption of produce, beef, pork, chickens, fish, and water. The HHRA used conservative default exposure assumptions recommended by EPA unless site-specific exposure parameters were available and determined to be appropriate. For example, the HHRA applied ingestion rates of locally caught fish specific to a water body, based on local advisories for fish consumption rather than HHRAP default values.

As described in Section 4.17, there were no human health risks above the EPA-recommended level of 10^{-4} to 10^{-6}; all of the results were more protective than the highest level of protection (10^{-6}). The HHRA addresses future risk within the dispersion plume of FCPP. The past and present cumulative risk was evaluated by soil sampling conducted within the footprint of the dispersion and deposition plume for FCPP (AECOM 2013). Samples were collected from shallow levels (0-30 cm depth) and deeper levels (30-100 cm depth). The shallower levels were representative of deposition from FCPP, while the deeper samples are more likely to represent background conditions. Based on a statistical comparison of the data, the shallow and deep samples have similar concentrations of metals (AECOM 2013). When compared to EPA standards for residential land uses, only arsenic exceeds the recommended values (average of 4.17 mg/kg in shallow samples). All other soil sample results are protective of residential land uses. Arsenic is known to be high in soils of the southwestern United States (AECOM 2013). Therefore, cumulative health risks from deposition are minor.

The cumulative public health effects also depend on the ambient air quality in the San Juan Air Basin and the respiratory health status of residents in the area. San Juan County and the other counties within the San Juan Air Basin are all designated as attainment areas for criteria pollutants. With the implementation of BART at FCPP, emissions from FCPP were reduced in comparison to baseline emissions. Given current regulatory trends, it is likely that allowable PM and ozone precursor emissions for all sources in San Juan County, including Navajo Mine, would be reduced to meet tighter ambient air quality standards for ozone and $PM_{2.5}$. As a result, ambient air concentrations of ozone and PM in San Juan County would be lower. Overall, there would be minor cumulative public health effects of the Proposed Action because there would be no measureable change to ambient air quality compared to baseline conditions, and there would be a reduction in FCPP emissions as a result of compliance with EPA's BART rule.

4.19 Summary of Mitigation Measures

This section provides a summary of all mitigation measures recommended by OSM to reduce identified impacts of the Proposed Action and alternatives. Mitigation measures are organized by resource area and summarize recommendations provided in Section 4.1 to 4.18. Applicant-proposed measures to avoid, minimize, or mitigate environmental impacts of the proposed action are listed in Section 4.20. This section lists mitigation conditions recommended in addition to the applicant-proposed measures. Taken together, the applicant proposed measures and the additional mitigation measures would be applied to reduce or eliminate the major impacts of the Project.

4.19.1 Air Quality

No mitigation measures are recommended.

4.19.2 Climate Change

No mitigation measures are recommended.

4.19.3 Earth Resources

4.19.3.1 Navajo Mine

To mitigate the adverse effects to paleontological resources, OSM recommends development of an inadvertent discovery plan that would establish the procedures to be followed in the event that fossilized remains are encountered during surface mining operations in the vicinity of the identified significant localities. The plan should include a discussion of the procedures for monitoring mining activity, procedures for halting operations around any discovery and securing it from further damage, and the procedures and methodologies for evaluating the significance of the discovery. It should also present the procedures and methodologies to be followed if the discovery is determined to be significant. The plan should include the field and laboratory methods, reporting guidelines, and curation procedures to be followed. These measures should include:

- Conduct an on-the-ground survey prior to mining and road construction, or have a paleontologist available as a monitor during activities.
- Implement an inadvertent discovery plan to ensure that any unknown paleontological resources are properly treated upon discovery.
- Train construction personnel in recognizing possible resources and how to contact a paleontologist if a possible paleontological resource is discovered. (4.3-15)

The plan should be submitted to OSM for review and approval at least 60 days prior to commencement of mining activities.

4.19.3.2 Four Corners Power Plant

No mitigation measures are recommended.

4.19.3.3 Transmission Lines

No mitigation measures are recommended.

