RECLAMATION

Managing Water in the West

Draft Environmental Impact Statement

Navajo Generating Station-Kayenta Mine Complex Project

Volume 3 – Section 3.17 through Index

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Section 3.17

Cultural Resources

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Acronyms and Abbreviations

1969 Lease	Navajo Project Indenture of Lease
ARPA	Archaeological Resource Protection Act
BART	Best Available Retrofit Technology
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BM&LP Railroad	Black Mesa & Lake Powell Railroad
BMAP	Black Mesa Archaeological Project
BO	Biological Opinion
CAP	Central Arizona Project
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO_2	carbon dioxide
Co-tenants	Salt River Project, Arizona Public Service Company, NV Energy, and Tucson Electric Power Company
Development Fund	Lower Colorado River Basin Development Fund
DQAS	Data Quality Assessment Survey
EIS	Environmental Impact Statement
ERA	Ecological Risk Assessment
ESA	Endangered Species Act of 1973
HHRA	Human Health Risk Assessment
km	kilometer
KMC	Kayenta Mine Complex
kV	kilovolt
kW	kilowatt
MW	megawatt
N-Aquifer	Navajo Aquifer
NAGPRA	Native American Graves Protection and Repatriation Act of 1990
NEPA	National Environmental Policy Act of 1969, as amended
NGS	Navajo Generating Station
NGS Participants	U.S. (Reclamation), Salt River Project, Arizona Public Service Company, NV Energy, and Tucson Electric Power Company
NHPA	National Historic Preservation Act
NNEPA	Navajo Nation Environmental Protection Agency
NO_2	nitrogen dioxide
NO_X	nitrogen oxide
NRHP	National Register of Historic Places
O&M	Operation and maintenance
OSMRE	Office of Surface Mining Reclamation and Enforcement
PA	Programmatic Agreement
PM	particulate matter

PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PFR	Partial Federal Replacement
PWCC	Peabody Western Coal Company
Reclamation	Bureau of Reclamation
ROW	Right-of-way
SMCRA	Surface Mining Control and Reclamation Act of 1977
SO_2	sulfur dioxide
SRP	Salt River Project Agricultural Improvement and Power District
STS	Southern Transmission System
TCL	Traditional Cultural Landscape
TCP	Traditional Cultural Property
tpy	tons per year
U.S.	United States
USEPA	U.S. Environmental Protection Agency
WTS	Western Transmission System

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3.17 Cultural Resources

Cultural resources is the term used by practitioners in the identification, evaluation, and treatment of tangible locations of human activity, occupation, or use that have been identified through field inventory (survey), historical documents, or oral evidence. Cultural resources include archaeological sites and districts, historical architectural resources (buildings, structures, and districts), and places of religious and cultural significance (including sacred sites) to cultural groups, including Indian Tribes. Under Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations at 36 Code of Federal Regulations (CFR) Part 800, federal agencies are required to consider the effects of their undertaking on cultural resources that are listed in or eligible for listing in the National Register of Historic Places (NRHP). These resources that are listed in or eligible for listing in the NRHP are defined in regulation as historic properties.

3.17.1 Regulatory Framework

Federal historic preservation legislation provides a legal framework for documentation, evaluation, and protection of cultural resources that may be affected by federal undertakings. The following laws and regulations are relevant to the Navajo Generating Station (NGS)-proposed Kayenta Mine Complex (KMC) Project.

Historic properties are districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering, and culture that are listed in or eligible for listing in the NRHP. The term historic property includes properties of religious and cultural significance to an Indian Tribe that meet the NRHP criteria. These places of religious and cultural significance are usually referred to as Traditional Cultural Properties (TCPs). Federal agencies also must afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.

36 CFR Part 800 is the Advisory Council on Historic Preservation's regulation implementing Section 106 of the NHPA. Part B of the regulation (36 CFR Part 800.3-800.6) establishes a process through which historic properties are identified, as follows:

- Initiate the Section 106 process by establishing the undertaking and consulting with the appropriate parties, including federal agencies, State Historic Preservation Offices, Tribal Historic Preservation Offices, Indian tribes, local governments, and the public.
- Identify historic properties within the Area of Potential Effects through inventory and evaluation of their historic significance by applying the NRHP criteria. See 36 CFR Part 60.4 for National Register criteria, National Register Bulletin 15 for the process of determining if a property is eligible for listing in the NRHP, and National Register Bulletin 38 for evaluating and documenting TCPs.
- Assess whether there would be effects to historic properties in the Area of Potential Effects by applying the criteria of effects.
- If effects would occur, take appropriate steps to resolve those effects.

Of particular importance to the NGS-KMC Project is the requirement set forth in 36 CFR Part 800 (and a 1992 amendment to the NHPA) that a federal agency must consult with Indian tribes concerning properties of religious and cultural significance to them that may be eligible for listing in the NRHP. National Register Bulletin 38 (Parker and King 1990) defines a TCP as one that is eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that: (1) is rooted in that community's history; and (2) is important in maintaining the continuing cultural identity of the community. American Indian consultation includes identification of tangible properties of traditional cultural importance that include, but are not limited to, physical locations associated with the traditional beliefs concerning tribal origins, cultural history, or the nature of the world; locations where religious

practitioners go, either in the past or present, to perform ceremonial activities based on traditional cultural rules or practice; ancestral habitation sites; trails; burial sites; and places from which plants, animals, minerals, and water possessing healing powers or used for other subsistence purposes may be taken. Some of these locations may be considered sacred to particular Native American individuals or tribal communities.

In addition to NHPA Section 106 requirements, federal agencies must meet the requirements of several additional laws, regulations, executive orders, and other federal authorities. Among these are the Archaeological Resource Protection Act (ARPA) of 1979; Native American Graves Protection and Repatriation Act of 1990 (NAGPRA); Surface Mining Control and Reclamation Act of 1977 (SMCRA); National Trails System Act of 1968; Secretarial Order No. 3175: Departmental Responsibilities for Indian Trust Resources; Executive Order 13007: Indian Sacred Sites; and Executive Order 13175: Consultation and Coordination with Indian Tribal Governments. For the NGS-KMC Project, the United States (U.S.) Bureau of Reclamation (Reclamation) also must acknowledge the jurisdiction of the Navajo Nation Cultural Resources Protection Act on surface lands controlled by the Navajo Nation and the jurisdiction of Hopi Ordinance 26: Ordinance for the Protection of Places and Objects of Sacred, Historical and Scientific Interest on the Hopi Reservation. In addition, Reclamation must adhere to state burial laws should human remains and associated funerary items be discovered on state lands as a result of its actions. A summary of these laws, regulations, executive orders, and other federal authorities is presented in **Table 3.17-1**.

Table 3.17-1 Cultural Resource Laws, Regulations, Executive Orders, and Other Federal Authorities

Regulation	Summary
National Historic Preservation Act of 1966, as amended (Public Law 89-665; formerly 16 U.S. Code Section 470 et seq., as amended, currently 54 U.S. Code Section 300101) Section 106 implementing regulations are at 36 CFR Part 800. 36 CFR Part 60 NRHP lists the criteria for eligibility.	Section 106 of NHPA requires federal agencies to take into account the effect of its undertaking on historic properties. Historic properties are districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering, and culture that are listed in or eligible for listing in the NRHP. The term historic property includes properties of religious and cultural significance to an Indian Tribe (also known as TCPs) that meet NRHP criteria. Federal agencies also must afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking. To be considered for inclusion in the National Register, properties must be at least 50 years old (unless they have exceptional significance) and possess integrity of location, design, setting, feeling, materials, workmanship, and association. To be eligible, properties must meet one or more of the following criteria to demonstrate their significance in American history, architecture, archaeology, engineering, or culture: Criterion A: are associated with events that have made a significant contribution to the broad patterns of our history; Criterion B: are associated with the lives of persons significant in our past; Criterion C: embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; Criterion D: have yielded, or may be likely to yield, information important in prehistory or history.

Table 3.17-1 Cultural Resource Laws, Regulations, Executive Orders, and Other Federal Authorities

Regulation	Summary
American Indian Religious Freedom Act, 1978; Public Law 95-341, 42 U.S. Code Section 1996 and 1996a (as amended).	American Indian Religious Freedom Act recognizes that religious practices of American Indians (as well as Native Alaskans and Native Hawaiians) form the basis of their cultural identity and value systems. American Indian Religious Freedom Act establishes a federal policy of protecting and preserving the inherent right of individual Native Americans to believe, express, and exercise their traditional religions including, but not limited to, access to sacred sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.
ARPA of 1979; Public Law 96-95, 16 U.S. Code Section 470aa-mm, as amended). Archaeological Resource Protection Act's implementing regulations are at 43 CFR Part 7.	ARPA acknowledges that archaeological resources on federal and American Indian land are an accessible and irreplaceable part of the Nation's heritage. ARPA requires that a permit be obtained from a federal land manager to excavate or remove any archaeological resource on U.S. public or Indian lands. Permits may be issued only to qualified educational or scientific institutions for the purpose of furthering archaeological knowledge in the public interest. Major penalties for violating this law include substantial fines and imprisonment.
Native American Graves Protection and Repatriation Act of 1990; Public Law 101-601, 25 U.S. Code Section 3001 et seq., as amended). The implementing regulations for NAGPRA are at 43 CFR Part 10.	NAGPRA establishes a means for culturally affiliated Indian tribes (and Native Hawaiian organizations) to request the return of human remains and associated funerary objects, as well as unassociated funerary objects, sacred objects, and objects of cultural patrimony, held by federal agencies or federally assisted museums or institutions. NAGPRA also contains provisions regarding the intentional excavation and removal, inadvertent discovery, and illegal trafficking of Native American human remains and sensitive cultural items.
Religious Freedom Restoration Act of 1993 (Religious Freedom Restoration Act; Public Law 103-141, 107 Stat. 1488, as amended).	The intent of Religious Freedom Restoration Act is to prevent enactment of federal laws that substantially burden an individual's free exercise of his or her religion. The law applies to Native American religious practitioners, as well as the wider U.S. public.
National Trails System Act of 1968 (Public Law 90-543 and PL. 111-11, 16 U.S. Code Section 1241–1251 (as amended).	National Trails System Act creates a series of national trails "to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the Nation." Specifically, the Act authorized three types of trails: national recreation trails, national scenic trails, national historic trails, and connecting or side trails to these three major classes of trail. Among these trails is the Old Spanish National Historic Trail, which intersects portions of the NGS-KMC Project area.
SMCRA; Public Law 95-87, 30 U.S. Code Section 1201 et seq. SMCRA's implementing regulations are at 30 CFR Part 750.	SMCRA establishes a nationwide program to protect society and the environment from the effects of surface coal mining operations. The Act also established the Office of Surface Mining Reclamation and Enforcement (OSMRE) to implement this law. Among its many provisions are 30 CFR Part 750.12 that addresses permit applications and the need for specific cultural resource information and 30 CFR Part 761.11 that address cemeteries (any area of land where human bodied are interred) as a type of area where mining is prohibited or limited.
Secretarial Order No. 3175: Departmental Responsibilities for Indian Trust Resources (November 8, 1993).	This order requires that all U.S. Department of the Interior bureaus and offices consult with the recognized tribal government with jurisdiction over the trust property potentially affected by a Proposed Action.

Table 3.17-1 Cultural Resource Laws, Regulations, Executive Orders, and Other Federal Authorities

Regulation	Summary
Executive Order 13007: Indian Sacred Sites (May 24, 1996).	Executive Order 13007 requires federal agencies to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions to: (1) accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners; and (2) avoid effects to the physical integrity of sacred sites. It also requires federal agencies to develop procedures for reasonable notification of proposed actions or land management policies that may restrict access to, ceremonial use of, or effect to sacred sites. A sacred site may not meet the NRHP criteria for defining a historic property, but may indeed be considered a TCP by one or more tribes.
Executive Order 13175: Consultation and Coordination with Indian Tribal Governments (November 6, 2000).	Executive Order 13175 was issued to establish regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications.
Hopi Ordinance 26: Ordinance for the Protection of Places and Objects of Sacred, Historical and Scientific Interest on the Hopi Reservation (November 5, 1974).	The purpose of this law is to protect sites, locations, structures, and objects of a sacred, historical, or scientific interest or nature on lands within the jurisdiction of the Hopi Tribe from desecration, destruction, theft, or other harm or interference. This Tribal Ordinance lists prohibited acts on any protected place or object (as defined in the ordinance) within the Hopi Reservation; provides penalties for violators; and requires approved licenses for qualified individuals or institutions with legitimate, specific, historical, and scientific research. In 1990, the Hopi Tribal government established the Hopi Cultural Preservation Office, under the division of the Department of Natural Resources. The Hopi Cultural Preservation Office is responsible for enforcement of Hopi Ordinance 26; it also conducts research, issues protocols for conducting research, and works closely with a group of cultural resource experts drawn from Hopi villages and religious societies to interpret and protect cultural knowledge.
Navajo Nation Cultural Resources Protection Act, 1988; CMY-19-88, Navajo Nation Code Title 19, Chapter 19, Chapter 11.	This law acknowledges the importance of preserving the cultural heritage of the Navajo Nation for the benefit of the Navajo People. It establishes as policy the use of appropriate measures to foster conditions under which modern Navajo society and its cultural resources can coexist in productive harmony to fulfill the social, economic, and other requirements of present and future generations. Navajo Nation Cultural Resources Protection Act establishes the following: (1) the Navajo Nation Historic Preservation Department within the Navajo Nation Division of Natural Resources serves as the agency responsible for the protection, preservation, and management planning for the Nation's cultural resources, directed by a Tribal Historic Preservation Officer (Tribal Historic Preservation Office); (2) the Navajo Nation Archaeology Department within the Navajo Nation Division of Natural Resources provides cultural resource services to project sponsors;

Table 3.17-1 Cultural Resource Laws, Regulations, Executive Orders, and Other Federal Authorities

Regulation	Summary
	[Note: In 2016, the Navajo Nation Historic Preservation Department and the Navajo Nation Archaeology Department were combined into a single agency, the Navajo Nation Heritage and Historic Preservation Department.] (3) the Navajo Nation Tribal Museum provides a repository for all cultural resources collected on Navajo lands; (4) a Navajo Nation Register of Cultural Properties; and (5) a Navajo Nation Cultural Landmarks program. The Navajo Nation Cultural Resources Protection Act requires that a sponsor of an undertaking on Navajo Nation land obtain the approval of the Tribal Historic Preservation Office prior to implementing or authorizing the undertaking. The law also prohibits the following activities: (a) On Navajo lands, only those cultural properties designated as open to the public within the boundaries of the Navajo Nation Park or a National Park or National Monument may be visited or investigated; (b) No person may alter, damage, excavate, deface, destroy, or remove any cultural properties on Navajo land; (c) No person may sell, purchase, exchange, or transport cultural resources from Navajo lands; (6) No person may engage in ethnographic research on Navajo lands except for those qualified individuals granted a Navajo Nation Cultural Resources Permit issued by the Tribal Historic Preservation Office, subject to appropriate terms and conditions. Prohibitions against visitation of cultural resources do not apply to enrolled members of the Navajo Nation and Navajo Nation employees engaged in official activities. Prohibitions against alteration, collection, disturbance, excavation or removal of cultural resources or collection of ethnographic data do not apply to Navajo traditional practitioners engaged in activities directly relating to the practice of traditional Navajo religion or Navajo Nation employees engaged in official business related to approved cultural resource management activities. In accordance with the Navajo Nation Cultural Resources Protection Act, the Navajo Nation Historic Preservation Department developed a series of guidelines and policies related to cultural resources on Navajo lands. Among these are: • Policies, Procedures, and Requirements for Acquiring Cultural Resource Investigation Permits; • Cultural Resources Investigation Permit Fee Schedule, Permit Request Forms, and ARPA Permit; • Fieldwork, Report Standards, and Guidelines; • Guidelines for the Treatment of Historic Sites; • Navajo Nation Policy to Protect TCPs; • Guidelines for the Treatment of Historic, Modern, and Contemporary Abandoned Sites;

Table 3.17-1 Cultural Resource Laws, Regulations, Executive Orders, and Other Federal Authorities

Regulation	Summary
	• Navajo Nation Policy for the Protection of *Jishchaa'*: Gravesites, Human Remains, and Funerary Items; and • Guidelines for the Treatment of Discovery Situations.
Arizona Revised Statues 41-841 through 41-844 and its implementing rules, and Arizona Revised Statute 41-865 and its implementing rules. Arizona State Historic Preservation Act of 1982 (Arizona Revised Statutes 41-861 through 41-864). Regulations on the confidentiality of information related to the location of archaeological discoveries or objects included or eligible for inclusion in the Arizona Register of Historic Places (Arizona Revised Statute 39-125).	Arizona Revised Statute 41-841 requires only permitted, qualified individuals acting as authorized agents of an institution or corporation may excavate historic and prehistoric ruins, burials, and paleontological sites on land owned or controlled by the State of Arizona. Arizona Revised Statute 41-842 allows only institutions, organizations, and corporations organized for scientific, research, or land-use planning purposes to pursue activities prescribed in 41-841. It also requires permits must be secured from the Director of the Arizona State Museum to undertake this work. Arizona Revised Statute 41-843 prohibits any person, institution, or corporation from defacing or otherwise altering any site or object embraced within the terms of 41-841 and 41-842 except as permitted by the director of Arizona State Museum. Arizona Revised Statute 41-844 protects human remains and associated funerary objects in unmarked graves and abandoned cemeteries that exceed 50 years in age on state, county, city, and municipal lands in Arizona. This statute also protects sacred ceremonial objects and objects of national or cultural patrimony on state lands that have special importance to American Indians. Arizona Revised Statute 41-865, the Arizona Burial Protection Act (1990), applies to private lands; it provides similar protection to human remains and associated funerary objects that also exceed 50 years in age. Arizona State Historic Preservation Act of 1982 is similar to the NHPA. Arizona Revised Statute-41-861 assigns responsibility to the administrator of each state agency for the preservation of historic properties which are owned or controlled by that agency. Arizona Revised Statute 41-862 requires each state agency locate, inventory, and nominate to the Arizona Register of Historic Places all properties that are under the agency's ownership or control and that appear to meet the criteria for inclusion on the register. In instances where sites cannot be avoided or substantially altered during a project, Arizona Revised Statute 41-863 requires that steps are taken to make appropriate documentary recordation in accordance with standards that the State Historic Preservation Office establishes and deposit those records with the Arizona State Library, Archives, and Public Records and with the State Historic Preservation Office for future use and reference. Arizona Revised Statute 41-364 requires state agencies to consult with the State Historic Preservation Office when planning projects, including sale or lease of state land, which may potentially affect any historic or prehistoric properties. It also says the State Historic Preservation Office has 30 days to review and comment on projects that may impact historic properties on state land. Arizona Revised Statute 39-125 addresses confidentiality of information related to site locations. A public official may decline to release this

Table 3.17-1 Cultural Resource Laws, Regulations, Executive Orders, and Other Federal Authorities

Regulation	Summary
	information if the officer determines that the release of the information creates a reasonable risk of vandalism, theft, or other damage to the archaeological discoveries or the places or objects that are included on or may qualify for inclusion in the State Register of Historic Places.
Utah Code Title 9, Chapter 9, Section 401-406: NAGPRA (1992).	The NAGPRA is the Utah State equivalent to the federal NAGPRA. It protects human remains and associated funerary objects on state, county, city, and municipal lands in Utah. Utah Code Title 9, Chapter 8, Section 309 protects ancient human remains on non-federal, non-state lands in Utah.
Nevada Revised Statute 383.150-190: Protection of Indian Burial Sites (1989).	The Protection of Indian Burial Sites law protects human remains and associated artifacts on non-federal lands in Nevada.

3.17.1.1 Development of Programmatic Agreements

The Section 106 process will be completed prior to the Record of Decision through the execution of Section 106 Programmatic Agreements. As described in 36 CFR Part 800.14(b), the development of programmatic agreements are the most commonly used program alternative for Section 106 compliance. A programmatic agreement is negotiated between the lead federal agency, other land-managing agencies, other key agencies, State Historic Preservation Office(s)/Tribal Historic Preservation Office(s), the Advisory Council on Historic Preservation, Tribes, private entities, and other parties. A programmatic agreement identifies the steps that the lead agency and the consulting parties agree to follow in resolving adverse effects to historic properties.