4.19.4 Cultural Resources

4.19.4.1 Navajo Mine

As part of the Proposed Action, a PA is being developed or the Navajo Mine that defines mitigation for adverse effects on historic properties. OSMRE recommends avoiding all TCPs through appropriate

routing of access roads and design. The PA for the Navajo Mine will propose specific mitigation measures for instances where it is not possible to avoid the resource.

4.19.4.2 Four Corners Power Plant

As part of the Proposed Action, a PA is being developed for the FCPP. OSMRE recommends avoiding all TCPs through design of proposed earth-moving activities (e.g., borrow pits and DFADA). The PA for the FCPP will propose specific mitigation measures for instances where it is not possible to avoid the historic property.

4.19.4.3 Transmission Lines

As part of the Proposed Action, a PA is being developed for the transmission line APE. OSMRE recommends avoiding all TCPs through design of proposed earth-moving activities (e.g., borrow pits and DFADA). The PA for the FCPP will propose specific mitigation measures for instances where it is not possible to avoid the historic property.

4.19.5 Water Resources/Hydrology

4.19.5.1 Navajo Mine

Compensatory mitigation for unavoidable impacts to waters of the US would be required under the 404 Individual Permit. USACE will include compensatory mitigation requirements as part of the 404 Permit for the Navajo Mine that are designed to compensate for the loss of jurisdictional areas in the Project Area, so as to ensure no net loss of functions and services of waters of the US as a result of the permitted activity. The primary mechanisms for mitigating the loss of jurisdictional areas are re-establishment and creation. MMCo has proposed the re-establishment of native riparian habitat and the creation of wetland habitat.

4.19.5.2 Four Corners Power Plant

Under the No Action Alternative, OSMRE recommends APS conduct heavy metal sampling and analysis and conduct remediation activities as needed at Morgan Lake.

4.19.5.3 Transmission Lines

No mitigation measures are recommended.

4.19.6 Vegetation

No mitigation measures are recommended.

4.19.7 Wildlife and Habitats

No mitigation measures are recommended.

4.19.8 Special Status Species

No mitigation measures are recommended.

4.19.9 Land Use and Transportation

No mitigation measures are recommended.

4.19.10 Socioeconomics

No mitigation measures are recommended.

4.19.11 Environmental Justice

No mitigation measures are recommended.

4.19.12 Indian Trust Assets

No mitigation measures are recommended

4.19.13 Visual Resources

No mitigation measures are recommended.

4.19.14 Noise and Vibration

4.19.14.1 Navajo Mine

OSMRE recommended the following measures to reduce noise and annoyance when operations are within approximately ½ mile (2,500 feet) of a receptor during Project activities:

- All equipment should be operated and maintained to minimize noise generation. Equipment and vehicles should be kept in good repair and fitted with “manufacturer-recommended” mufflers.
- Natural barriers such as vegetation curtains or soil berms should be installed where practicable at the boundaries of active mining operations within 1 mile of any occupied residence.
- Portable noise screens or enclosures to provide shielding for high-noise activities or equipment should be used as where practicable. The effectiveness of a barrier depends upon factors such as relative height of the barrier relative to the line-of-sight from the source of the receiver, the distance from the barrier to the source and to the receiver, and the reflections of sound. To be effective, a barrier must block the line-of-sight from the source to the receiver. A properly designed noise barrier can reduce noise as much as 20 dBA.
- Alternate methods of noise shielding are acceptable, if noise monitoring is conducted to verify that the 55 dBA level at the receptor site is achieved.
- Combine noisy operations to occur in the same period. The total noise produced would not be significantly greater than the level produced if the operations were performed separately.

4.19.14.2 Four Corners Power Plant

No mitigation measures are recommended.

4.19.14.3 Transmission Lines

No mitigation measures are recommended.

4.19.15 Hazardous and Solid Wastes

To address the unknown nature of the off-site contamination from past disposal activities and the uncertainty of the regulatory requirements for CCR, OSMRE recommends APS implement the measures listed below. Depending on the outcome of the EPA’s Final Rule, some or all of these measures may be requirements of EPA’s Final Rule on CCR.

Location Restrictions

Any new disposal units (landfills or surface impoundments) should be sited above the natural water table and should not be located in wetlands, within 200 feet of a fault zone, or in a seismic impact zone. Any new disposal units should not be located in an unstable area (e.g., a location susceptible to natural or human-induced events or forces capable of impairing the integrity of the unit). A review of existing disposal units

must ensure they are not located in an unstable area or they would be subject to closure requirements (described below).