For the NGS-KMC Project, two programmatic agreements were developed. Reclamation as lead agency, with the approval of the Advisory Council on Historic Preservation, created two programmatic agreements because the potential effects to historic properties in the proposed KMC are markedly different than potential effects to other project components. The programmatic agreement regarding the management of historic properties at the proposed KMC, was developed to address potential effects to historic properties within the proposed KMC boundary. No new construction is anticipated for the NGS portion of the project; therefore, the NGS Programmatic Agreement was developed to address the potential for effects from routine operation and maintenance (O&M) activities within all other portions of the study area, including the NGS and the transmission system.

Given land ownership and leasing agreements on Indian land, Reclamation prepared the KMC Programmatic Agreement in consultation with entities listed in **Table 3.17-2**. The KMC Programmatic Agreement outlines general and specific measures that Reclamation and OSMRE would take to fulfill their responsibilities to consider the effects of their actions on historic properties under the NHPA and Tribal laws. As part of the programmatic agreement process, Reclamation sent letters to local governments, agencies and other entities inviting them to be consulting parties to the agreement. Those that accepted Reclamation's invitation are listed in **Table 3.17-2**. Also involved are several non-governmental organizations who have expressed interest and been involved in the overall project through submission of comments during scoping meetings, attendance at Cultural Resource Update Meetings, and participation in invited Listening Sessions. These organizations include Black Mesa Coal'tion, Black Mesa Conservancy, Black Mesa Trust, Black Mesa Water Coalition, Black Mesa United, Diné CARE, Forgotten Navajo People, and To' Nizhoni Ani.

Table 3.17-2 KMC Programmatic Agreement Consultation

Tribal Governments Consulted	Other Entities Consulted
Navajo Nation	Advisory Council on Historic Preservation
Hopi Tribe	Arizona State Historic Preservation Office
Pueblo of Zuni	Bureau of Indian Affairs (BIA)-Navajo Region
	BIA-Western Region
	OSMRE
	Peabody Western Coal Company (PWCC)

The NGS Programmatic Agreement was prepared in consultation with entities listed in **Table 3.17-3**. As with the KMC Programmatic Agreement, the NGS Programmatic Agreement outlines general and specific measures that Reclamation would take to fulfill its responsibilities to resolve effects to historic properties under the NHPA, Tribal laws (**Table 3.17-1**), and state laws. As part of the programmatic agreement process, Reclamation sent letters to the parties listed in **Table 3.17-3**, inviting them to be consulting parties to the agreement. Those that accepted Reclamation's invitation to participate have as yet to be determined as of July 15, 2016.

Table 3.17-3 NGS Programmatic Agreement Consultation

Tribal Governments Consulted	Other Entities Consulted
Ak-Chin Indian Community	Advisory Council on Historic Preservation
Cedar Band of Paiutes	Arizona Public Service Company
Fort McDowell Yavapai Nation	Arizona State Historic Preservation Office
Fort Mojave Indian Tribe	Arizona State Lands Department
Fort Yuma-Quechan Tribe	Arizona State Museum
Gila River Indian Community	BIA-Navajo Region
Havasupai Tribe	BIA-Western Region
Hopi Tribe	Bureau of Land Management (BLM)
Hualapai Tribe	National Park Service – Glen Canyon National Recreation Area)
Indian Peaks Band of Paiutes	NV Energy
Kaibab Band of Paiutes	Nevada State Historic Preservation Office
Kanosh Band of Paiutes	Salt River Project Agricultural Improvement and Power District
Koosharem Band of Paiutes	U.S. Forest Service – Southwest Regional Office, Kaibab National Forest, Prescott National Forest
Las Vegas Paiute Tribe	Utah State Historic Preservation Office
Moapa Band of Paiutes	—
Navajo Nation	—
Paiute Indian Tribe of Utah	—
Pascua Yaqui Tribe	—
Pueblo of Zuni	—
Salt River Pima-Maricopa Indian Community	—
San Carlos Apache Tribe	—

Table 3.17-3 NGS Programmatic Agreement Consultation

Tribal Governments Consulted	Other Entities Consulted
San Juan Southern Paiute Tribe	—
Shivwits Band of Paiutes	—
Southern Ute Indian Tribe	—
Tohono O'Odham Nation	—
Tonto Apache Tribe	—
Ute Indian Tribe of the Uintah and Ouray Reservation	—
Ute Mountain Ute Tribe of the Ute Mountain Reservation	—
White Mountain Apache	—
Yavapai-Apache Nation	—
Yavapai-Prescott Indian Tribe	—

The NGS and KMC Programmatic Agreements would stipulate how historic properties are identified and establish a process for assessing and resolving effects to historic properties. Measures to resolve effects (avoidance, minimization, or mitigation) to historic properties are built into the two programmatic agreements. Effects to historic properties would be anticipated in the proposed KMC where permitted mining and mine preparation activities likely would result in effects to historic properties. In anticipation of these effects, the KMC Programmatic Agreement establishes specific procedures to avoid, minimize, and resolve effects. These include avoidance measures designed to ensure against effects if and when mine-related activities are in proximity to known NRHP eligible historic properties, such as archaeological sites and TCPs. Provisions for monitoring any ground disturbing activities near historic properties also are provided to supplement avoidance procedures when needed. When avoidance is not practicable, PWCC would be required to follow stipulations designed to ensure that any effects to historic properties are resolved before mine related activities begin. Preparation of a Historic Properties Treatment Plan will be required to guide all necessary treatment activities. The Historic Properties Treatment Plan will be prepared in consultation with the parties to the programmatic agreement and agreed to in advance of mine-related activities. All approved treatment activities will be reported after the investigations are completed.

The KMC Programmatic Agreement addresses the discovery of human remains and objects of cultural patrimony as required under Tribal law and policy and in compliance with the NAGPRA. It specifies that the lead federal agency will treat all human remains with dignity and respect, and those remains will be reburied or curated in consultation with the affected Tribes. All cultural materials recovered through approved treatment will be curated in a facility located either on the Navajo or Hopi reservations, as applicable, or in an off-reservation facility as approved by the Tribes and the lead federal agency. It should be noted that the Navajo Nation has a reburial policy that stipulates the reburial of cultural materials recovered from archaeological excavation (**Table 3.17-1**, Navajo Nation Policy for the Protection of *Jishchaa'*: Gravesites, Human Remains, and Funerary Items).

The NGS Programmatic Agreement also addresses the potential for effects that may result from current and future O&M activities and the resolution of any effects that may occur. No new construction is planned for any of the project elements outside of the proposed KMC; therefore, the NGS Programmatic Agreement focuses on O&M tasks. It is anticipated that many such tasks would have no potential to cause effects and may be exempted from Section 106 consultation; however, the programmatic agreement includes provisions for when effects to historic properties may occur, as negotiated with

Tribes, the lead agency, and other parties to the programmatic agreement. Procedures for resolving any effects also are included.

Provisions for addressing the discovery of human remains is included in the NGS Programmatic Agreement. On federal and tribal lands, such discoveries will follow NAGPRA, as well as Tribal law and policy, where applicable. On state, municipal, and private lands, the discovery of human remains will abide by applicable state burial laws. The lead federal agency will treat all human remains with dignity and respect and the disposition of those remains will be carried out in consultation with Tribes and other parties.

3.17.2 Study Areas

3.17.2.1 Proposed Action and Action Alternatives

The study area for identifying cultural resources for the Proposed Action and action alternatives corresponds to the project limits, as defined by lease and permit boundaries and rights-of-way (ROWs), for all elements of the NGS)-KMC Project. Based on current information, the study area consists of the following features discussed below (**Figure 3.17-1**).

3.17.2.1.1 Navajo Generating Station

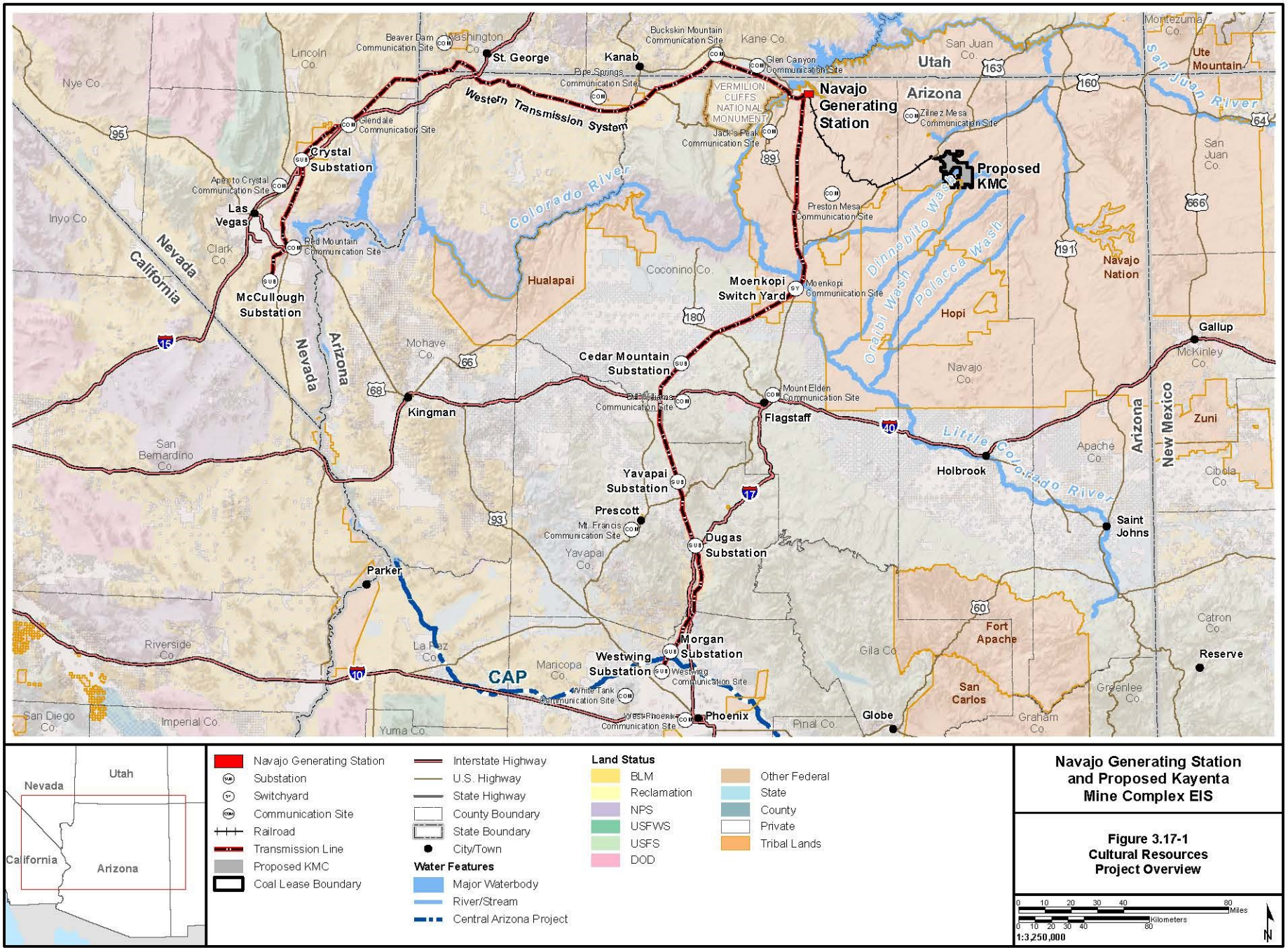
The NGS portion of the cultural resources study area consists of the footprints of the facilities listed in **Table 1-2**. The NGS cultural resources study area includes the following components:

- The NGS plant site;
- The ash disposal site;
- The road between the plant site and the ash disposal site;
- The lake pump station;
- The road between the lake pump station and N22b;
- The pipeline, powerlines, and road between the lake and the plant site;
- The 230-kilovolt (kV) tie line;
- The Black Mesa & Lake Powell (BM&LP) Railroad ROW, which varies in width between 100 and 560 feet; and
- The coal loadout silo.

For the purposes of the analyses in this section, the BM&LP Railroad and the coal loadout silo are considered together but separate from the remainder of the NGS and associated facilities.

3.17.2.1.2 Proposed Kayenta Mine Complex

- The study area of the proposed KMC consists of lands contained within the 62,930 acres of land covered by the OSMRE permit AZ-0001E (**Figure 3.17-2**). This study area includes the former Black Mesa Mine and associated infrastructure. See Section 1.7.2 for a description of the Kayenta Mine and the former Black Mesa Mine.
- Within the study area of the proposed KMC are lands that would be affected by the Proposed Action (**Figure 3.17-2**). These lands consist of the following:



Navajo Generating Station and Proposed Kayenta Mine Complex EIS

Figure 3.17-1
Cultural Resources
Project Overview

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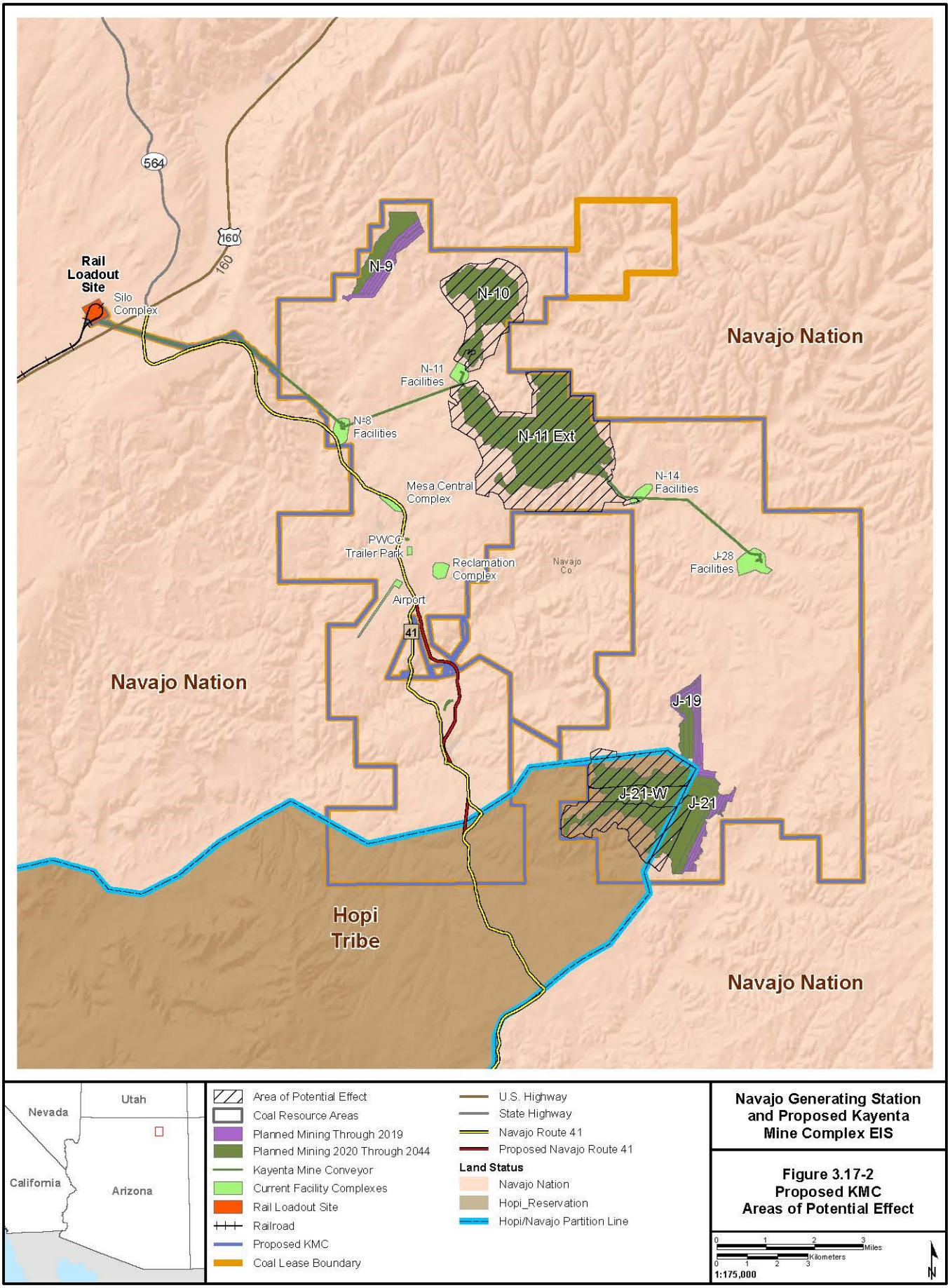

Navajo Generating Station and Proposed Kayenta Mine Complex EIS

Figure 3.17-2 Proposed KMC Areas of Potential Effect

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1. The affected lands associated with the five proposed mine areas: J-19, J-21, J-21 West, N-10, and N-11 Extension. These affected lands include reclaimed areas within N-10 and N-11 Extension (**Table 3.17-4**).
2. The coal conveyor that runs from the J-28 facilities to the Silo Complex and the terminus of the BM&LP Railroad. The corridor of the coal conveyor belt consists of a 50-foot-wide buffer on both sides of the centerline of the belt.
3. Two new proposed rerouted sections of Navajo Route 41. The corridors of these two new sections of Navajo Route 41 consist of 50-foot-wide buffers on both sides of their centerlines.
4. Existing facilities in the proposed KMC. These consist of the facilities in J-28, N-8, N-11, and N-14 in the current Kayenta Mine; the Airport, Mesa Central Complex, PWCC Trailer Park, and Reclamation Complex in the former Black Mesa Mine; and the southern portion of the Silo Complex at the terminus of the coal conveyor. Section 1.7.2.1 presents more detailed descriptions of these facilities.

Table 3.17-4 Affected Environment Lands within the Proposed KMC

Mine Area	Acreage
J-19	55
J-21	296
J-21 West	2,300
N-10[1]	956
N-11 Extension[2]	3,553

[1] N-10 acreage excludes 616 acres of reclaimed land.

[2] N-11 Extension acreage excludes 863 acres of reclaimed land.

3.17.2.1.3 Transmission Systems and Communication Sites

3.17.2.1.3.1 Western Transmission System

- The single circuit line 500-kV Western Transmission System (WTS) is approximately 275 miles long with a ROW varying in width from 200 to 330 feet. The line begins at the NGS and terminates at the McCullough Substation southeast of Las Vegas, Nevada (**Figure 3.17-1**).
- The McCullough Substation and Crystal Substation are parts of the WTS.
- Multiple transmission corridor access roads are part of the WTS, including primary access roads to the corridors that will be maintained by the transmission line operators and, in some cases, secondary roads that connect to the primary roads.

3.17.2.1.3.2 Southern Transmission System

- The double circuit line 500-kV Southern Transmission System (STS) is approximately 256 miles long with a ROW varying in width from 230 to 330 feet. The line begins at the NGS and terminates at the Westwing Substation north of Phoenix, Arizona (**Figure 3.17-1**).
- The Moenkopi Switchyard and the Cedar Mountain, Yavapai, Dugas, Morgan, and Westwing substations are part of the STS.
- Multiple transmission corridor access roads that will be maintained by the transmission line operators are part of the STS.

3.17.2.1.3.3 Communication Sites

- Nineteen communication sites also are used to maintain the operation of the NGS, WTS, and STS.
- Fifteen of the 19 communication sites are external to the footprints of other NGS-KMC Project features (**Figure 3.17-1**). The study areas for these 15 external communication sites are a 100-meter buffer surrounding the point location of each site as defined by Salt River Project Agricultural Improvement and Power District.

3.17.2.2 Cumulative

The study area for evaluating cumulative impacts to cultural resources is the same as the study area for the Proposed Action and action alternatives and corresponds to the project limits, as defined by lease and permit boundaries and ROWs, for all elements of the NGS-KMC Project. This includes the NGS, the proposed KMC, and the transmission systems and communication sites. The study area is depicted **Figure 3.17-1** and is described in Section 3.17.2.1. The study area includes a portion of Black Mesa, which as a TCP and is part of a larger Traditional Cultural Landscape (TCL). Ongoing ethnographic studies conducted for the NGS-KMC Project will provide important information concerning cumulative impacts to TCPs and other cultural resources in the study area.

3.17.3 Affected Environment

This section provides: 1) a description of the data collected and used for this analysis; 2) a brief introduction to the cultural history of the project and the Native American tribes who live in and adjacent to the project study area; and 3) a description of the affected environment for cultural resources described by project feature, all of which are common to all project alternatives. Given the size of the study area, only a brief introduction to the cultural diversity, culture history, and the Native American tribes associated with the study area is given here. A more detailed treatment of archaeological cultural resources can be found in the cultural resources records search report (Graves 2015).

3.17.3.1 Data Collection

An inventory of archaeological sites, historic architectural resources, and TCPs known to lie within the study area was compiled through a variety of file searches, archaeological surveys, and ethnographic/ TCP investigations. Some of these data collections are complete, whereas others are on-going or stipulated in the project programmatic agreements. These investigations provide the baseline for understanding potential impacts to cultural resources and historic properties under the different project alternatives and are introduced briefly in this section.

A Class I-level cultural resources records search and literature review was completed for the project (Graves 2015). The records search consisted of a search of existing literature and site and project documentation to create a project-wide cultural resources geodatabase and bibliography of cultural resources research. The records search included the project study area plus a 100-meter-wide buffer. In conjunction with the 2015-2016 pedestrian resurvey of the WTS, 1-mile-wide buffer on either side of the centerline of the transmission line corridor was used to provide more extensive background data and literature review. The records search also included the entire mine leasehold area, not just the specific lands of the proposed KMC described in **Table 3.17-4**.

The records search was conducted to document and characterize the nature and extent of known cultural resources within and adjacent to the study area. **Table 3.17-5** lists the repositories and institutions from which data were acquired. Graves (2015) lists the attributes for which information was acquired for cultural resources and previously conducted cultural resources investigations. In addition to non-spatial attribute data, geographic information systems locational data also were acquired for resources and cultural resources investigations within the project area and a 100-meter buffer. Resources included in the records search and literature review consisted of prehistoric and historical

period archaeological sites, historic architectural resources, and TCPs. The study defined appropriate research contexts and themes with which the significance of cultural resources can be evaluated and was concerned primarily with archaeological cultural resources. It also identified geographic spaces within the study area where cultural resource inventory was either lacking or potentially outdated, as well as gaps in knowledge concerning the nature and distribution of cultural resources. However, it is important to note that ethnographic studies of TCPs and TCLs also are being conducted to more fully understand the cultural resources of the project area, including places of religious and cultural significance. Tribes are being consulted regarding the incorporation of Tribal-specific traditions and culture into research contexts and themes appropriate to future Historic Properties Treatment Plans associated with mitigation of effects to cultural resources.

Table 3.17-5 Repositories and Institutions Providing Data for the Cultural Resources Records Search and Literature Review

Repository/Institution
Arizona Public Service Company
Arizona State Museum and AZSITE
Museum of Northern Arizona
Navajo Nation Historic Preservation Department (including the Traditional Cultural Program)
Nevada State Historic Preservation Office, Nevada Cultural Resource Information System, and the Southern Nevada Archaeological Archive
PWCC
Southern Illinois University, Center for Archaeological Investigations
Salt River Project
BLM, Arizona Strip Office
BLM, Southern Nevada District, Las Vegas Office
Bureau of Reclamation, Lower Colorado Region, Boulder City and Phoenix Offices
Coconino National Forest
Kaibab National Forest
Prescott National Forest
Glen Canyon National Recreation Area
OSMRE
Utah State Historical Society

Source: Graves 2015.

Information was collected about the NRHP eligibility status of the cultural resources identified (Graves 2015). Those cultural resources considered historic properties, those not considered historic properties, and those for which NRHP-eligibility has not been evaluated were identified. Documentation for the mine leasehold area was obtained from both OSMRE and PWCC. The records search and literature review did not find supporting documentation for any other sites in the other project components of the study area that were identified through data collection efforts as having been determined eligible for listing in the NRHP. Graves (2015) provides a more in-depth discussion of the NRHP-eligibility data of sites identified during the course of the records search inventory.

Previous surveys of the PWCC mine lease area were conducted in the late 1960s, 1970s, and early 1980s through the Black Mesa Archaeological Project (BMAP). New survey methods and technologies have increased the ability to identify and precisely locate archaeological sites on the landscape. In 2014,

the Data Quality Assessment Survey (DQAS) was conducted on just over 850 acres within areas proposed for mining to evaluate the quality of cultural resources documentation in those areas. The description and results of this survey are reported in the cultural resources records search report (Graves 2015). Locations were selected for survey within the affected lands associated with the five mine areas: J-19, J-21, J-21 West, N-10, and N-11 Extension (**Figure 3.17-2**). The survey evaluated the accuracy of site plots, determined the completeness of prior site identification and site recording, and provided a preliminary assessment of the nature and extent of potential culturally important sites that might not have been identified during or after the BMAP.

In addition to archaeological resources, the literature and records search identified a small number of recorded TCPs within the footprint of the entire study area. These properties comprise only a partial inventory of the total number of existing potential TCPs for the project (Graves 2015). PWCC also has sponsored a number of small-scale ethnographic/TCP investigations within both the former Black Mesa Mine and the Kayenta Mine from 1994 to 2014 (PWCC 2012 et seq.). Information from these studies is included in the discussions and analysis of TCPs.

In addition to the studies described above, several cultural resource studies are underway or planned for the NGS-KMC Project. These studies provide additional information about the distribution and nature of cultural resources throughout the study area and address the data gaps and missing information identified by the inventory and the DQAS (Graves 2015). These additional studies include:

- Ethnographic/TCP and TCL study for the Navajo Nation of proposed mining areas within the proposed KMC. The study consisted of a literature search on the relevant environmental, ethnohistorical, and ethnographic information and data pertaining to the proposed KMC and Black Mesa; collection and analysis if background data; training of three Navajo student interns to assist with project tasks; outreach efforts with Navajo Chapters, medicine men associations, and non-governmental organizations; numerous outreach meetings and interviews with Navajo residents living within the proposed KMC area, as well as follow-up meetings with the same residents to confirm the accuracy of recorded information; site visits and interviews with KMC residents, representatives of Black Mesa United and Black Mesa Review Board, and Chapter House representatives; and development of 7) developed a variety of geographic information systems-enabled maps to assist with the identification of TCPs and characterization of TCLs; 8) transcribed interviews; and 9) begun drafting sections of the ethnographic report.
- Ethnographic/TCP/TCL study for the Hopi Tribe of proposed mining areas, as well as TCP overview for all other portions of the study area. Ethnographers in collaboration with members of the Hopi Tribe, have completed focused fieldwork in coal resource areas N-10, N-11 Extension, J-21, and J-21 West within the Kayenta Mine, as well as portions of the former Black Mesa Mine. The BM&LP Railroad, the NGS facility, WTS, and the STS also have been inspected through a vehicular survey. To date, 49 members of the Hopi Tribe, including tribal members from all 12 Hopi villages and men and women from 23 different clans, have participated in fieldwork and interviews. This collaborative effort has resulted in identification of TCPs in the proposed KMC; documentation of Hopi history and traditions in the broader region to develop a cultural and historical context for Hopi TCPs identified within the study area; evaluation of effects of mining on Hopi TCPs within the proposed KMC and associated facilities under NHPA; 4) identification of direct, indirect, or cumulative impacts that mining may have on the Hopi people under the National Environmental Policy Act; and recommendations on behalf of the Hopi Tribe concerning proposed activities in the proposed KMC. In addition, research has been conducted on water sources and springs within the proposed KMC that are culturally important to the Hopi Tribe and archival research pertinent to the identification and evaluation of TCPs.
- Ethnographic/TCP/TCL overview for the Pueblo of Zuni for the entire NGS-KMC Project study area. This study began in the spring of 2016.

- Ethnographic/TCP/TCL overview of the WTS, STS, and 19 communication sites for Tribes with traditional and on-going religious and cultural practices that intersect the KMC-NGS Project study area. This study will begin during the fall of 2016.
- Intensive, pedestrian cultural resources survey of the entire WTS corridor ROW including access roads. A field survey of the 274-mile-long WTS corridor in Arizona, Nevada, and Utah was completed on February 23, 2016. Approximately 190 sites were identified; approximately half of these 190 sites were newly recorded. Data analysis and report preparation is in progress.
- Intensive, pedestrian cultural resources surveys of the lands not included in the DQAS within the affected lands associated with the proposed mine areas. The survey of Hopi Tribal lands in J-21 West was undertaken from April through June 2016. The survey of Navajo Nation lands in N-10, N-11 Extension, J-19, and J-21 was undertaken in August 2016.

3.17.3.2 Overview: Cultural History and Federally Recognized Tribes

The study area encompasses a vast portion of the U.S. Southwest and traverses a remarkable diversity of the environmental zones and cultural-historical areas in Arizona, Nevada, and Utah. To facilitate this discussion, the study area has been divided into meaningful segments (cultural-environmental areas) based on variability in geography, archaeology, and cultural history (**Figure 3.17-3**). The following discussion is based in a Western normative view of prehistory that has not included Native American views of the prehistoric past. However, the cultural-historical categories used here provide a temporal sequence that contributes to the larger archaeological record of the U.S. Southwest. In order to capture Native American perspectives of the prehistoric past, the ethnographic TCP/TCL inventories will provide an Indigenized cultural-historical temporal sequence that reflects tribal oral histories.

3.17.3.2.1 Cultural-environmental Areas

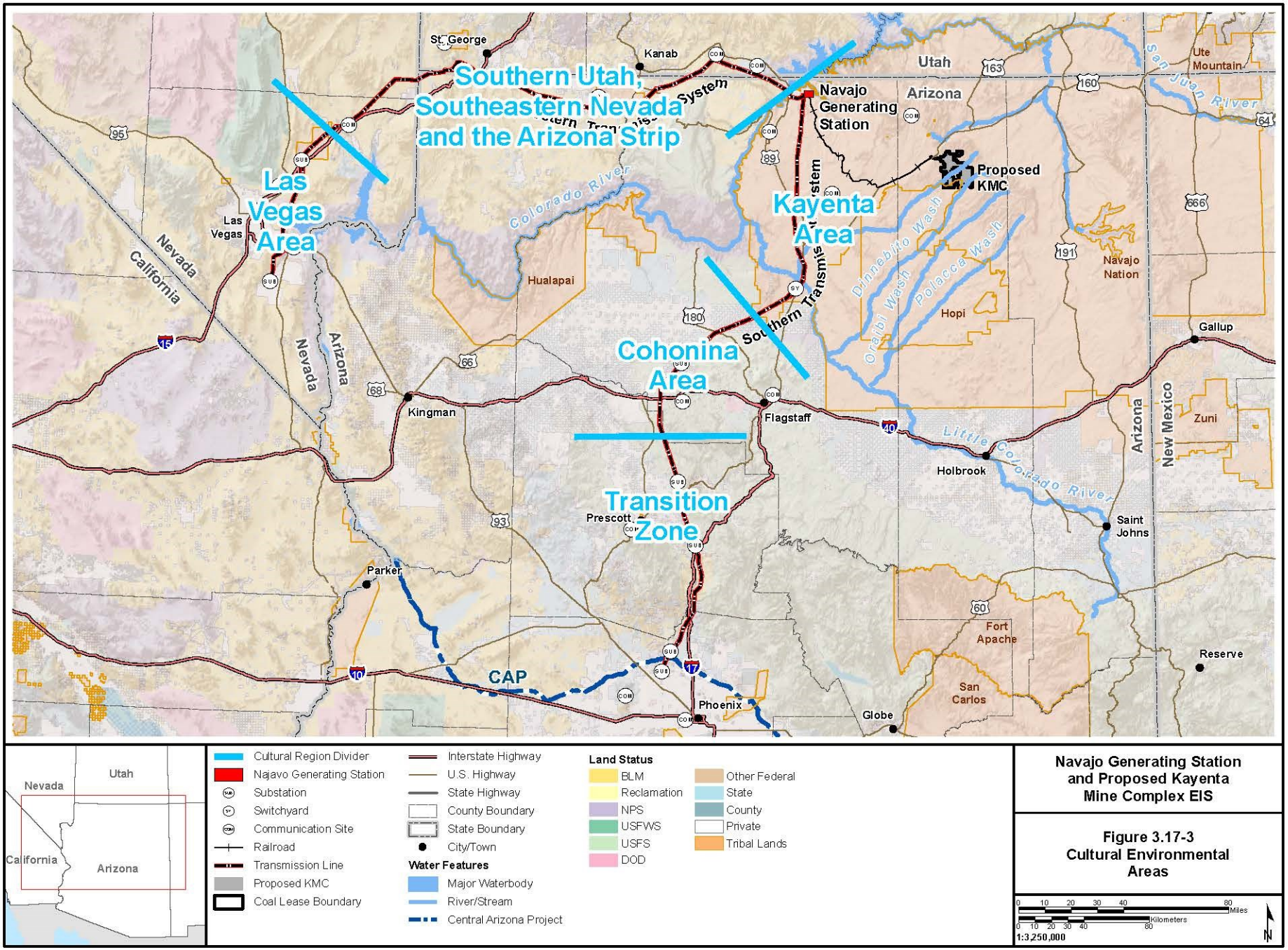
3.17.3.2.1.1 Kayenta Area

The Kayenta Area includes those portions of the study area that lie within the Navajo Nation and the Hopi reservations. Archaeologically, the Kayenta Area has been characterized by a distinctive set of material culture, site structure, and settlement patterns (Dean 1996; Schachner et al. 2012). This was the heartland of the Kayenta Anasazi/Ancestral Pueblo people. Throughout this cultural resource section, the phrase Anasazi/Ancestral Pueblo is used to reflect the preferred terms of the Navajo (Anasazi) and the Hopi (Ancestral Pueblo) for the same archaeological cultural-historical sequence.[1]

3.17.3.2.1.2 Southern Utah, Southeastern Nevada, and Arizona Strip Area

Located west of the Kayenta area, this cultural-environmental area includes the very western extent of the Kayenta Anasazi/Ancestral Pueblo occupation. The Southern Utah, Southeastern Nevada, and the Arizona Strip Area is located approximately between the Colorado River and Kanab Creek, and the Virgin Anasazi/Ancestral Pueblo area, which extends from the Virgin River and Muddy River drainages on the west to Kanab Creek on the east (Lyneis 2000, 1996). This region also is home to the Southern Paiute (Euler 1966; Kelly 1934; Kelly and Fowler 1986).

[1] Navajo Nation recently has requested non-Navajos use the Navajo term “Nihinasaazi” meaning “the Ancestors” rather than the archaeological term, “Anasazi” when referring to the archaeological cultural-historical sequence that occurs on Navajo lands (Ora Marek-Martinez, Navajo Nation Tribal Historic Preservation Officer, correspondence dated July 2015).



Navajo Generating Station and Proposed Kayenta Mine Complex EIS

Figure 3.17-3
Cultural Environmental Areas

7/29/2016

3.17.3.2.1.3 Las Vegas Area

After crossing the Muddy River and entering the Moapa River Indian Reservation, the study area enters the Las Vegas Area. This cultural-environmental area traverses the more arid Mojave Desert, and the archaeological record reflects a mix of Virgin Anasazi/Ancestral Pueblo and Patayan archaeological cultural traits. Historically, the Las Vegas Area has been home to Southern Paiute groups as well as Yuman-speaking groups along the Colorado River (Roberts 2012).

3.17.3.2.1.4 Cohonina Area

South of the Kayenta Area lies the Cohonina Area. This cultural-environmental area extends from the boundary of the Navajo Nation on the north to the approximate edge of the Colorado Plateau and the upper Verde River valley. The Cohonina Area is home to the Cohonina archaeological culture and, during the Late Prehistoric/Protohistoric and Historical periods, was inhabited and used by several Native American tribes, including the Havasupai, the Yavapai, the Navajo, and the Hopi (Cleeland et al. 1992).

3.17.3.2.1.5 Transition Zone

This cultural-environmental area lies south of the Cohonina Area encompassing the portion of central Arizona lying between the desert basins and ranges to the south and the Colorado Plateau to the north (Whittlesey and Ciolek-Torrello 1998). The Transition Zone encompasses a vast and diverse region with considerable topographic relief and environmental and biotic diversity. The Sinagua, Cohonina, Prescott, Central Arizona Tradition, and Hohokam archaeological cultures all are present in this area. The Transition Zone was home territory of the Northeastern Yavapai, and the Yavapai-Prescott Tribe; the Yavapai-Apache Nation reservations also are located in this area.

3.17.3.2.2 Cultural History

3.17.3.2.2.1 Paleoindian Period

Within the areas intersected by the NGS-KMC Project, the beginning dates of the Paleoindian Period range from 11,150 BC to 9,950 BC. Ending dates for this period range from 10,850 BC to 7,050 BC. The Paleoindian Period occupation of the region generally is represented by rare surface or isolated finds of fluted, Clovis-style projectile points similar to other fluted points found throughout the U.S. Southwest and the Great Basin (Roth 2012). Archaeological evidence of the period indicates the existence of an adaptation based on the hunting of large game that concentrated on extinct Pleistocene species of mammoth (Mammuthus), bison (Bison), and other megafauna. Paleoindian Period hunter-gatherers use and occupation of the entire region was sporadic and generally reflects occasional hunting forays into the area by small, mobile groups following the migratory corridors of large game (Jones and Edwards 1994; Roth 2012).

3.17.3.2.2.2 Archaic Period and Basketmaker II/Terminal Archaic Period

Based largely on changing projectile point styles and artifact-assemblage variability, the Archaic Period across the study area is divided into three temporal categories: the Early (9050-7000 BC to 5550-4250 BC); Middle (5500-3500 BC to 2650-2000 BC); and Late (2600-2000 BC to 400 BC-AD 400) Archaic periods. The ranges in the beginning and ending dates of these periods reflect the variation in the changes in the archaeological record that form the basis of the dating of these periods among the cultural-environmental areas the traversed by the study area. In the Southern Utah, Southeastern Nevada, and the Arizona Strip Area and the Kayenta Area, a preceramic Basketmaker II Period (AD 1 to 500) that overlaps the Late Archaic Period has been defined. This period is called the Terminal Archaic in the Las Vegas Area.

During the Early Archaic Period, human groups began to rely less on big-game hunting and more heavily on plant and small-animal resources for subsistence. Overall, the record of the Early Archaic Period across the study area reflects an adaptation focusing on wetland resources and a wide variety of hunted

and gathered resources that required relatively little storage and processing such as grinding, roasting, or parching (Roth 2012). The density of Early Archaic Period sites across the footprint of the study area is low.

There is an increase in the frequencies of sites and isolated surface projectile points that date to the Middle Archaic Period throughout the cultural-environmental areas that intersect the study area. This increase in sites and points may indicate an increase in the size of populations occupying these areas and a more-intensive use of the landscape. A focus on plant processing also is evident in the observed increase and elaboration of ground stone implements recovered from Middle Archaic Period sites (Sayles and Antevs 1941). Overall, the archaeological record of the Middle Archaic Period reflects a hunter-gatherer adaptation where people were still reliant on hunting but were becoming more generalized in their subsistence pursuits and were exploiting a wider variety of food resources compared to earlier time periods.

Subsistence and settlement practices apparently continued to intensify during the Late Archaic Period and the Terminal Archaic and Basketmaker II periods throughout the U.S. Southwest. The frequency of sites appears to increase dramatically from the Middle Archaic Period to the Late Archaic Period and consist of a wide variety of site types including caves and rockshelters, rock art, and open-air artifact scatters. The Late Archaic Period also was a time of residential stability and the formation of village settlements of hunter-gatherers and farmers. Settlement permanency and subsistence strategies intensified during this period, with an increasing reliance on big-game hunting and more intense plant use and processing. The period witnessed decreasing residential mobility and the formation of relatively stable residential campsites.

As early as 2000 BC, domesticated crops arrived in the U.S. Southwest, and groups began to practice agriculture (Huber 2005; Huckell 1996, 1995; Matson 1991; Wills and Huckell 1994). In the Kayenta area, a Late Archaic period hunter-and-gather economy may have existed that was contemporaneous with more agriculturally focused groups dating to the Basketmaker II Period. The possibility of Late Archaic/Basketmaker II Period hunter-and-gather groups and early agricultural groups functioning concurrently also has been suggested in southern Arizona (Huckell 1996) as that region also experienced profound cultural changes during the Late Archaic Period, including the adoption of domesticated-plant resources such as maize. The existence of roughly contemporaneous hunter-gather and farming subsistence strategies during the end of the Late Archaic Period and during the Terminal Archaic/Basketmaker II periods may indicate that different cultural groups inhabited each of the cultural-environmental areas traversed by the study area, or it may indicate that human groups practiced diverse settlement and subsistence strategies and did not rely exclusively on either farming or hunting-and-gathering.