Operating Requirements

New and existing disposal units would be subject to fugitive dust controls and liquid runoff/run-on control. Conditions of the permit program must include record-keeping requirements that specify that all records, reports, studies, or other documentation demonstrating compliance with the requirements must be made publicly available at the facility or on a publicly accessible Internet site.

Any existing or proposed surface impoundments should be subject to design and inspection requirements similar to MSHAs, including certification from an independent registered professional engineer that the impoundment's design is in accordance with engineering practices applicable to that unit; weekly inspections to identify potentially hazardous conditions or structural weakness;, and annual inspections to assure design, operation, and maintenance of the unit is in accordance with engineering practices applicable to such units in accordance with regulations similar to those promulgated under MSHA at 30 CFR Section 77.216, by an independent registered professional engineer.

Design Requirements

Any new landfills and surface impoundments should be constructed with a composite liner. Existing surface impoundments must have solids removed and be retrofitted with a composite liner by a deadline determined by the permit program. New disposal units should be constructed with a composite liner.

Groundwater Monitoring and Corrective Action Requirements

Groundwater monitoring should be conducted for both new and existing disposal units. If certain hazardous constituents (including arsenic, cadmium, or selenium) are detected at a level exceeding groundwater protection standards, the FCPP should assess corrective measures and select a remedy that would protect human health and the environment within 90 days.

Closure and Post-closure Requirements

Under current regulations, there are no closure or post-closure requirements for the FCPP or the DFADA. APS should develop a closure and post-closure management plan for areas where CCRs have been disposed or where they will be disposed. The plan should include provisions for providing adequate surface protection during closure, including provisions to limit surface water run-on that could increase leaching. The plan should also include provisions for groundwater monitoring.

4.19.16 Recreation

No mitigation measures are recommended.

4.19.17 Health and Safety

No mitigation measures are recommended.

4.20 Short-Term Use and Long-Term Productivity

Title 1, Section 102 (c)(iv) of NEPA requires that the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity be addressed. As such, this section addresses use of existing environmental resources to support the proposed action or alternatives and long-term impacts to the Project site and regional area resources after Project completion. Both short- and long-term impacts would be reduced by compliance with established requirements in applicable laws, regulations, plans, procedures, BMPs, and mitigations.

Short-term impacts are changes to the environment experienced during implementation of the Proposed Action or alternatives that generally would revert to pre-disturbance conditions within a few years after the disturbance occurred. Short-term uses of the environment associated with the alternatives include changes to the physical environment due to mining and from energy and utility use during the construction of facilities and roads associated with alternatives. For mining operations, short-term impacts are those that would occur from the time when mining begins in a mine resource unit through reclamation and re-establishment of vegetation in that unit. For the power plant and transmission lines, short-term impacts of the project are those that would occur immediately following approval of the lease renewal plus a reasonable period afterwards (approximately 5 years).

Long-term impacts are defined as those that would remain to a substantial degree beyond the Project's ground-disturbing activities. Long-term changes to land use and productivity are expected to be minor, due to reclamation of mined lands, demolition of power plant facilities, and reuse of transmission lines after completion of the proposed action or alternatives. The primary pre-action productive land use is livestock grazing and wildlife habitat, which would be supported and potentially enhanced after reclamation of mined lands.

4.20.1 Short-Term Gains

No short-term gains would be realized under the no-action alternative. Short-term gains associated with the Proposed Action or alternatives include:

- Coal would be mined to generate and distribute electricity to markets in the southwest through 2041.
- The Navajo Nation and the local surrounding workforce and economies would benefit from the continued operation of the power plant and transmission lines and the extension of the Navajo Mine and production of large quantities of commercially useful byproducts.
- The local population would benefit from increased safety resulting from realignment of Burnham Road.