3.17.3.2.2.3 Ceramic Period

The widespread adoption of ceramic technology and the intensification of agricultural practices are hallmarks of the Ceramic Period throughout the study area. The chronology of the Ceramic Period in the Kayenta Area consists of the Basketmaker III Period (ca. AD 550-850), the Pueblo I and II periods (ca. AD 850-1150), and the Pueblo III Period (ca. AD 1150-1300) (the subsequent Pueblo IV Period (ca. AD 1300-1600) is discussed below as part of the Late Prehistoric/Protohistoric Period). The Basketmaker III Period witnessed substantial changes in technology, architecture, settlement, and construction throughout the Kayenta Area, including the widespread adoption of ceramics, farming of maize, the adoption of bow-and-arrow technology, the construction of larger, more-permanent pit houses, and more formal settlement layouts. The Pueblo I Period is characterized by the addition of aboveground masonry storage rooms, ceremonial pit structures or kivas, and formalized site configurations known as unit pueblos (Powell 2002). During the Pueblo II period in the Kayenta area, kiva construction became more standardized and aboveground masonry or jacal (wattle-and-daub) habitation structures were more commonly constructed. By about AD 900, population in the area peaked and settlements were more numerous and widespread. At the beginning of the Pueblo III Period (AD 1150) many of the outlying

parts of the Kayenta Area, such as the Grand Canyon, western Glen Canyon, and the northern Black Mesa areas, were abandoned and populations were concentrated in several core areas, including Long House Valley, Marsh Pass, Tsegi Canyon, Rainbow Plateau/Navajo Mountain, Canyon de Chelly, and the Hopi Buttes (Powell 2002). By the end of the Pueblo III Period (ca. AD 1275-1300), the Kayenta area, along with the overall San Juan Basin, was largely depopulated and many Kayenta groups left their homeland and emigrated to the Hopi Mesas, the Homol'ovi area of the Little Colorado River, and beyond (Adams 2002; Lyons 2003).

The Ceramic Period in the Southern Utah, Southeastern Nevada, and the Arizona Strip Area began with the adoption of agriculture and ended with the prehistoric abandonment of the area by AD 1300. This time period is divided into the Basketmaker III Period (AD 550-850), the Pueblo I Period (AD 850-1000), the Pueblo II Period (AD 1000-1150), and the Pueblo III Period (AD 1150-1300). The Ceramic Period in the Southern Utah, Southeastern Nevada, and the Arizona Strip Area was characterized by the presence of two different archaeological-cultural traditions. The Kayenta Anasazi/Ancestral Pueblo tradition extends west into the eastern portion of the area to roughly Kanab Creek. From Kanab Creek to the Muddy and Virgin River valleys, the Virgin Anasazi/Ancestral Pueblo tradition characterizes the Ceramic Period. The Basketmaker III Period marked a number of important technological changes in the area such as the introduction of bows and arrows and ceramic containers, as well as advances in ground stone technology associated with maize farming (Reed 2000). These developments would have had considerable impacts on hunting, storage, and culinary behaviors. The Pueblo I Period was characterized by increasing population and numerous changes in technology and settlement practices, such as the increasing production and use of decorated ceramics, the introduction and widespread construction of aboveground residential architecture, and the increasing aggregation of populations into small unit pueblo settlements (Fairley 1989; Lyneis 1995). The Pueblo II Period witnessed continued population increase and an expansion of populations into previously unoccupied areas (Euler et al. 1979; Noble 2006; Varien 1999). Sites in the Arizona Strip were culturally diverse and often included cultural markers from both Kayenta Anasazi/Ancestral Pueblo and Virgin Anasazi/Ancestral Pueblo traditions. The eastern portion of the Arizona Strip witnessed a Kayenta intrusion ca. AD 1050 (Gumerman and Dean 1989; Lyneis 1996). In southeastern Nevada, the Pueblo II Period marks the height of the Virgin Anasazi/Ancestral Pueblo occupation. Residential sites such as the Lost City complex provide a wealth of information about lifeways in the Muddy River and Virgin River valleys during this time. By AD 1150, the beginning of the Pueblo III Period, much of southern Utah and the Arizona Strip were completely abandoned (Effland et al. 1981; Euler and Chandler 1978; Lyneis 1996; Schwartz et al. 1980). In the Muddy River and Virgin River valleys, there is evidence for the continuation of Virgin Anasazi/Ancestral Pueblo populations well into the AD 1200s, with abandonment of the area by AD 1300.

The Ceramic Period in the Las Vegas Area includes the Basketmaker III (AD 500-800), Pueblo I (AD 800-1000), Pueblo II (AD 1000-1200), and Pueblo III (AD 1200-1300) periods (Ahlstrom and Roberts 2012). The Basketmaker III and Pueblo I periods are represented by only a few archaeological sites that generally consist of small habitation structures, flaked stone tools, pottery, and domesticated corn remains. The Pueblo II and Pueblo III periods saw a great population increase, similar to contemporary population increases to the east. The Las Vegas Area also had non-Anasazi/Ancestral Pueblo occupations; the area also includes archaeological materials of the Patayan archaeological culture during these periods. The Patayan were located in the Las Vegas area and along the Colorado River (McGuire and Schiffer 1982). Patayan people are believed to be the ancestors of the modern Yuman-language-speaking people who live along the lower Colorado River (Roberts 2012).

The Ceramic Period in the Cohonina Area is defined by the appearance of pottery ca. AD 400 and an overall increase in population until sometime in the 1200s, when the area apparently was abandoned. The Ceramic Period is divided into the Early Ceramic (AD 400-700) and Late Ceramic (AD 700-1300) periods (Lyndon 2005). The early Ceramic period in the Cohonina Area is coeval with the Basketmaker III Period of the Kayenta Area, and evidence of early Ceramic period use and occupation of the area is relatively sparse. Increasing settlement size and permanency, population size, and reliance on agriculture are all evident in the Late Ceramic Period (Sperinck 2009). Aggregated villages consisting

of masonry room blocks are common. Ball courts, an architectural form common in the Hohokam Area to the south, also were introduced into the region and show the local participation in non-local social and ceremonial networks (Sperinck 2009). By the early AD 1200s, Cohonina populations abandoned the area, and the region was apparently uninhabited for more than a century (Schubert 2008).

The Ceramic Period for the Transition Zone is divided into three subperiods, following the cultural-historical framework of the Hohokam archaeological culture: the Early Ceramic Period (AD 200-600), the Pre-Classic Period (AD 600-1150), and the Classic Period (AD 1150-1450). Early ceramic period settlements in the Transition Zone reflect a seasonally based pattern, where people aggregated into small villages for the fall through the spring and then dispersed in the summer months into scattered agriculture-based farmsteads. Mobile populations, seasonally occupied pit houses, and a well-developed ceramic assemblage are all hallmarks of this early period. During the pre-Classic period, large Hohokam communities were established along the southern edge of the Transition Zone. Sites consist of many residential structures, trash mounds, and public architecture (Doyel 1986; Doyel and Elson 1985). Hohokam communities relied on an agricultural economy reflected in a variety of water-control features including canal systems that diverted water from major drainages. Pre-Classic period sites around Prescott and along the Agua Fria drainage represent a melding of cultural traits of local populations with Hohokam colonists from the south. By AD 1150, much of the Transition Zone experienced a dramatic decrease in population. This population decrease may have been the result of climatic changes and decreased rainfall, which led to decreases in agricultural productivity and profound social change. However, around AD 1200, Perry Mesa, between the New River drainage and the Prescott Valley, experienced a dramatic increase in population and the establishment of numerous habitation sites, many located near the edges of the mesa. This dramatic increase in population continued until the early 1400s, when Perry Mesa and the Transition Zone more generally experienced an equally dramatic population decline.

3.17.3.2.2.4 Late Prehistoric/Protohistoric Period

The Late Prehistoric/Protohistoric Period in the U.S. Southwest was a time of important cultural change. Major population movements and abandonments beginning ca. AD 1300 characterize much of the study area. The end of the Late Prehistoric/Protohistoric Period is defined by the arrival of the Spanish into the U.S. Southwest, but the dates for this incursion vary across the overall study area.

In the Kayenta Area, the Late Prehistoric/Protohistoric Period as defined here begins with the Pueblo IV Period, ca. AD 1275-1300, to the arrival of the Spanish ca. AD 1540-1600 (Adams and Duff 2004). The Pueblo IV Period was a time of extensive population dislocation, migration, and aggregation (Adams et al. 2004). Aggregated villages that characterized the Pueblo IV Period surpassed in size the largest of the Pueblo III Period settlements and these villages were almost always parts of larger settlement clusters (Adams and Duff 2004). The Hopi Mesas are located at the extreme southern end of Black Mesa. The villages of the Hopi are arranged in three main groups: First, Second, and Third mesas. Each Hopi Mesa is a distinct settlement cluster that consisted of a primary village associated with several smaller villages. A fourth settlement cluster centered around the Village of Awatovi is located on Antelope Mesa just southeast of First Mesa, but Antelope Mesa was abandoned after AD 1700 (Adams et al. 2004). The Hopi Mesas have been continuously occupied since ca. AD 1200 (Adams 1996).

After the post-1300 abandonment of large parts of the Kayenta Area by Anasazi/Ancestral Pueblo groups, Athabaskan-speaking groups arrived in the area. The exact timing of this arrival is debated, mostly because of a lack of archaeological data (Towner 1996), although most scholars believe that they arrived in the northern portion of the U.S. Southwest sometime between AD 1450 and 1500 (Wilshusen 2010). By AD 1600-1650, a distinct and identifiable Navajo culture emerged in the Dinétah, the Navajo homeland, located in northwestern New Mexico (Wilshusen 2010). By AD 1700, the Navajo occupation of Dinétah was well established, and the Navajo lived in forked-pole hogans and constructed masonry pueblitos; farmed maize, beans, and squash; and raised sheep, goats, and horses (Towner and Heckman 2011).

The Late Prehistoric/Protohistoric Period in the Southern Utah, Southeastern Nevada, and the Arizona Strip Area and the Las Vegas Area begins with the abandonment of the area by Anasazi/Ancestral Pueblo peoples. Historical accounts and archaeological evidence point to the occupation of these cultural-environmental areas by Patayan (ancestral Yuman) and Southern Paiute groups.

In the Cohonina area, archaeological evidence suggests a 100- to 200-year gap between the final Cohonina presence in the region (dated to ca. AD 1300) and the appearance of early northern Pai-speaking hunter-gatherer occupations. The Cohonina Area was used and occupied by several Native American groups during the Late Prehistoric/Protohistoric and Historical periods, including the Hualapai, the Havasupai, the Yavapai, the Navajo, and the Hopi.

Relatively little is known archaeologically of the Late Prehistoric/Protohistoric Period in the Transition Zone, and historical accounts indicate that the portion of the Transition Zone traversed by the NGS-KMC Project crosses through the traditional homeland of three Native American groups; the Hualapai, the Yavapai, and the O'odham (Fontana 1983; Khera and Mariella 1983; McGuire 1983).

3.17.3.2.2.5 Historic Period

The portions of the U.S. Southwest that are traversed by the study area share common elements of historical-period development. The entire region has been witness to numerous Spanish, Mexican, and American exploration efforts. Exploration began with early Spanish colonial forays of the mid-1500s and early 1600s, and though the Spanish utilized travel and supply routes through the region, they implemented only limited colonization efforts. Commercial trade on the routes was encouraged under Mexican rule in the 1800s.

Surveys and expeditions by the U.S. government in the last half of the 19th Century provided mapping and information critical for settlement in the American period. The establishment of local roads in the late nineteenth and early twentieth centuries was critical for the success of remote ranches, mines, and settlements. The growing population of the desert U.S. Southwest required an increasingly complex and dependable transportation system of roads, highways, and railroads linking water sources and connecting population centers. Similarly, electrical transmission lines and communication systems provided necessary infrastructure for the region where settlements were often separated by long distances and away from crucial resources.

Resource exploitation played a major role in the more recent history of the U.S. Southwest. Prospectors spread across the region in search of precious metals after the excitement of the California Gold Rush waned. Settlers took advantage of homestead laws enacted during the late 19th Century; consequently, most of the available arable land with water sources was appropriated. The earliest settlements were limited to areas with reliable water sources, but settlers learned to modify the landscape as well as traditional farming and ranching techniques to improve success under harsh conditions. Mormon colonies were formed in northern Arizona, southern Nevada, and southern Utah. The establishment of National Forests by the U.S. government and the rise of mining and timber industries fueled both economic and population growth throughout the larger region, facilitating ranching, farming and industry in remote areas. At the end of the 19th Century, regional ranching efforts expanded beyond a subsistence economy into commercial farming and stock raising. Increasingly complex water management developments in the late 1800s and early 1900s ranged from local work by irrigation cooperatives to federally-funded dams and hydroelectric plants.

The City of Las Vegas boomed following development of dependable water sources at the turn of the 20th Century, and later with electrical power supplied by completion of Hoover Dam in 1935. Tourism and recreation became an increasingly important part of the economy for the cultural-environmental areas intersected by the study area, including destinations such as the Grand Canyon, Las Vegas, and Lake Mead.

Despite conflicts with U.S. governmental policies, most regional Native American populations have retained their cultural identity and re-established aspects of their sovereignty as independent nations.

3.17.3.2.3 Federally Recognized Tribes

3.17.3.2.3.1 Land-owning Tribes

Elements of the proposed NGS-KMC Project are situated on or traverse portions of tribal land belonging to three federally recognized American Indian tribes: the Navajo Nation, the Hopi Tribe, and the Kaibab Band of Paiute Indians. In addition, the Moapa River Indian Reservation surrounds a portion of the WTS corridor that is managed by the BLM. The presence of archaeological sites, places of religious and cultural significance (TCPs), and human remains within the study area are potential cultural resource concerns for each tribal group.

3.17.3.2.3.2 Aboriginal Territories of Other Tribes

The extensive land use practices of the Zuni people, especially those related to religious practices and long-distance travel and trade, occurred within the traditional territories of the four land-owning tribes (Ferguson and Hart 1985). Although the Pueblo of Zuni does not have reservation land within the study area, TCPs for the Zuni people may be present in or adjacent to project features. Consequently, an ethnographic overview that addresses TCPs is being conducted to identify these places in advance of proposed project undertakings (i.e., at the proposed KMC) and routine O&M on other existing project facilities where no new construction or land disturbance is planned (i.e., NGS, BM&LP Railroad, WTS, STS, and communication sites). This investigation is being conducted in conjunction with the Zuni Tribal Historic Preservation Office.

The traditional territories of other Southern Paiutes Bands, including the San Juan, Kaiparowits, Uinkaret, Shivwits, Saint George, and Las Vegas bands, encompass the route of the WTS and its associated communication sites (Kelly and Fowler 1986). In addition, the traditional territories of other tribal groups, such as the Walapai (a.k.a. Hualapai; McGuire 1983) and Havasupai (Schwartz 1983), may overlap with that of the Southern Paiutes and include the land and TCPs near the WTS. The traditional territories of other federally recognized tribes, including two groups of Yuman speakers (Maricopa and Yavapai; Harwell and Kelly 1983; Khera and Mariella 1983), and the Phoenix-area Pima peoples (Fontana 1983), contain the route of the STS and related Communication Sites. As with the Zunis, none of these tribes own land within the project footprint, but TCPs important to each group may be present. An ethnographic overview that identifies TCPs important to tribal communities who claim connection to the land associated with the project features, especially high places on which Communication Sites exist, will begin in 2016. As with the Zuni study, this study will provide spatial information important to consider as part of O&M of existing project features.

3.17.3.3 Navajo Generating Station

3.17.3.3.1 Archaeological Resources

The cultural resources records search identified seven previous cultural resource investigations located within or intersecting the NGS and associated facilities (**Table 1-2**). For a detailed discussion of survey coverage of the NGS refer to the cultural resources records search report (Graves 2015). These prior investigations include both survey projects and a survey and excavation project conducted by the Museum of Northern Arizona from 1969 through 1971 of the NGS and the BM&LP Railroad (Stebbins 1982; Stebbins et al. 1986; Swarthout et al. 1986). The Museum of Northern Arizona railroad project surveyed “a 413 hectare plant site plus related facilities such as an ash disposal yard, access roads, a water pumping station, and a water pipeline” (Stebbins et al. 1986).

Four archaeological sites have been identified within the NGS and its immediate related facilities. One small site is located at the southern end of the lake pump road (**Figure 1-3**). No information concerning its archaeological-culture/cultural designation, NRHP-eligibility status, site type, or chronological period

was found (Graves 2015). The three other sites were recorded by the 1969-1971 Museum of Northern Arizona survey and excavation project and are located within the ash-disposal area of the NGS. These are two excavated Pueblo II Period Anasazi sites (Stebbins et al. 1986) and one unexcavated early-20th Century Navajo site (Stebbins 1982). The term Anasazi is used here rather than Anasazi/Ancestral Pueblo because the NGS (including the BM&LP Railroad) is located on Navajo Nation land. The NRHP-eligibility status of these three sites is not known. The Museum of Northern Arizona also reported that no archaeological sites were encountered at the NGS plant and that three additional prehistoric sites were found "in ancillary facilities" (Stebbins et al. 1986). These three sites were reported to have been avoided by construction of the NGS and were not excavated. Descriptions of these sites and their locations are not included in the reports resulting from the Museum of Northern Arizona project (Stebbins et al. 1986; Swarthout et al. 1986).

The cultural resources records search identified nine previous investigations within or intersecting the BM&LP Railroad ROW that covered the majority of the footprint of this portion of the study area. This total includes the original survey and excavation of sites by the Museum of Northern Arizona from 1969 through 1971 within the ROW of the railroad before its construction (Stebbins 1982; Stebbins et al. 1986). Including the three sites reported to have been located within the NGS (see discussion above), 123 prehistoric sites and 48 Navajo sites were identified. Fifty-one of the 123 prehistoric sites (Stebbins et al. 1986; Swarthout et al. 1986) and 11 of the 48 Navajo sites (Stebbins 1982) were excavated.

Sixty archaeological cultural resources intersect or are contained within the BM&LP Railroad portion of the study area. This total does not include an additional 16 sites that were identified in the Museum of Northern Arizona records as being part of the original survey of the railroad ROW but lacked locational data (Graves 2015). Because the locations of these cultural resources and their current conditions are not known, they are not included here.

The archaeological sites identified within the BM&LP Railroad portion of the study area are comprised largely of Anasazi and historic Navajo sites (**Table 3.17-6**). Sixty-three percent of the sites in the BM&LP Railroad ROW are Anasazi sites or have an Anasazi component. Although most of the Anasazi sites are dated to the less specifically defined Ceramic Period, 11 Anasazi site records had sufficient description to permit these 11 sites to be assigned to either the Basketmaker periods or the Pueblo periods (**Table 3.17-6**). Approximately 26 percent of cultural resources in the BM&LP Railroad ROW are Historic Period Navajo sites or have a Historic Period Navajo component. No Paleoindian Period, Archaic Period, or Late Prehistoric/Protohistoric Period sites were identified. Anasazi sites in the BM&LP Railroad portion of the study area consist mainly of artifact scatters and artifact scatters with non-linear features that mostly represent the structural remains of habitation structures (**Table 3.17-7**). All of the identified Navajo sites contained features such as hogans, sweat lodges, and corrals (**Table 3.17-7**).

Table 3.17-6 Chronological Period of Archaeological Cultural Resources in the BM&LP Railroad Portion of the Study Area

	Archaeological Cultural Tradition (number of sites)				
Chronological Period	**Anasazi**	**Anasazi and Navajo**	**Navajo**	**Not Specified**	**Total**
Basketmaker Periods (Basketmaker II and/or Basketmaker III)	2	—	—	—	2
Basketmaker Periods and Pueblo Periods	1	—	—	—	1
Pueblo Periods (Pueblo I, Pueblo II, and/or Pueblo III)	8	—	—	—	8
Ceramic Period	25	—	—	2	27
Ceramic Period and Historic Period	—	2	—	—	2

Table 3.17-6 Chronological Period of Archaeological Cultural Resources in the BM&LP Railroad Portion of the Study Area

Chronological Period	Archaeological Cultural Tradition (number of sites)				
	Anasazi	Anasazi and Navajo	Navajo	Not Specified	Total
Unknown Prehistoric Period	—	—	—	1	1
Historic Period	—	—	14	2	16
Unknown	—	—	—	3	3
Total	36	2	14	8	60

Table 3.17-7 Archaeological Site Type of Archaeological Cultural Resources in the BM&LP Railroad Portion of the Study Area

Site Type	Archaeological Cultural Tradition (number of sites)				
	Anasazi	Anasazi and Navajo	Navajo	Not Specified	Total
Artifact(s)	7	—	—	1	8
Artifact(s) and non-linear feature(s)	7	1	4	—	12
Non-linear feature(s)	3	—	8	1	12
Linear feature(s)	—	—	—	1	1
Not enough information	19	1	2	5	27
Total	36	2	14	8	60

Only 2 of the 60 archaeological cultural resources identified in the BM&LP Railroad study area were identified as historic properties during the cultural resources records search. These are two Ceramic Period, Anasazi sites that were recommended eligible for listing in the NRHP by their site recorders. One is an artifact and non-linear feature site; the other is an artifact scatter site. Both sites are located along the eastern end of the railroad in the Klethla Valley, the area of the highest density of archaeological cultural resources along the BM&LP Railroad ROW. Both sites were excavated by the Museum of Northern Arizona survey and excavation project that was conducted prior to railroad construction. The portion of the artifact(s) and non-linear feature(s) site within the railroad ROW was excavated and no unequivocal archaeological features or undisturbed archaeological deposits were identified (Swarthout et al. 1986). The portion of the artifact scatter site within the railroad ROW was partially excavated and only buried artifacts were recovered (Swarthout et al. 1986).

3.17.3.3.2 Architectural Resources

No buildings, structures, or engineering features currently are considered historic properties within the NGS cultural resource study area, including the approximately 80-mile-long fenced corridor containing the BM&LP Railroad. Construction of these facilities began in 1969, and may be eligible for listing as elements of a historic district in the NRHP for their engineering and historical significance when they reach 50 years old.

3.17.3.3.3 Traditional Cultural Properties

No specific places of religious and cultural significance have yet been identified within the NGS study area. However, the Colorado River and San Juan River are considered to be TCPs by the Navajo Nation

(Keur et al. 2015; Martin 2002; Navajo Nation Historic Preservation Department-TCP files), and the nearby confluence of these two rivers, now submerged below Lake Powell, is especially meaningful (Linford 2000). Current and future TCP studies conducted for the Navajo Nation, Hopi Tribe, Pueblo of Zuni, and other tribes with traditional and on-going associations may reveal places of religious and cultural significance that need to be evaluated for their eligibility to the NRHP.

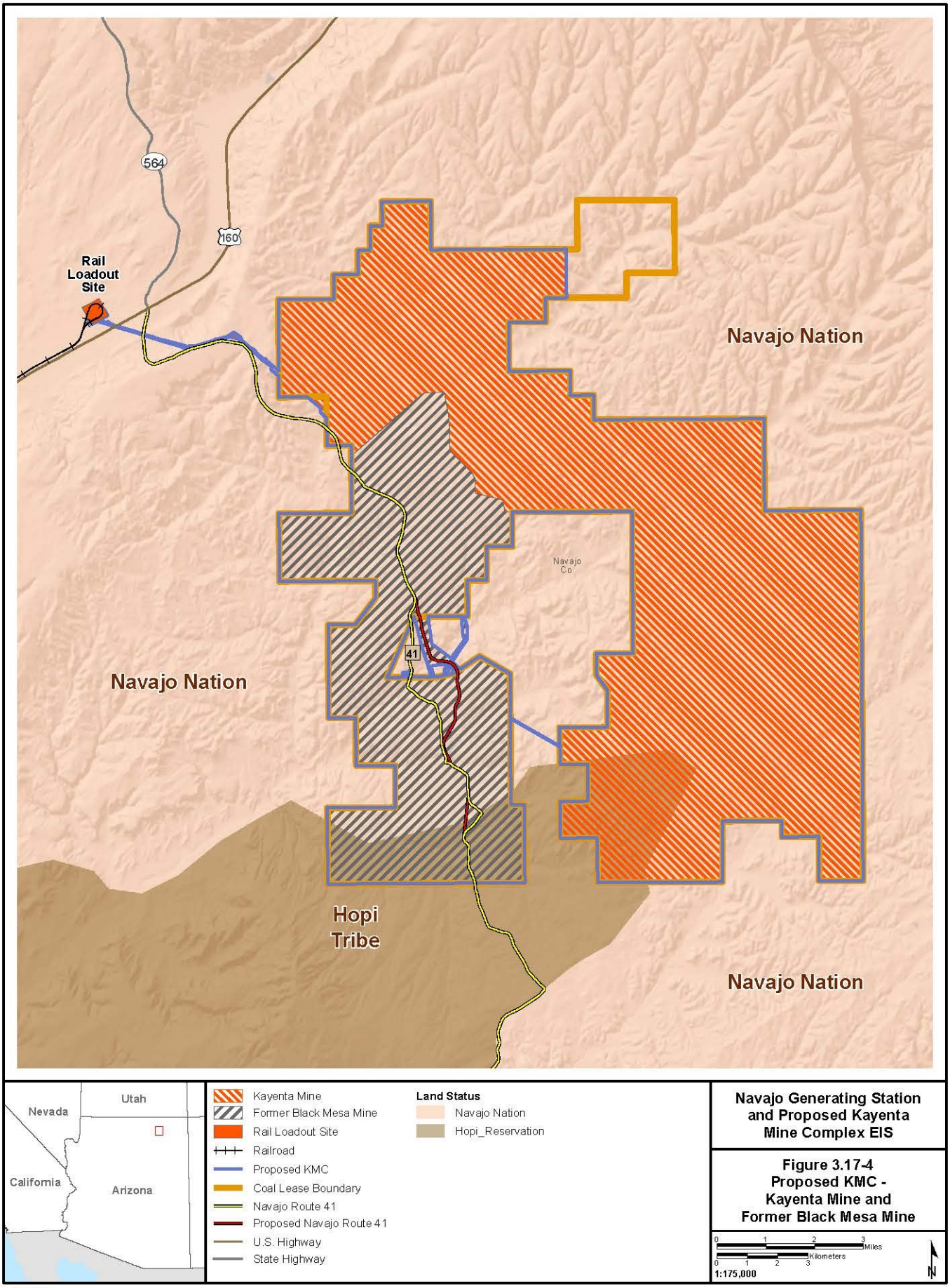
The cultural resources records search effort revealed that the Navajo Nation Historic Preservation Department Traditional Culture Program has identified a single TCP near Cow Springs, Arizona, that may partially intersect the railroad corridor; however, the mapped location was imprecise. On-going ethnographic investigations may confirm the location of this resource (Keur et al. 2015). It is described as a portion of a turquoise trading route, a migration route for certain clans, and a resting place for holy people.

3.17.3.4 Proposed Kayenta Mine Complex

The affected environment for archaeological resources is the entire proposed KMC, which includes the ongoing Kayenta Mine and the former Black Mesa Mine (**Figure 3.17-4**). The affected environment includes both the areas that have been disturbed by mining since the late 1960s and the undisturbed areas proposed for future mining.

Conducted from 1967 to 1987, the BMAP was one of the largest and longest-running archaeological projects in the U.S. Southwest. The BMAP was initiated when the Peabody Coal Company (now the PWCC) obtained a lease to extract coal from the northern end of Black Mesa. Early investigations were directed first by Robert C. Euler (1968) through Prescott College and Fort Lewis College. Later research was directed by George J. Gumerman (1969-1974), Stephen Plog (1975-1977), and Shirley Powell (1978-1987) through Southern Illinois University at Carbondale (Powell et al. 2002).

Over the course of the project, a survey was conducted of the entirety of both the former Black Mesa Mine and the Kayenta Mine, approximately 256 square kilometers or nearly 99 square miles (Powell et al. 1983; Powell and Gumerman 1990). Between 1968 and 1974, surveys were conducted in several areas in the western portion of the mining-lease area. This western lease area includes the former Black Mesa Mine and the northwestern portion of the Kayenta Mine, west of a line bisecting the N-11 Extension mine area. These early surveys of the western lease were conducted on relatively small areas where mining or other development was imminent; it may lack the precision and rigor of later BMAP surveys (Powell and Gumerman 1990). In 1975, a systematic, intensive survey of the entire eastern lease area, which totaled nearly 47 square miles (Powell and Gumerman 1990). From 1975 through 1979, survey of specific areas of the western lease area that were slated for immediate mining or development continued. In 1980, all undisturbed areas remaining in the western lease area were surveyed, whether they had been surveyed in previous field seasons or not. In addition, all non-lease lands between the western and eastern lease areas under Navajo jurisdiction were surveyed in 1980. Non-lease lands south of the Hopi-Navajo boundary under Hopi jurisdiction were not surveyed (Powell and Gumerman 1990).



Navajo Generating Station and Proposed Kayenta Mine Complex EIS

Figure 3.17-4
Proposed KMC - Kayenta Mine and Former Black Mesa Mine

8/8/2016

According to published accounts, approximately 2,700 archaeological sites were identified and recorded by the BMAP (Graves 2015). Of these, between 166 and 188 Prehistoric sites and between 12 and 27 Historic Period sites were excavated (site frequency ranges reflect variation in reported site frequencies; Powell et al. 2002; Powell and Gumerman 1990; PWCC 2012 et seq.). Each year of the BMAP, the information obtained from survey and excavation were compiled into a descriptive report: 1968 (Gumerman 1970); 1969-1970 (Gumerman et al. 1972); 1971-1976 (Powell 1984); 1977 (Klesert 1978); 1978 (Klesert and Powell 1979); 1979 (Powell et al. 1980); 1980 (Andrews et al. 1982); 1981 (Smiley et al. 1983); 1982 (Nichols and Smiley 1984); and 1983 (Christenson and Parry 1985). Later, more-synthetic reports were published based on data from the BMAP (Blomberg 1983; Gumerman 1984; Parry and Smiley 1990; Powell 1983; Powell and Gumerman 1987; Powell and Smiley 2002; Powell et al. 1990a,b), as well as stone artifact (Green 1985; Parry and Christenson 1987), ceramic artifact (Smith 1994), and mortuary analyses (Martin et al. 1991).

Per approved SMCRA permit AZ-0001E, PWCC continues to 1) report the discovery of any previously unrecorded cultural resources to OSMRE and cease work near discoveries until OSMRE determines appropriate disposition, 2) identify and respectfully treat any human remains associated with archaeological sites, 3) take into account any sacred and ceremonial sites brought to the attention of PWCC by local residents, clans, or Tribal government representatives of the Hopi Tribe and Navajo Nation, and 4) sponsor ethnographic and TCP investigations in future disturbance areas (OSMRE 2011, 2008, 1990; PWCC 2012 et seq.).

PWCC provided archaeological site data for the cultural resources records search that included information and locational data for 2,761 sites identified by BMAP. These data were received in January 2014. Of the 2,380 archaeological sites discovered by BMAP in the overall permitted area and included in the PWCC data, 685 were located within the former Black Mesa Mine permit area, and 1,695 were located within the Kayenta Mine permit area. There are an additional 12 sites outside the permit areas but within the PWCC lease area. Prior actions for the former Black Mesa Mine include mining areas and infrastructure construction and operation (e.g., buildings, roads). Existing and current actions for the Kayenta Mine include all mining conducted since inception through 2019 and infrastructure construction and operation (e.g., buildings, roads, conveyors, storage sites) that historically has been used to support the Kayenta Mine. Some facilities constructed within the Black Mesa permit area are used for Kayenta Mine operations. **Table 3.17-8** provides a summary of the number of archaeological sites that have been progressively removed (or avoided) by mining within the former Black Mesa Mine and the Kayenta Mine. The cumulative effects of these past and present mining activities, combined with the Proposed Action mining activities, are further discussed under Section 3.17.4.

Table 3.17-8 Status of Cultural Resources Sites on Former Black Mesa Mine and Kayenta Mine Permit Areas

Site Status	Number of Sites[1]	
	Former Black Mesa Mine[2]	Kayenta Mine through 2019
Archaeological sites identified by BMAP	685	1,695
Number of archaeological sites removed by mining and support infrastructure[3]	139	766
Sites remaining	546	929

[1] Data are from the PWCC archaeological site data acquired for the cultural resources records search in January 2014. Data does not include the 12 sites located outside of the permit areas in Coal Mine Wash but within the PWCC lease area.

[2] Includes infrastructure that was constructed on the former Black Mesa Mine permit area that is still used on the Kayenta Mine.

[3] Includes sites identified as disturbed/mined out in the PWCC data and presumably include sites affected by mining activities and other infrastructure construction and operation (e.g., roads, buildings, conveyor systems, and storage areas).

Since the 1990s, in response to NAGPRA and Tribal legislation, PWCC has sponsored additional investigations at Prehistoric archaeological sites identified by the BMAP as having features with "a high potential to contain human burials" (PWCC 2012 et seq.). PWCC in consultation with the Navajo Nation and the Hopi Tribe developed a procedure to address the likelihood that human remains would be encountered in given archaeological contexts and historic settings. Between 1993 and 2014, 16 projects resulted in the investigation of 60 sites for the presence of human remains and burials (Ballagh et al. 1999a; Ballagh et al. 1999b; Bungart 1997, 2000; Geib and Spurr 2006; PWCC 2012 et seq.; Sandoval 2013b; Spurr 2014, 2006, 2002a, 1999, 1998, 1993; Spurr and Collette 2006; Spurr et al. 2013, 1998; Tsosie 2007). Of these 60 sites, 30 were found to contain human remains. When human remains were encountered, they were either recorded and reburied in locations that would not be disturbed by future mining-related activities (Ballagh et al. 1999a; Geib and Spurr 2006; PWCC 2012 et seq.; Spurr 2014, 2006, 2002a, 1999, 1998, 1993; Spurr and Collette 2006; Spurr et al. 2013, 1998) or fenced and avoided. The Tribes participated in the development of reburial protocols and gave their consent for reburial. These investigations complied with federal laws, including NAGPRA.

From 1994 through 2014, PWCC (2012 et seq.) also sponsored 21 projects within the Black Mesa and Kayenta Mines to identify and record TCPs in areas where mining activities were planned. TCPs are discussed in detail later in this section.

3.17.3.4.1 Data Quality Assessment Survey

The DQAS was conducted in September and October 2014, to survey areas proposed to be mined. Appendix A in Graves 2015, determine how accurately sites were recorded and plotted by BMAP, and determine if additional sites were now detectable. The surveyed locations were associated with the mine areas of the proposed KMC (J-19, J-21, J-21 West, N-10, and N-11 Extension [**Figure 3.17-2**]). Approximately 852 acres across 13 separate survey blocks were surveyed. The total surveyed area constitutes approximately 11 percent of the undisturbed acreage of the affected lands associated with the mine areas and only applied to areas proposed to be mined after 2019; all of the survey blocks had been previously surveyed by BMAP archaeologists.

Thirty-five archaeological sites were identified and recorded during the survey, 10 of which were newly discovered and recorded. The remaining 25 sites were previously recorded by BMAP in the 1970s. According to the site-location data received from PWCC, 31 sites were plotted within the survey blocks. Ten of these sites were found to be not located within the surveyed areas and, in most cases, were just outside of survey blocks covered by the DQAS. The remaining 21 were relocated and re-recorded. Four additional sites recorded by BMAP and plotted outside of the survey blocks in the PWCC site-location data were found to be located within the survey blocks investigated and were re-recorded. Seven of the 25 sites encountered that were previously identified and recorded by the BMAP also had been previously excavated or partially excavated during the BMAP. PWCC operations are in compliance with Chapter 13 of the currently approved Permit Application Package (PWCC 2012 et seq.), which addresses cultural resources.

The original recordings of sites conducted by BMAP in the survey areas were done to high professional standards and were comprehensive in their descriptions. The discovery of newly recorded sites and the inaccurate plotting of some previously recorded sites does not reflect negatively on the quality of site recording or the field methods of BMAP. Rather, their discovery reflects improvements in archaeological detection and recording methods since the 1970s and 1980s and contemporary archaeologists' access to new technologies such as global positioning systems and geographic information systems that more accurately record site locations and site boundaries.

In addition, 62 isolated artifacts, small sets of artifacts, and features were encountered and recorded. Two of the isolates may represent culturally significant features or potential TCPs. These include a culturally modified juniper tree on Navajo Nation land and a potential shrine located on Hopi land (Graves 2015).

Based on the results of the DQAS, new intensive, pedestrian ground surveys will be conducted of all areas proposed for mining (Section 3.17.3.1, Data Collection). These surveys are to be conducted in 2016.

3.17.3.4.2 Archaeological Cultural Resources and Historic Properties

A total of 224 archaeological cultural resource sites were identified by the cultural resources records search and the survey (**Table 3.17-9**). This total excludes those sites already removed by mining and support infrastructure (**Table 3.17-8**). No sites were recorded within the corridors of the two proposed reroute segments of Navajo Route 41 because these areas were previously mined (**Table 3.17-9**). Of the 224 sites identified, 214 were identified as being recorded by BMAP. The remaining 10 sites were newly recorded by the DQAS: 4 in J-21, 4 in J-21 West, and 2 in N-10 (Graves 2015). Given the issue of accuracy in the plotting of previously recorded sites in the proposed KMC, no attempt was made to remove the previously recorded BMAP sites from the total of 214 sites identified in the cultural resources records search.

Table 3.17-9 Data Quality Assessment Survey Results

Mine Component	Archaeological Sites	Eligible Archaeological Sites[1]	Comments
J-19	1	1	—
J-21	14	9	4 of the 14 sites were newly recorded
J-21 West	118	112	4 of the 118 sites were newly recorded
N-10	24	17	2 of the 24 sites were newly recorded
N-11 Extension	67	63	—
Navajo Route 41 Proposed Re-Route Corridors	0	0	—
Total archaeological cultural resources	*224*	*202*	—

[1] Includes those archaeological sites with NRHP status of "determined eligible" or "recommended eligible" in the cultural resources records search (Graves 2015). The NRHP-eligibilities of the 10 newly recorded sites were not evaluated.

Land and facilities affected by prior actions in the proposed KMC and the archaeological cultural resources identified in these locations are listed in **Table 3.17-10**. **Table 3.17-10** does not include sites identified as being removed by mining and support infrastructure (**Table 3.17-8**). Forty-four archaeological sites have been identified within lands in J-19, J-21, and N-9 that will be impacted prior to 2020. Of these 44 sites, 41 have been identified as historic properties. Twelve sites have been identified by the cultural resources records search study as being located within the footprints of the Mesa Central Complex, the N-11 facilities, the Reclamation Complex, and the Silo Complex; and 6 sites have been identified within the conveyor belt corridor. Of these 18 sites, 5 have been identified as historic properties. Any lands impacted prior to 2020 are covered under existing permits and on-going authorizations.

The archaeological cultural resources located within the proposed KMC are either: 1) Anasazi or Ancestral Pueblo sites that date to the Basketmaker and/or Pueblo periods or the more general Ceramic period; or 2) Historical period Navajo sites (**Table 3.17-11**). All archaeological sites identified as Anasazi are located on Navajo Nation lands, and all archaeological sites identified as Ancestral Pueblo are located on Hopi Tribal lands (**Figure 3.17-2**). The majority of Anasazi and Ancestral Pueblo sites contain either artifacts only or combinations of both artifacts and features such as subterranean pit structures or kivas, aboveground storage and habitation rooms, and/or pits or cists. Historic Period Navajo sites

consist of either combinations of artifacts and features (such as hogans, corrals, or sweat lodges) or features without surface artifacts.

Approximately 90 percent of the archaeological cultural resources located within the proposed KMC were identified in the cultural resources records search as historic properties (**Tables 3.17-8** and **3.17-9**). That is, the data compiled during the inventory describe these sites as being either determined or recommended NRHP eligible.