4.20.2 Short-Term Losses

Under the No Action alternative, short-term socioeconomic losses would be experienced due to lack of tribal and non-tribal jobs and current coal and energy production would be lost. Short-term losses associated with the Proposed Action and alternatives include:

- Construction, mining, and hauling coal would involve short-term increases in fugitive emissions and construction-generated noise and would increase the use of fossil fuels for operation of construction equipment.
- Use of borrow area materials would create short-term ground-disturbing impacts to land that would be reclaimed according to established procedures.
- Ground-dwelling species in the mining and construction footprints would be impacted in the short term. Mobile species would be expected to migrate to suitable habitat in the region.

- Short-term increases in the ambient noise would result from mining activities and construction at the FCPP ash disposal area and during the Burnham Road realignment.
- Construction and mining activities would result in short-term risks to surface water quality. To minimize these potential impacts, construction-specific BMPs would be implemented, and mandates of stormwater pollution prevention regulations would be followed to reduce the associated potential for erosion, runoff, and sedimentation.
- Existing grazing land would be lost during active mining operations, but would be reclaimed sequentially during the life of the project. Mined areas would be reclaimed per SMCRA specifications to again be suitable for livestock grazing and wildlife habitat.
- During mining operations, views would change in various parts of the regional viewshed where new mining operations occur.

4.20.3 Long-Term Gains

No long-term gains would be realized under the no-action alternative. Long-term gains associated with the Proposed Action and alternatives include:

- Generation of direct and indirect revenues for the Navajo Nation, benefiting housing, health care, education, and other Navajo Nation initiatives.
- Electricity would continue to be distributed to utility subscribers.
- Following realignment of Burnham Road, the Navajo Nation would benefit from long-term use of the proposed upgraded road. Traffic conditions are expected to remain similar to existing conditions.

4.20.4 Long-Term Losses

Under the No Action alternative, long-term socioeconomic losses would be experienced due to lack of tribal and non-tribal jobs and current coal and energy production would be lost. Long-term losses associated with the Proposed Action or alternatives include:

- During the life of the project, coal resources would be permanently removed from the geologic formation and the Navajo Nation's coal reserves.
- Long-term effects would be expected at areas containing cultural resources and historic properties; however, treatment plans would be in place in one of two PAs, one for the Navajo Mine and one for the FCPP and transmission lines. Three dwellings currently located in the mining lease area would be relocated; however, historic sense of place would be lost.
- Impacts to surface and sub-surface paleontological resources would be expected; however impacts would be minimized through implementation of the inadvertent discovery procedures to be included in the mine permit.
- Topographic features would be changed by proposed mining and construction activities; however, long-term losses would be expected to be mitigated through surface contouring in the reclamation plans.

4.21 Irreversible and Irretrievable Commitment of Resources

This section describes irreversible and irretrievable commitments of resources associated with implementation of the Proposed Action and alternatives analyzed in this EIS. A resource commitment is considered irreversible when primary or secondary impacts from its use limit future use options. Irreversible commitment applies primarily to nonrenewable resources, such as minerals or cultural resources, and to those resources that are renewable only over long time spans, such as soil productivity. A resource commitment is considered irretrievable when the use or consumption of the resource is neither renewable nor recoverable for use by future generations. Irretrievable commitment applies to the loss of production, harvest, or natural resources.

4.21.1 Minerals

The removal of coal during surface mining would be an irreversible and irretrievable commitment of resources. The coal would be irreversibly committed from the geologic formations and irretrievably committed when it is burned for electrical generation.

4.21.2 Earth Resources

As mentioned above, the removal of the coal resource would be both an irreversible and irretrievable commitment of the resource.

The development of Pinabete Permit Area and the FCPP DFADAs could have an adverse impact on paleontological resources. Ground-disturbing activities associated with the Project could damage or destroy previously undiscovered paleontological resources, which would be an irreversible impact.

4.21.3 Cultural Resources

Previously undiscovered cultural resources, including archaeological resources, traditional cultural properties and human remains, could be irreversibly affected during construction of the Project.

4.21.4 Water Resources/Hydrology

The loss of the coal seam aquifers would be an irreversible impact. However, coal seam aquifers are not currently used for drinking or domestic purposes because of its low quality. Hydraulic conductivity and recharge rate to groundwater would be irreversibly impacted. Because of the length of time required for aquifer recharge, this commitment would be considered irreversible and irretrievable.

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