Table 3.17-10 Archaeological Cultural Resources within Lands Affected by Prior Actions in the Proposed KMC

Mine Component	Number of Archaeological Sites	Eligible Archaeological Sites[1]
Lands Impacted Prior to 2020		
J-19	7	7
J-21	26	25
N-9	11	9
Facilities		
Airport	0	0
J-28 Facilities	0	0
Mesa Central Complex	2	0
N-11 Facilities	2	1
N-14 Facilities	0	0
N-8 Facilities	0	0
PWCC Trailer Park	0	0
Reclamation Complex	2	2
Silo Complex	6	0
Conveyor Belt Corridor	6	2
Total archaeological cultural resources	62	46

[1] Includes those archaeological sites with NRHP status of “determined eligible” or “recommended eligible” in the cultural resources records search (Graves 2015).

Table 3.17-11 Archaeological Cultural Resources within the Proposed KMC

Cultural Tradition	Chronological Period	Archaeological Site Type
Anasazi (n = 79)	Basketmaker Periods (Basketmaker II and/or Basketmaker III) (n = 16)	Artifact(s) (n = 109)
Ancestral Pueblo (n = 104)	Basketmaker Periods and Pueblo Periods (n = 9)	Artifact(s) and non-linear feature(s) (n = 100)
Historic Period Navajo (n = 38)	Pueblo Periods (Pueblo I, Pueblo II, and/or Pueblo III) (n = 150)	Non-linear feature(s) (n = 11)
Not specified (n = 3)	Ceramic Period (n = 8)	Not enough information (n = 4)
—	Historical Period (n = 39)	—
—	Unknown Period (n = 2)	—

Note: Frequencies of sites assigned to each value are shown in parentheses. These frequencies represent the total number of sites in areas proposed for mining: J-19, J-21, J-21W, N-10, and N-11 Extension.

3.17.3.4.3 Architectural Resources

No buildings, structures, or engineering features currently are considered historic properties within the 62,930-acre proposed KMC area, including the coal conveyor system and the coal silo facilities. One or more resources may become eligible as elements of a historic district for listing in the NRHP for their engineering and historical significance when they reach 50 years old. A list of facilities appended to the KMC Programmatic Agreement provides a partial list of buildings and structures that, upon reaching 50 years of age, will require evaluation for the NRHP. Their known construction ages range from 1973 to 2005, with more than half of these structures constructed after 1983.

3.17.3.4.4 Traditional Cultural Properties

Efforts to identify TCPs within the Kayenta Mine permit area began in 1994 (Bungart and Livingston 1994a,b) and have continued to the present. When land-disturbance is anticipated, PWCC contracts with ethnographers and archaeologists to investigate specific localities for the presence of places of religious and cultural significance. When such places are identified, local residents are consulted regarding the age, function, and continuing importance of the places. Some of these places are largely unaltered landscape features associated with religious and traditional practices of individuals, families, communities, and clans. Other places are locations of recognizable past or present human activity associated with one or more of these entities (Martin n.d.).

TCPs that appear to be unaltered natural features within the permit area include places associated with events connected to supernatural beings, where resources (e.g., plants, soils, minerals, water) are collected, where offerings are made, and places that have played a part in the life-cycle of an individual (e.g., where a newborn child's umbilical cord is placed). Through consultation with local residents, a number of hills and high points, springs, and ponds; a hawk nesting place; and a lightning-struck tree have been identified as places of traditional and on-going cultural importance. Many of these places are used in conjunction with specific rituals and ceremonies.

TCPs that are places of past or present activity within the proposed KMC include archaeological sites where ancestors once resided and still maintain a spiritual presence as well as a variety of contemporary blessed places. Among these blessed places are hogans, houses, sweat lodges, ramadas, cornfields, domestic animal and game corrals, and trail shrines.

To date, at least 52 places of religious and cultural significance to local individuals and families have been identified within the proposed KMC between 1994 and 2014 (Bungart and Livingston 1994a,b; Dongoske 2001, 1998a,b; Sandoval 2013a,b, 2012, 2011, 2003a,b; Sandoval and Begay 2006; Sandoval et al. 2002; Spurr 2002a, 1998; Spurr and Two Bears 2003; Spurr et al. 2004; Tsosie 2007, 2005; Warburton 1997; Yazzie 2000). However, not all identified places were deemed worthy of in-place protection.

3.17.3.4.5 Human Burials

Historic Period human burials also are places of religious and cultural importance; their importance and treatment is culturally specific. The Navajo Nation refers to gravesites, human remains, and funerary items as *Jishchaa'* and has developed specific guidelines and policies related to the discovery and treatment of human remains and burials. The Hopi Tribe also has specific protocols for addressing the discovery of human remains. To date, the recovery, discovery, and treatment of human remains has been addressed on a case-by-case basis. Some human remains have been relocated after their recovery, and others have been left in place and protected from mining-related activities.

Within the proposed KMC, efforts to locate, record, disinter, and respectfully rebury human remains in new locations where they would not be disturbed in the future began in 1993 (Spurr 1993). At least 96 deceased individuals were identified within the permit area between 1993 and 2014

(Ballagh et al. 1999a,b; Bungart 2000, 1997; Geib and Spurr 2006; Spurr 2014, 2006, 2002a, 2002b, 1999, 1998, 1993; Sandoval 2003a,b; Spurr and Collette 2006; Spurr et al. 2013, 1998; Tsosie 2007).

Twenty-four TCPs, including places with known or expected human burials, are located within or adjacent to mine areas J-19, J-21, J-21 West, and N-9 (**Table 3.17-12**). This does not include Black Mesa itself as a TCP (Keur et al. 2015; Linford 2000; Martin n.d.; Sandoval and Begay 2006). On-going ethnographic work for the Navajo Nation, the Hopi Tribe, and the Pueblo of Zuni may result in the identification of additional TCPs in and near these same proposed mine areas.

Black Mesa as a topographic feature is a TCP. The Navajo Nation includes Black Mesa (Dzł yíjiin) as belonging to a TCP category that includes sacred/offering places and landscapes (Martin n.d.). Black Mesa is understood to be a female mountain (bi'áádii) that symbolizes feminine attributes and imparts this female quality to the wildlife, plants, minerals, and other resources found on this landscape feature (Martin n.d.). For the Navajo Nation, Black Mesa also is a widely acknowledged TCP within the larger Navajo TCL. On-going ethnographic work within the proposed KMC will contribute to the evaluation of Black Mesa itself as a TCP.

Table 3.17-12 Known TCPs and Human Burials Within or Near Proposed KMC Mine Areas

Mine Area	TCPs and Human Remains[1]	Source
J-19	1 (burial)	Bungart 1997
J-21	11 (ceremony sites, offering sites [including 2 archaeological sites], trail shrine, lightning struck trees, isolated burial, and 2 family cemeteries)	Sandoval 2013b; Spurr 2014, 1998, 1997; Spurr et al. 2004; Tsosie 2007
J-21 West	9 archaeological sites likely to contain human remains, at least 3 of these 9 contain village shrines considered TCPs	Dongoske 2001
N-9	3 (2 offering and collection places, 1 hawk nesting place)	Sandoval 2003b; Tsosie 2005
N-10	None as of 2014	—
N-11 Extension	None as of 2014	—

[1] The Navajo Nation does not consider human remains, burials, or other *Jishchaa'* to be cultural resources or TCPs.

3.17.3.5 Transmission Systems and Communication Sites

3.17.3.5.1 Western Transmission System

3.17.3.5.1.1 Archaeological Resources

Two hundred and thirty-two prior cultural resource investigations have been carried out within or intersecting the WTS (Graves 2015). Two of the earliest projects along the WTS are the surveys and excavations conducted for the original construction of the transmission line in Arizona, Utah, and Nevada, which was originally called the Navajo-McCullough Transmission Line. In 1971 and 1972, the Nevada Archaeological Survey at the University of Nevada, Las Vegas, conducted survey and excavations in the portion of the transmission line ROW in Nevada (Brooks et al. 1975). In all, 92 sites were recorded on the survey (Brooks et al. 1975). These consisted of Anasazi/Ancestral Pueblo, Paiute, and Lower Colorado River (i.e., Patayan or Yuman) and Historic Period non-Native American sites. Of these sites, 15 were excavated (Brooks et al. 1975). Work along the Arizona and Utah portion of the Navajo-McCullough Transmission Line was conducted by the Museum of Northern Arizona from 1972 through 1974 (Moffitt et al. 1978). Sixty-two sites were recorded in Arizona and Utah. These resources consist of Virgin Anasazi/Ancestral Pueblo, Kayenta Anasazi/Ancestral Pueblo, and Southern Paiute sites. Of these 62 sites, 32 were fully or extensively excavated.

Despite the extensive prior cultural-resources work conducted along the transmission line ROW, nearly 30 percent of the WTS has not been surveyed for cultural resources (Graves 2015). The pedestrian resurvey of the WTS completed in 2016 will fill gaps in data and provide a more complete view of the nature and distribution of cultural resources in this portion of the study area.

Prior to the resurvey, 129 archaeological cultural resources were identified as being located within or intersecting the WTS (Graves 2015; **Table 3.17-13**). Most of these are located in the portion of the WTS that falls into the southern Utah, southeastern Nevada, and Arizona Strip Area. This area has a higher density of cultural resources than the adjacent Las Vegas Area (Graves 2015). Only a small portion of the WTS lies within the Kayenta Area (**Figure 3.17-3**).

Table 3.17-13 Archaeological Cultural Resources Along the Western Transmission System

Cultural-Environmental Area	Number of Properties		
	Historic	Non-historic	Total
Las Vegas Area	18	17	35
Southern Utah, Southeastern Nevada, and the Arizona Strip Area	23	70	93
Kayenta Area	1	-	1
Total	42	87	129

The majority of archaeological cultural resources identified within or intersecting the WTS date to the Prehistoric Period (**Table 3.17-14**). Thirty-two sites date to the Historic Period or have a Historic Period component, and only 13 sites date to the Ceramic Period. In terms of archaeological site type, the most common types along the WTS are those that consist of artifacts only or artifacts and non-linear features (**Table 3.17-14**). The majority of these are from the Prehistoric Period. Sixteen sites that consist of or contain linear features also were located along the WTS. These sites date primarily to the Historic Period and consist of transmission lines, railroads, canals, roads, and trails. Three sites consist of or contain rockshelters (**Table 3.17-14**). Two of these rockshelter sites are located in Utah and one in Nevada. Only 6 of the 129 sites had information concerning archaeological culture or cultural affiliation. These six were Ceramic Period sites identified as Anasazi/Ancestral Pueblo sites and are located in Nevada and Arizona.

Table 3.17-14 Chronological Period of Archaeological Cultural Resources Along the Western Transmission System

Site Type	Period (number of sites)					
	Ceramic Period	Unknown Prehistoric Period	Unknown Prehistoric Period and Historic Period	Historic Period	Unknown	Total
Artifact(s)	6	59	5	1	—	71
Artifact(s) and non-linear feature(s)	5	10	4	3	—	22
Non-linear feature(s)	—	—	—	1	1	2
Linear feature(s)	—	—	1	8	—	9
Linear feature(s) and artifact(s)	—	1	1	5	—	7
Rock shelter	—	—	—	—	1	1

Table 3.17-14 Chronological Period of Archaeological Cultural Resources Along the Western Transmission System

Site Type	Period (number of sites)					
	Ceramic Period	Unknown Prehistoric Period	Unknown Prehistoric Period and Historic Period	Historic Period	Unknown	Total
Rock shelter and artifact(s)	2	—	—	—	—	2
Not enough information	—	1	—	3	11	15
Total	13	71	11	21	13	129

Of the 129 identified cultural resources within or intersecting the WTS, 42 (or 33 percent) were identified as historic properties; that is, they were identified as being determined or recommended eligible for listing or are listed in the NRHP (**Table 3.17-15**). Identified historic properties are not distributed evenly across the WTS; half of the sites in the Las Vegas Area were identified as being historic properties, while only approximately one-quarter of the cultural resources within the Southern Utah, Southeastern Nevada, and the Arizona Strip Area were identified as such (**Table 3.17-15**). Over half of the historic properties identified in the WTS date to the Prehistoric Period, while approximately one-quarter date to the Historic Period (**Table 3.17-15**). Nearly 70 percent of the historic properties within or intersecting the WTS consists of artifacts and non-linear features. Eight of the 16 sites that consist of or contain linear features and one of the three sites that consist of or contain a rockshelter were identified as historic properties (**Tables 3.17-14** and **3.17-15**).

Table 3.17-15 Historic Properties Along the Western Transmission System

Site Type	Period (number of sites)				
	Ceramic Period	Unknown Prehistoric Period	Unknown Prehistoric Period and Historic Period	Historic Period	Total
Artifact(s)	1	10	3	—	14
Artifact(s) and non-linear feature(s)	3	7	3	1	14
Non-linear feature(s)	—	—	—	1	1
Linear feature(s)	—	—	—	5	5
Linear feature(s) and artifact(s)	—	1	1	1	3
Rock shelter and artifact(s)	1	—	—	—	1
Not enough information	—	1	—	3	4
Total	5	19	7	11	42

Only 2 of the 42 archeological cultural resources identified as historic properties along the WTS in the cultural resources record search are counted among the sites reported as being excavated in the original survey and excavation projects conducted before the construction of the transmission line (Brooks et al. 1975; Moffitt et al. 1978). These two sites were excavated along the Nevada portion of the WTS, and

both date to the unknown Prehistoric Period in the cultural resources records search. One was described as being determined eligible and the other as being recommended eligible.

One of the historic properties in the WTS is a segment of the Old Spanish Trail in Nevada. The Old Spanish Trail is listed in the NRHP as a historic district (McBride and Rolf 2001). However, the segment of the Old Spanish Trail that intersects the WTS is identified as being recommended eligible for listing in the NRHP (Graves 2015) and is not a contributing element to the NRHP-eligibility of the overall property. This segment of the Old Spanish Trail intersects the WTS in three places between the Town of Moapa and Interstate 15 in the Dry Lake Valley. Two of the intersections of the Old Spanish Trail with the WTS occur on the Moapa River Indian Reservation, and the third intersection occurs just south of the reservation at the Crystal Substation.

3.17.3.5.1.2 Architectural Resources

No buildings, structures, or engineering features currently are considered historic properties within the 274-mile-long corridor containing the WTS.

3.17.3.5.1.3 Traditional Cultural Properties

Although the Gypsum Cave site lies outside the WTS corridor, the boundary established for it as a TCP intersects the WTS corridor. No other places of religious or cultural significance have been identified to date within or adjacent to the WTS land corridor. However, the transmission line does cross the Colorado River, which is considered to be a TCP by the Navajo Nation (Navajo Nation Historic Preservation Department-TCP files; Keur et al. 2015; Martin n.d.), among other indigenous tribes of the U.S. Southwest. On-going and future TCP studies conducted for the Navajo Nation, Hopi Tribe, Pueblo of Zuni, and other Tribes regarding the landscape encompassing the WTS may reveal places of religious and cultural significance that need to be evaluated for their eligibility to the NRHP.

3.17.3.5.2 Southern Transmission System

3.17.3.5.2.1 Archaeological Resources

The cultural resources records search revealed that 187 prior cultural resources investigations intersected or were carried out within the STS (Graves 2015). Of these, two investigations focused on nearly the entirety of the transmission line ROW. A survey and excavation project of the transmission line corridor from the NGS to the Westwing substation was conducted before the construction of the STS. Fieldwork was carried out from 1970 through 1973 by the Museum of Northern Arizona (Fiero et al. 1980). A total of 88 sites were identified, and 20 of these 88 sites were excavated. The excavated sites were all prehistoric and consisted of Kayenta, Cohonina, Perry Mesa tradition, and Agua Fria tradition sites (Fiero et al. 1980). In 2007 and 2008, a Class III survey of the STS was conducted along a corridor centered on the midline between the two transmission lines from the NGS to the Westwing substation (Bild et al. 2011; Laurila et al. 2011a, 2011b). In all, 262 cultural resources and 2 in-use Navajo sites were identified and recorded. Of these 262 sites, 79 were previously recorded and 183 were newly recorded (Bild et al. 2011; Laurila et al. 2011a, 2011b). Most of the sites identified and recorded by the Museum of Northern Arizona in the early 1970s were relocated during the 2007 and 2008 survey (Bild et al. 2011; Laurila et al. 2011a).

Three hundred-twenty archaeological cultural resources were identified within or intersecting the STS (**Table 3.17-16**). Frequencies of identified cultural resources are greater in the Cohonina area and the Transition Zone than they are in the portion of the STS that traverses the Kayenta area.

Table 3.17-16 Archaeological Cultural Resources Along the Southern Transmission System

Cultural-Environmental Area	Number of Properties		
	Historic	Non-historic	Total
Kayenta Area	40	29	69
Cohonina Area	56	47	103
Transition Zone	60	88	148
Total	156	164	320

The STS corridor contains a more diverse set of cultural resources than the other project features because of the variety of natural landscapes and culture areas it traverses. Thirteen different individual archaeological cultural traditions (excluding unknown) were identified for 253 of the 320 sites along the STS. Thirty-nine of the 253 sites were multiple component sites with two or more different archaeological cultural traditions assigned. The most numerous cultural resources within the STS in terms of archaeological cultural traditions are single component sites identified as Cohonina, Central Arizona tradition, Euroamerican, Navajo, Anasazi, or Salado. The term Anasazi is used here rather than Anasazi/Ancestral Pueblo because these sites are all located on Navajo Nation land (Graves 2015). All but 15 of the 320 archaeological sites along the STS had information allowing them to be assigned to one or more chronological periods. Thirty-five sites were multiple component sites with two or more different chronological periods assigned. The most numerous cultural resources within the STS in terms of chronological period are sites assigned to the Ceramic Period and sites that date to the Historic Period.

Thirteen different archaeological site types were identified among the 320 sites along the STS (Graves 2015).The most numerous site types are those identified as artifacts or artifacts and non-linear features. Twelve sites along the STS consist of or include rock-art images. All 12 date to the Ceramic Period, have a Ceramic Period component, or are dated less specifically to the Prehistoric Period. Four sites along the STS include rockshelters. Three of these sites are in the Cohonina Area, and one is in the Transition Zone. Rockshelters were identified only at sites that date to the Ceramic Period or have a Ceramic Period component.

Of the 320 archaeological cultural resources identified within or intersecting the STS, nearly half are identified as historic properties in the cultural resources records search. Of these 156 historic properties, the majority (151) were identified as recommended eligible for listing in NRHP. Three sites were identified as having been determined eligible for listing in the NRHP.

The 156 archaeological cultural resources within the STS corridor that have been identified as historic properties are similarly diverse in terms of archaeological cultural tradition, chronological period, and site type as the entire set of 320 identified resources. Relatively high percentages of Ceramic Period and Historic Period sites identified along the STS are historic properties. None of the sites of unknown chronological period were identified as historic properties along the STS.

Two properties listed in the NRHP intersect the STS in the Cohonina Area: the Grand Canyon Railway district and the Ash Fork Hill segment of U.S. Route 66. The rail line of the Grand Canyon Railway crosses the WTS north of Williams, Arizona. A portion of U.S. Route 66 that is listed in the NRHP intersects the STS west of Williams. This abandoned Ash Fork Hill segment of U.S. Route 66, crosses the STS in two segments, one just north of Interstate 40 and the other within the existing ROW of the Interstate 40. The Ash Fork Hill segment of U.S. Route 66 dates to the period 1921 to 1944 and is listed in the NRHP under Criteria A and C (Cleeland 1989).One other segment of U.S. Route 66 also crosses the STS just north of Interstate 40. However, the NRHP eligibility of this segment has not been evaluated, and it is not considered a historic property.

3.17.3.5.2.2 Architectural Resources

No buildings, structures, or engineering features currently are considered historic properties within the 257-mile-long corridor containing the STS.

3.17.3.5.2.3 Traditional Cultural Properties

To date, only a handful of places of religious or cultural significance have been identified near the STS corridor (**Table 3.17-17**). No TCPs have been identified within the corridor ROW. On-going and future TCP studies conducted for the Navajo Nation, Hopi Tribe, Pueblo of Zuni, and other tribes regarding the landscape encompassing the STS may reveal places of religious and cultural significance that need to be evaluated for their NRHP eligibility.

Table 3.17-17 Existing and Potential TCPs near the Southern Transmission System ROW

Existing or Potential TCP	Reference
Echo Cliffs. Place associated with hunting, traditional ceremonial history, game trails, and travel across	Navajo Nation Historic Preservation Department-TCP files; Keur et al. 2015
Gap in Echo Cliffs	Navajo Nation Historic Preservation Department-TCP files; Keur et al. 2015
Unnamed feature on Addition Hill	Navajo Nation Historic Preservation Department-TCP files; Keur et al. 2015
Copper Mine south of Page; place considered to be the “earbob” of the earth figure	Navajo Nation Historic Preservation Department-TCP files; Keur et al. 2015
Unnamed feature east of Cameron along Little Colorado River	Navajo Nation Historic Preservation Department-TCP files; Keur et al. 2015
Unnamed feature between Page and Cameron	Navajo Nation Historic Preservation Department-TCP files; Keur et al. 2015

3.17.3.5.3 Communication Sites

3.17.3.5.3.1 Archaeological Resources

The cultural resources records search identified 37 previous cultural resources investigations within or intersecting 9 of the 15 external communication sites (**Table 3.17-18**). These previous investigations cover approximately one-third of the acreage encompassing the 15 external communication sites (Graves 2015).

Table 3.17-18 Locations of Previous Cultural Resources Investigations at External Communications Sites

External Communication Sites with Previous Investigations	External Communication Sites with No Previous Investigations
Western Transmission System Communication Sites:	
Apex Peak (includes Powerline ROW)	Red Mountain
Glendale	Pipe Springs
Beaver Dam	
Buckskin Mountain	
Glen Canyon	

Table 3.17-18 Locations of Previous Cultural Resources Investigations at External Communications Sites

External Communication Sites with Previous Investigations	External Communication Sites with No Previous Investigations
Southern Transmission System Communication Sites:	
Jack's Peak	Zilnez Mesa
Preston Mesa	Mt. Francis
Mount Elden	White Tanks
Bill Williams Mountain	West Phoenix

Nine archaeological cultural resources were identified in the footprints of four external communication sites (**Table 3.17-19**; Graves 2015). Three sites are located within the study areas of two WTS communication sites: Apex Peak and Buckskin Mountain. Six sites were identified in the study areas of two STS communication sites: Mount Elden and Bill Williams Mountain. Only one of the nine sites was identified as a historic property. This site is located on the Buckskin Mountain communication site and was recommended eligible for listing in the NRHP (**Table 3.17-19**). The cultural resources records search did not identify information suggesting that any of these sites may have been destroyed by communication site construction or operations. Consequently, they are assumed to be still in existence.

Table 3.17-19 Archaeological Cultural Resources at External Communication Sites

Communication Site	Description	NRHP-Eligibility Status
Apex Peak	Prehistoric period rockshelter and artifact(s) site; unknown archaeological-culture/cultural designation	Not evaluated
	Prehistoric period artifact(s) site containing lithic artifacts; unknown archaeological-culture/cultural designation	Recommended not eligible
Buckskin Mountain	Prehistoric period artifact(s) site consisting of lithic artifacts; unknown archaeological-culture/cultural designation	Recommended eligible
Mount Elden	Nonlinear feature(s) site that consists of, or includes, a depression; unknown age and unknown archaeological-culture/cultural designation	Unknown
	Historical period nonlinear feature(s) site consisting of, or including, a cabin; unknown archaeological-culture/cultural designation	Unknown
Bill Williams Mountain	Euroamerican nonlinear feature(s) site described as a government tower	Unknown
	Historical period Euroamerican linear feature(s) site	Unknown
	Historical period site; unknown site type and unknown archaeological-culture/cultural designation	Unknown
	Historical period site; unknown site type and unknown archaeological-culture/cultural designation	Unknown

3.17.3.5.3.2 Architectural Resources

No buildings, structures, or engineering features are currently considered historic properties within the study areas of any of the communication sites.

3.17.3.5.3.3 Traditional Cultural Properties

Places of religious and cultural significance have been identified within or adjacent to several of 15 external communication sites. Bill Williams Mountain, Glen Canyon/Lake Powell, and Zilnez Mesa have been cited by Linford (2000) as places of religious and cultural significance to the Navajo Nation. Mount Elden and Preston Mesa have been recorded as TCPs by the Navajo Nation Historic Preservation Department Traditional Culture Program (**Table 3.17-20**). Bill Williams Mountain also is a place of geographic importance to the Hopi Tribe (Ferguson et al. 1993) and to the Havasupai and Yavapai-Prescott tribes (Lane 2003). On-going and future TCP studies conducted for the Navajo Nation, Hopi Tribe, Pueblo of Zuni, and other Tribes regarding the geographic features on which the communication sites have been built may reveal places of religious and cultural significance that need to be evaluated for their eligibility to the NRHP.

Table 3.17-20 Existing and Potential TCPs at or Near External Communication Sites

Communication Site	Existing or Potential TCP	Reference
Bill Williams Mountain	Navajo TCP. Place associated with Navajo Blessingway Chant; place marking one of the margins of the Hopi heartland and a location associated with migration stories and plant-gathering activities (*Hopi Tutsqwa*); place also important to Hualapai and Yavapai-Prescott people.	Navajo Nation Historic Preservation Department-TCP files; Keur et al. 2015; Ferguson et al. 1993; Linford 2000
Glen Canyon/Lake Powell	Navajo TCP. Place where male-gendered San Juan River joins the female-gendered Colorado River is a very sacred location. The Colorado River is a widely accepted TCP for many tribes.	Linford 2000; Martin n.d.
Mount Elden	Navajo TCP. Elden Spring and Mount Elden; Elden Spring is near the Mount Elden Communication site. Mount Elden is a place associated with ceremonial stories and clan histories associated with Western Water Clan.	Navajo Nation Historic Preservation Department-TCP files; Keur et al. 2015
Preston Mesa	Navajo TCP. Preston Mesa is the location of hunting grounds, prehistoric sites, a location associated with ceremonial stories, and a location for storing ceremonial items.	Navajo Nation Historic Preservation Department-TCP files; Keur et al. 2015
Zilnez Mesa	Navajo traditional wild plant gathering location.	Linford 2000

3.17.3.6 Summary

Information derived from the cultural resources records search and the DQAS identified a total of 825 intact archaeological cultural resources within the entire study area (**Table 3.17-21**). In addition, 28 TCPs are known from the literature review and records search to be within or near the overall project footprint that comprises the entire study area. On-going and future TCP studies conducted for the Navajo Nation, Hopi Tribe, Pueblo of Zuni, and other tribes may reveal additional places of religious and cultural significance that need to be evaluated for their NRHP eligibility. A new archaeological survey of 5 mine areas within the proposed KMC (J-19, J-21, J-21 West, N-10, and N-11 Extension) likely will increase the number of cultural resources for the mine. Per the terms of the KMC Programmatic Agreement, each cultural resource will be evaluated for its eligibility for listing in the NRHP, and the responsible federal agency will be required to collaborate on these determinations with the Navajo Nation Heritage and Historic Preservation Department, Hopi Cultural Preservation Office, and the Zuni Tribal Historic

Preservation Office, as appropriate. These evaluations will result in a new count for historic properties in the proposed KMC study area.

Table 3.17-21 Status of Archaeological Cultural Resources by Project Feature

Project Feature	NRHP Status (number of sites)[1]							
	Listed	Determined Eligible	Recommended Eligible	Determined Not Eligible	Recommended Not Eligible	Not Evaluated	Unknown[2]	Total
NGS	—	—	—	—	—	—	4	4
BM&LP Railroad	—	—	2	—	—	—	58	60
Proposed KMC[3]	—	251	16	8	4	11	13	303
WTS[4]	1	7	34	3	39	23	22	129
STS[4]	2	3	151	1	32	65	66	320
External Communication Sites	—	—	1	—	1	1	6	9
Total	3[5]	261	204	12	76	100	169	825

[1] Data derived from the cultural resources records search report and the results of the DQAS (Graves 2015).

[2] Those archaeological cultural resources identified in the cultural resources records search but lacking information on whether or not they have been evaluated for their NRHP eligibility are assigned to Unknown status.

[3] Sites determined eligible for listing in the NRHP in the proposed KMC are under Criterion D (Graves 2015).

[4] Sites listed in and determined eligible for listing in the NRHP along the WTS and STS are under Criteria A, B, D, D, and various combinations of Criteria (Graves 2015).

[5] The Old Spanish Trail, the Grand Canyon Railway district, and the abandoned Ash Fork Hill segment of U.S. Route 66 are listed in the NRHP.

A new archaeological survey of the WTS and new TCP studies for the NGS, BM&LP Railroad, WTS, STS, and external communication sites are being conducted to improve existing cultural resources inventories and provide information in case of unanticipated discoveries during routine O&M on these facilities. It is likely that additional archaeological sites and TCPs of significance to different Tribes would be identified and would increase the number of identified properties.

3.17.4 Environmental Consequences

3.17.4.1 Issues

The 2014 public scoping process resulted in the identification of several issues related to the impacts to and treatment of cultural resources (Section 1.11). Issues of concern related to cultural resources included potential impacts to archaeological sites and human burials, and physical disturbance to TCPs (including changes in surrounding landscape appearance in relation to those locations) by NGS-KMC Project construction activities (**Table 1-12**). Most cultural resource issues identified during the scoping process and subsequent listening sessions concerned direct and indirect impacts from mining. Comments received during the 2014 scoping process generally addressed concerns resulting from the earlier BMAP work on the Black Mesa and Kayenta mines. Community listening sessions held during July and August of 2014 on Black Mesa also expressed concerns that on-going mining activities were negatively affecting human remains and burials (*Jishchaa'*) and offering places important to Navajo community members living on and near the Kayenta Mine. **Table 3.17-22** summarizes the cultural resource impact issues for the proposed KMC.

Table 3.17-22 Impact Issues Anticipated on the Proposed KMC

Impact Issue	Impact Measurement Parameter (Units)	Applicable Regulatory / Compliance Thresholds
Effects of proposed mining on archaeological sites and historical-period sites	List of NRHP eligible and listed sites defined by cultural resources record search and refined by intensive archaeological survey, inventory, and evaluation.	NHPA-Section 106, Navajo Nation Cultural Resources Protection Act, and Hopi Ordinance 26
Effects of proposed mining on historic buildings and structures	Inventory and NRHP-eligibility evaluation of standing buildings and structures to be transferred to the proposed KMC. These buildings and structures will become 50 years old beginning in 2023.	NHPA–Section 106
Effects of proposed mining on places of religious and cultural significance to Tribes (TCPs) including natural resources such as springs	Inventory of TCPs consider historic properties on the former Black Mesa and Kayenta mines; on-going ethnographic investigations for Navajo, Hopi, and Zuni tribes would result in additional TCPs that would be evaluated for NRHP eligibility.	NHPA–Section 106, American Indian Religious Freedom Act, Executive Order 13007, Navajo Nation Cultural Resources Protection Act, and Hopi Ordinance 26
Effects of proposed mining on human burials	On-going investigations related to the search for and recovery of human remains (or avoidance and protection of human remains) on the proposed KMC.	SMCRA (0 CFR Part 761.11); NAGPRA; Navajo Nation Cultural Resources Protection Act; Navajo Nation Policy for the Protection of *Jishchaa'*: Gravesites, Human Remains, and Funerary Items; and Hopi Ordinance 26

3.17.4.2 Assumptions and Impact Methodology

Potential effects on cultural resources listed in or eligible for listing in the NRHP (i.e., historic properties) are assessed using criteria defined in 36 CFR Part 800 (Protection of Historic Properties), which is the regulation that implements the NHPA of 1966, as amended. 36 CFR Part 800.5(a)(1) defines an adverse effect: "An adverse effect is found when an undertaking may alter, 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... Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative."

Additionally, 36 CFR Part 800.5(a)(2) provides examples of adverse effects and include but are not limited to:

- Physical destruction of or damage to all or part of the property;
- Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR Part 68) and applicable guidelines;
- Removal of the property from its historic location;

- Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features;
- Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
- Transfer, lease, or sale of property out of federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

The thresholds and logic for the intensity of impacts and significance are presented for cultural resources in **Table 3.17-23**. Impact intensity may range from negligible to major for cultural resources. For the purposes of this analysis, when proposed project actions have the potential to damage or destroy archaeological sites, the impact level will be considered moderate if the effect would be readily apparent, tangible, and subject to mitigation measures that considerably reduce the effect. As nonrenewable resources, individual archaeological sites cannot be replaced, but efforts can be undertaken to recover information and materials prior to removal to lessen their loss. Similarly, when proposed actions have the potential to alter, move, or demolish extant architectural features and structures that may qualify as historic properties during the proposed action time period, the impact level will be considered moderate if the effect would be readily apparent, tangible, and subject to mitigation through a variety of data recording methods.

Table 3.17-23 Definitions of Impact Magnitude Determinations for Cultural Resources

Negligible	Minor	Moderate	Major
Properties listed in or eligible for listing in the NRHP would not be directly or indirectly affected. For purposes of NHPA Section 106, the determination would be *no effect*.	Properties listed in or eligible for listing in the NRHP might be directly or indirectly affected, but the effects are unlikely to diminish the location, design, setting, materials, workmanship, feeling, or association that qualify a property for the NRHP. For purposes of NHPA Section 106, the finding of effect would be no historic properties affected or *no adverse effect*.	Properties listed in or eligible for listing in the NRHP could be directly or indirectly affected in a manner that would diminish the integrity of a property's location, design, setting, materials, workmanship, feeling, or association that qualify the property for the NRHP. Following mitigation, for the purposes of NHPA Section 106, the finding of effect would be *adverse effect*, but there is a high likelihood that the effect can be adequately mitigated by treatment developed in consultation with parties participating in the Section 106 review of the project.	Properties listed in or eligible for listing in the NRHP could be directly or indirectly affected in a manner that would diminish the integrity of a property's location, design, setting, materials, workmanship, feeling, or association that qualify the property for the NRHP. For the purposes of NRHP Section 106, the finding of effect would be *adverse effect*, and consulting parties likely would not concur that treatment could be implemented to adequately mitigate those impacts. In such a case, the Lead Agency has to consider how it would meet its Section 106 responsibilities.

For TCPs, when proposed project actions have the potential to alter, damage, or destroy biotic resources, water sources, and landforms considered TCPs by specific cultural groups, the impact level would be considered on a case-by-case basis and could range between minor and major, depending on the ability of that natural resource to recover from sustained impacts. For example, if another location for procuring specific plants, minerals, sediment, or water used in subsistence, religious, or ceremonial activities is acceptable and can be substituted for the original source, then the impact may be considered negligible or minor. If the resource can be relocated away from the impact area and culturally appropriate measures used to reinstate the resource's holiness, then the impact may be considered moderate. This situation would apply to structural features, such as trail shrines, that could regain their sacredness and utility by applying cultural appropriate rituals and ceremonies. However, if original landforms and the entire suite of biotic and abiotic resources associated with that specific place are damaged, destroyed, or encroached upon by incompatible visual, atmospheric, or audible influences caused by project actions, then the impact may be considered major because the effects could either be permanent or have long-term consequences for those who interact with this locality. Similarly, impacts would be considered major to human burials if previously unknown human remains are discovered inadvertently during mining operations.

The two programmatic agreements developed for the NGS-KMC Project define procedures for continuing inventory, evaluating NRHP eligibility, and resolving effects within the study area during project implementation. Execution of the programmatic agreement demonstrates that the responsible federal agency has met the requirements of NHPA Section 106.

3.17.4.3 Proposed Action

3.17.4.3.1 Navajo Generating Station

Under the Proposed Action, operations at NGS would continue from 2020 through decommissioning within the existing footprint and include the historical disturbance by construction of the original 3-Unit Operation power plant and associated support facilities. The ash disposal site is the only facility that could continue to expand into previously undisturbed land under the 3-Unit Operation. The estimated maximum footprint of the ash disposal site was previously investigated for cultural resources and no NRHP eligible or listed historic properties identified were within this area. Impacts to cultural resources would be none or negligible.

No TCP locations within the NGS study area have been identified; however, these facilities share the broader landscape with other human-made features and collectively may be considered to be inconsistent with the values of a TCP within sight of these features. Ethnographic studies currently underway will define the relative sensitivity of various TCPs, should they be identified. The NGS Programmatic Agreement establishes the process for evaluation and treatment of TCPs, which would be undertaken in collaboration with consulting parties, including Tribes.

3.17.4.3.2 Proposed Kayenta Mine Complex

Table 3.17-24 lists the cultural resources potentially affected by the Proposed Action under the 8.1 million tons per year (tpy) Operation. These resources include archaeological sites, architectural resources, TCPs, and currently known or suspected human burials within or adjacent to areas to be mined. This table lists historic properties and potential historic properties that may be impacted by the project. Additional historic properties, including natural and cultural resources considered to be traditional cultural resources, likely will be added to this list as a result of on-going ethnographic and archaeological inventory and evaluation. The first column on the left lists the number of properties that have been formally determined eligible for listing on the NRHP through consultation among agencies, State Historic Preservation Offices, and Tribes (e.g., Levine 1978; Martin n.d.; Graves 2015).The second column lists the number of properties recommended as eligible for listing in the NRHP by archaeologists and ethnographers who conducted cultural resource inventories at the mine through 2014 (Bungart 1997; Dongoske 2001; Sandoval 2013b; Sandoval and Begay 2006; Spurr 2014, 1998, 1997;

Spurr et al. 2004; Tsosie 2007; Graves 2015). The column entitled "not evaluated" lists cultural resources that have been identified in the cultural resources records search as having not been evaluated for their eligibility to the NRHP. The column entitled "unknown status" lists cultural resources identified in the cultural resources records search but lack associated information as to whether they have been formally evaluated for their eligibility to the NRHP. Due to the geographical extent of the mine areas and the variety of the cultural resources potentially affected (archaeological sites, architectural resources, TCPs, and human remains or burials), the impact to cultural resources would be negligible to major.

Table 3.17-24 Eligible Cultural Resources Potentially Affected by the Proposed Action 8.1 Million tpy Operation

Project Feature	Determined Eligible	Recommended Eligible	Not Evaluated	Unknown Status[1]	*Total*
Archaeological Sites[2, 3]	188	14	11	1	*214*
Architectural Resources[4]	0	0	0	0	*0*
TCPs, including Black Mesa as a geographic feature and TCL	1	13	1	0	*15*
Known or suspected human remains in archaeological sites, in family cemeteries, or as protected isolated burials[5,6]	0	13	0	0	*13*
Total	**189**	**40**	**12**	**1**	**242**

[1] Those archaeological cultural resources identified in the cultural resources records search but lacking information on whether or not they have been evaluated for their NRHP eligibility.

[2] Includes those sites identified as historic properties in **Table 3.17-9** as well as other sites with NRHP-eligibility values of "not evaluated" or "unknown".

[3] Archaeological site data are derived from the cultural resources records search report and the results of the DQAS (Graves 2015).

[4] Extant architectural features (buildings and structures) will be evaluated for NRHP eligibility when they reach 50 years old if there is a federal undertaking.

[5] Human remains are considered sacred sites and protected under NAGPRA; they also can be considered TCPs under NHPA, Section 106 and its implementing regulation at 36 CFR Part 800. SMCRA regulation 30 CFR Part 761.11 prohibits mining within 100 feet of a human cemetery if left in place but allows mining to occur if human remains are relocated in accordance with all applicable laws and regulations.

[6] The Navajo Nation does not consider human remains, burials, or other *Jishchaa'* to be cultural resources or TCPs.

Impacts under the 5.5 million tpy Operation would be the same as the 8.1 million tpy Operation except coal resource area N-10 would not be mined, and no effects would occur to cultural resources in that area (**Table 3.17-25**).On-going archaeological inventory and ethnographic studies on behalf of the Navajo Nation, Hopi Tribe, and Pueblo of Zuni may identify additional properties beyond what are included in **Tables 3.17-24** and **3.17-25.** These properties may include Prehistoric and Historic Period archaeological sites and places of on-going religious and cultural significance to Tribes (TCPs). Following the procedures stipulated in the KMC Programmatic Agreement, these additional cultural resources would be evaluated in terms of their NRHP eligibility.

Table 3.17-25 Eligible and Potentially Eligible Cultural Resources Potentially Affected by the Proposed Action 5.5 Million tpy Operation

Project Feature	Determined Eligible	Recommended Eligible	Not Evaluated	Unknown Status[1]	*Total*
Archaeological Sites[2, 3]	175	10	9	1	*195*
Architectural Resources[4]	0	0	0	0	*0*
TCPs, including Black Mesa as a geographic feature and TCL	1	13	1	0	*15*
Known or suspected human remains in archaeological sites, in family cemeteries, or as protected isolated burials[5, 6]	0	13	0	0	*13*
Total	**176**	**36**	**10**	**1**	**223**

[1] Those archaeological cultural resources identified in the cultural resources records search but lacking information on whether or not they have been evaluated for their NRHP eligibility.

[2] Includes those sites identified as historic properties in **Table 3.17-9** (except those in coal resource area N-10) as well as other sites with NRHP-eligibility values of "not evaluated" or "unknown".

[3] Archaeological site data are derived from the cultural resources records search report and the results of the DQAS (Graves 2015).

[4] Extant architectural features (buildings and structures) will be evaluated for NRHP eligibility when they reach 50 years old if there is a federal undertaking.

[5] Human remains are considered sacred sites and protected under NAGPRA; they also can be considered TCPs under NHPA, Section 106 and its implementing regulation at 36 CFR Part 800. SMCRA regulation 30 CFR Part 761.11 prohibits mining within 100 feet of a human cemetery if left in place but allows mining to occur if human remains are relocated in accordance with all applicable laws and regulations.

[6] The Navajo Nation does not consider human remains, burials, or other *Jishchaa'* to be cultural resources or TCPs.

Any impacts on historic properties that may result from the Proposed Action would be resolved through implementation of the stipulations in the KMC Programmatic Agreement. This applies to historic properties and potential historic properties documented as of 2014 (Graves 2015) as well as new historic properties documented by on-going archaeological and ethnographic investigations. These measures to resolve impacts on archaeological sites, historical-period resources, and TCPs could include avoidance, monitoring, or resolving direct and indirect impacts through the development of a Historic Properties Treatment Plan. The Historic Properties Treatment Plan would be developed in consultation with the Tribes, BIA, State Historic Preservation Office, and the parties to the programmatic agreement. Treatment of historic properties would be completed prior to the commencement of any applicable mine-related activity. Thereafter, a treatment report or reports documenting the results of treatment carried out in accordance with the Historic Properties Treatment Plan would be prepared, submitted to applicable agencies, reviewed by agencies and Tribes, finalized, and made available to applicable agencies and institutions.

If architectural remains, including the coal conveyor belt and/or one or more buildings and structures considered part of the proposed KMC facilities, are determined to be eligible NRHP, either individually or as a historic district, then Historic American Building Survey/Historic American Engineering Record or equivalent documentation would be undertaken when continued use of these historic properties may

result in effects. As with development of the Historic Properties Treatment Plan, a Historic American Building Survey/Historic American Engineering Record, or equivalent, would be prepared, submitted to applicable agencies, reviewed by agencies and Tribes, finalized, and made available to applicable agencies and institutions.

The KMC Programmatic Agreement also addresses unanticipated discoveries of cultural resources and encountering unmarked burials and undocumented human remains during mine-related activities. If human remains are encountered during project-related activities, all ground-disturbing activity would cease, the discovery location would be secured, specific protocols for notifying Tribes and agencies would be followed, and appropriate treatments would be undertaken. The KMC Programmatic Agreement specifies the treatment process for these discovery situations as they apply to Navajo Nation and Hopi Tribe surface lands.

3.17.4.3.3 Transmission Systems and Communication Sites

Operation of the WTS and STS would continue for the life of the project. The timing of decommissioning and final reclamation requirements for the WTS and STS ROWs ultimately would be determined by the authorities with responsibility for ROW issuance.

Operation and maintenance activities such as structure and conductor repairs (Chapter 2.0 and **Appendix 1B**) would be conducted by system operators, and the ROW access would be provided by existing service roads that are located within or adjacent to the transmission line corridor and connect to other public roads. The NGS O&M Plan (**Appendix 1B**) outlines the road system used for maintenance, and the procedures to be followed in the event that new surface disturbance would be required. In general, cultural resource surveys would be conducted in any area proposed for new ground disturbance. Coordination with the federal land management agency or land owner would occur before new ground disturbance could begin. These procedures also are contained in the NGS Programmatic Agreement, including those for unanticipated discoveries and notifications.

The existing communication sites would be operated from 2020 to 2044. These sites are fully operational and no additional modifications for the purposes of the Proposed Action would be required. As a consequence, no NRHP eligible or listed historic properties would be affected. Some communication sites are located on high terrain such as mountain tops that have been designated as TCPs. The communication sites represent long-term human-made features at these locations and, as explained in Chapter 2.0, are part of the transmission systems and would remain operational beyond 2020 with or without the proposed project. Cultural resource surveys would be conducted in any area proposed for new ground disturbance. Coordination with the federal land management agency or land owner would occur before new ground disturbance could begin. These procedures also are contained in the NGS Programmatic Agreement, including those for unanticipated discoveries and notifications.

Impacts to cultural resources from ongoing operation of the transmission systems and communication sites would be negligible.

3.17.4.3.4 Project Impact Summary – All Project Components

The study area for evaluating potential environmental impacts to historic properties corresponds to the project limits, as defined by lease and permit boundaries and ROWs, for all elements of the NGS-KMC Project. This includes the NGS and associated facilities, the proposed KMC, and the transmission systems and communication sites. The study area is depicted **Figure 3.17-1** and is described in Section 3.17.2.

The only project component with identified historic properties and potential historic properties that may be impacted by the Proposed Action are located in the proposed KMC (**Table 3.17-26**). The number of resources potentially affected consists of 195 archaeological sites for the 5.5 million tpy Operation and 214 sites for the 8.1 million tpy Operation; 15 TCPs; and 13 human remains (**Tables 3.17-24**

and **3.17-25**). These resource frequencies likely will change depending on the results of the on-going archaeological surveys and TCPs ethnographic studies. Should TCPs of religious and cultural significance to the Tribes be identified within or adjacent to project components or unanticipated archaeological discoveries or discoveries of human remains occur within or adjacent to any project component, then the characterization of impacts in **Table 3.17-26** may change. The NGS Programmatic Agreement addresses these potential situations and outlines the process for addressing newly identified TCPs and unanticipated discovery situations.

Table 3.17-26 Proposed Action Impact Summary to Historic Properties and TCPs

Project Component	Archaeological Sites	Architectural Resources	TCPs	Human Burials
NGS	None	None	None[1]	None[2]
Proposed KMC	Moderate	Moderate	Negligible to Major	Moderate to Major
Transmission Lines and Communication Sites	Negligible	Negligible	Negligible [1]	Negligible [2]

[1] Thus far, none have been identified; however, on-going studies may reveal unidentified TCPs which would trigger Section 106 consideration on a case by case basis.

[2] Unanticipated discoveries would trigger Section 106 consideration on a case by case basis.

3.17.4.3.5 Cumulative Impacts

As with the Proposed Action study area, the study area for evaluating cumulative impacts to historic properties corresponds to the project limits, as defined by lease and permit boundaries and ROWs, for all elements of the NGS-KMC Project. This includes the NGS and associated facilities, the proposed KMC, and the transmission systems and communication sites. The study area is depicted **Figure 3.17-1** and is described in Section 3.17.2.

For the purposes of this analysis, past impacts to cultural resources in the proposed KMC are quantifiable because the number of archaeological sites recorded and the number of sites removed by mining over the life of mining activities are known. For the NGS, transmission systems and communication sites, past impacts to cultural resources cannot be known with the same level of specificity. For those project components, past impacts to cultural resources are estimated by the number of cultural resources recorded by survey projects and subsequently excavated prior to the construction of those project components.

Table 3.17-27 summarizes the impacts to cultural resources resulting from past and present actions, the Proposed Action, and reasonably foreseeable actions. Aside from the construction and use of the NGS and mining operations at the proposed KMC, no other industrial projects or agency actions require consideration as past or present actions because none overlap with the project area. Cumulative impacts to cultural resources are not expected to occur for the vast majority of the project. No ground-disturbing actions from other foreseeable activities overlap with the NGS and associated facilities, the proposed KMC, or the STS and the external communication sites. Ongoing ethnographic studies may identify TCPs for which cumulative impacts need to be considered. TCPs identified in the future would be managed according to guidelines contained in the NGS and KMC programmatic agreements.

Table 3.17-27 Cumulative Impacts to Cultural Resources

Project Component	Past / Present (through 2019)	Proposed Action (2020-2044)	Reasonably Foreseeable Actions
NGS	171 archaeological sites were identified in the survey conducted before the construction of the NGS and the BM&LP Railroad (Stebbins 1982; Stebbins et al. 1986; Swarthout et al. 1986). Of these 171 sites, 62 of these sites were excavated by that project (Section 3.17.3.2).	None. NGS Programmatic Agreement provides guidance for evaluation of effects to TCPs and unanticipated discoveries of historic properties within project area.	None
Proposed KMC	2,380 archaeological sites were identified in the former Black Mesa Mine and Kayenta Mine permit areas. Of these, 905 were removed by mining activity in the former Black Mesa and Kayenta Mines from 1967 to 2014 (**Table 3.17-8**). An additional 44 sites will be removed by mining preparations by 2019 in J-19, J-21, and N-9 (**Table 3.17-10**).	The Proposed Action may potentially affect 195 to 214 archaeological sites (5.5 million tpy and. 8.1 million tpy operations, respectively), 15 TCPs, and 13 human remains (**Tables 3.17-24** and **3.17-25**).	None
Transmission Lines and Communication Sites	154 archaeological sites were identified in the surveys conducted before the construction of the WTS (Brooks et al. 1975; Moffitt et al. 1978). Of these 154 sites, 47 were excavated by those projects (Section 3.17.3.4). 88 archaeological sites were identified in the survey conducted before the construction of the STS (Fiero et al. 1980). Of these 88 sites, 20 of these sites were excavated by this project (Section 3.17.3.4). Construction of external communication sites was not preceded by survey and excavation (Section 3.17.3.4).	None. NGS Programmatic Agreement provides guidance for the identification, evaluation, and treatment of effects to historic properties, TCPs, and human burials as well as unanticipated discoveries of historic properties.	TransWest Express, Southern Nevada Intertie, and Eastern Nevada transmission lines may overlap with select access roads to the WTS. Segments of the Lake Powell water pipeline and transmission line may overlap with the WTS corridor. None for the STS. None for the Communication Sites.

The only portion of the overall project for which cumulative impacts to cultural resources may occur is the WTS. The TransWest Express, Southern Nevada Intertie, and Eastern Nevada transmission lines may be constructed in an existing West-Wide ROW adjacent to the WTS from the vicinity of Mesquite to the Eldorado Valley south of Las Vegas, Nevada (**Figure 3.0-4**). Segments of the Lake Powell water pipeline and transmission line are proposed to overlap with the WTS utility corridor in Coconino County, Arizona, west of Lake Powell (**Figure 3.0-3**).

The primary potential cumulative impacts to cultural resources would be due to disturbance of previously undiscovered archaeological and burial sites with the overlapping use of existing access roads by construction and maintenance equipment for adjacent utility projects sharing the same broadly defined utility corridor. For example, the TransWest Express Plan of Development indicates it would use existing utility corridor roads with short spur roads for transmission line structure construction and operation. Any specific proposals to construct new projects and maintain existing facilities would be coordinated through the responsible BLM or other federal and tribal land management agency offices in Nevada, Utah, and Arizona. Requirement for new roads, maintenance of existing roads, and repair of damaged roads would be developed on a project-specific basis. The net result would be reduced requirements for new access roads, which would reduce the risk of discovery and damage to cultural resources from the road system.

For the WTS, the impact to cultural resources would be negligible to major due to the geographical extent of the study area for cumulative impacts, potential for ground disturbing activities from other projects, and the type of the cultural resources potentially affected. For the remainder of the cumulative study area, the impacts would be none to major, the latter due to the contributions of mine-related disturbance.

3.17.4.4 Natural Gas Partial Federal Replacement Alternative

Under the Natural Gas Partial Federal Replacement (PFR) Alternative, a selected quantity of power between 100 megawatts (MW) and 250 MW would be contracted for under a long-term power purchase agreement from currently unidentified, existing natural gas generation sources, displacing an equivalent amount of power from the federal share of NGS generation. Because the facility is assumed to currently exist, prior disturbance impacts to cultural resources have not been evaluated for that facility.

3.17.4.4.1 Navajo Generating Station

Under the Natural Gas PFR Alternative, impacts to cultural resources at the NGS would not differ from the Proposed Action 3-Unit Operation or 2-Unit Operation. No impacts to historic properties are anticipated (**Table 3.17-26**) because the area has been previously inventoried for cultural resources and minimal additional surface disturbance would be expected.

3.17.4.4.2 Proposed Kayenta Mine Complex

Under the Natural Gas PFR Alternative, impacts to cultural resources at the proposed KMC would not differ from mining 8.1 million tpy to 5.5 million tpy due to the small differences in surface disturbances compared to the Proposed Action. As for the Proposed Action, due to the geographical extent of the mine areas and the type of the cultural resources potentially affected, the impact to cultural resources may be negligible to major (**Table 3.17-26**).

3.17.4.4.3 Transmission Systems and Communication Sites

Operation of the WTS and STS would continue for the life of the project. The timing of decommissioning and final reclamation requirements for the WTS and STS ROWs ultimately would be determined by the authorities with responsibility for ROW issuance.

There would be no impacts to historic properties from the existing transmission systems and communication sites (**Table 3.17-26**) because no changes in the operations of the WTS, STS, or communications sites would occur due to the implementation of the Natural Gas PFR Alternative.

3.17.4.4.4 Project Impact Summary – All Project Components

Impacts to cultural resources would be the same under the Natural Gas PFR Alternative as they would be under the Proposed Action 3-Unit Operation or 2-Unit Operation (**Table 3.17-26**). The only project component with identified historic properties and identified potential historic properties that may be impacted by the Natural Gas PFR Alternative are located in the proposed KMC. The number of

resources potentially affected consists of 195 to 214 archaeological sites; 15 TCPs, and 13 human remains (**Tables 3.17-24** and **3.17-25**). These frequencies of resources will likely change depending on the results of the on-going archaeological surveys and TCPs ethnographic studies. Impacts to cultural resources would range from none to major, depending on the facility type and potential for surface disturbance.

3.17.4.4.5 Cumulative Impacts

Cumulative impacts to cultural resources would be the same under the Natural Gas PFR Alternative as for the Proposed Action 3-Unit Operation or 2-Unit Operation (**Table 3.17-27**) and would occur only for the WTS. The TransWest Express, Southern Nevada Intertie, and Eastern Nevada transmission lines may be constructed in an existing West-Wide ROW adjacent to the WTS from the vicinity of Mesquite to the Eldorado Valley south of Las Vegas, Nevada (**Figure 3.0-4**). Segments of the Lake Powell water pipeline and transmission line are proposed to overlap with the WTS utility corridor in Coconino County, Arizona, west of Lake Powell (**Figure 3.0-3**). The primary potential cumulative impacts to cultural resources would be disturbance of undiscovered archaeological and burial sites with the overlapping use of existing access roads by construction and maintenance equipment for adjacent utility projects sharing the same broadly defined utility corridor. Any specific proposals to construct new projects and maintain existing facilities would be coordinated through the responsible BLM or other federal and tribal land management agency offices in Nevada, Utah, and Arizona. For the WTS, the impact to cultural resources would be negligible to major due to the geographical extent of the study area for cumulative impacts, potential for ground disturbing activities from other projects, and the type of the cultural resources potentially affected. For the remainder of the cumulative study area, the impacts would be none to major, the latter due to the contributions of mine-related disturbance.

3.17.4.5 Renewable Partial Federal Replacement Alternative

Under the Renewable PFR Alternative, a selected quantity of power between 100 MW and 250 MW would be contracted for under a long-term power purchase agreement from a currently unidentified, existing renewable energy power source, displacing an equivalent amount of power from the federal share of NGS generation.

3.17.4.5.1 Navajo Generating Station

Under the Renewable PFR Alternative, impacts to cultural resources at the NGS would not differ from the Proposed Action 3-Unit Operation or 2-Unit Operation. No impacts to historic properties are anticipated (**Table 3.17-26**) because the area has been previously inventoried for cultural resources and minimal additional surface disturbance would be expected

3.17.4.5.2 Proposed Kayenta Mine Complex

Under the Renewable PFR Alternative, impacts to cultural resources at the proposed KMC would not differ from mining 8.1 million tpy to 5.5 million tpy due to the small differences in surface disturbances compared to the Proposed Action. As for the Proposed Action, due to the geographical extent of the mine areas and the type of the cultural resources potentially affected, the impact to cultural resources may be negligible to major (**Table 3.17-26**).

3.17.4.5.3 Transmission Systems and Communication Sites

Operation of the WTS and STS would continue for the life of the project. The timing of decommissioning and final reclamation requirements for the WTS and STS ROWs ultimately would be determined by the authorities with responsibility for ROW issuance.

There would be no impacts to historic properties from the existing transmission systems and communication sites (**Table 3.17-26**) because no changes in the operations of the WTS, STS, or communications sites would occur due to the implementation of the Renewable PFR Alternative.

3.17.4.5.4 Project Impact Summary – All Project Components

Impacts to cultural resources would be the same under the Renewable PFR Alternative as they would be under the Proposed Action 3-Unit Operation or 2-Unit Operation (**Table 3.17-27**). The only project component with identified historic properties and identified potential historic properties that may be impacted by the Renewable PFR Alternative are located in the proposed KMC. The number of resources potentially affected consists of 195 to 214 archaeological sites, 15 TCPs, and 13 human remains (**Tables 3.17-24** and **3.17-25**). These frequencies of resources will likely change depending on the results of the on-going archaeological surveys and TCPs ethnographic studies. Impacts to cultural resources would range from none to major, depending on the facility type and potential for surface disturbance.

3.17.4.5.5 Cumulative Impacts

Cumulative impacts to cultural resources would be the same under the Renewable PFR Alternative as for the Proposed Action 3-Unit Operation or 2-Unit Operation (**Table 3.17-27**) and would occur only for the WTS. The TransWest Express, Southern Nevada Intertie, and Eastern Nevada transmission lines may be constructed in an existing West-Wide ROW adjacent to the WTS from the vicinity of Mesquite to the Eldorado Valley south of Las Vegas, Nevada (**Figure 3.0-4**). Segments of the Lake Powell water pipeline and transmission line are proposed to overlap with the WTS utility corridor in Coconino County, Arizona, west of Lake Powell (**Figure 3.0-3**). The primary potential cumulative impacts to cultural resources would be disturbance of previously undiscovered archaeological and burial sites with the overlapping use of existing access roads by construction and maintenance equipment for adjacent utility projects sharing the same broadly defined utility corridor. Any specific proposals to construct new projects and maintain existing facilities would be coordinated through the responsible BLM or other federal and tribal land management agency offices in Nevada, Utah, and Arizona. For the WTS, the impact to cultural resources would be negligible to major due to the geographical extent of the study area for cumulative impacts and the type of the cultural resources potentially affected. For the remainder of the cumulative study area, the impacts would be none to major, the latter due to the contributions of mine-related disturbance.

3.17.4.6 Tribal Partial Federal Replacement Alternative

Under the Tribal PFR Alternative, between 100 MW and 250 MW of power generation from the NGS would be replaced by power supplied by a new photovoltaic generation facility on tribal land, displacing an equivalent amount of power from the federal share of NGS generation. The construction of a new photovoltaic generation site on tribal land would result in between 1,200 and 3,000 acres of new surface disturbance. The Tribal PFR facility would be analyzed in a separate National Environmental Policy Act process once a facility location is identified. If this alternative is selected, the new 1,200-acre or 3,000-acre photovoltaic construction project would meet its NHPA Section 106 obligations through the standard 36 CFR Part 800 regulations.

3.17.4.6.1 Navajo Generating Station

Under the Tribal PFR Alternative, impacts to cultural resources at the NGS and Associated Facilities would not differ from the Proposed Action 3-Unit Operation or 2-Unit Operation. No impacts to historic properties are anticipated (**Table 3.17-26**) because the area has been previously inventoried for cultural resources and minimal additional surface disturbance would be expected.

3.17.4.6.2 Proposed Kayenta Mine Complex

Under the Tribal PFR Alternative, impacts to cultural resources at the proposed KMC would not differ from mining 8.1 million tpy to 5.5 million tpy due to the small differences in surface disturbances compared to the Proposed Action. As for the Proposed Action, due to the geographical extent of the mine areas and the type of the cultural resources potentially affected, the impact to cultural resources may be negligible to major (**Table 3.17-26**).

3.17.4.6.3 Transmission Systems and Communication Sites

Operation of the WTS and STS would continue for the life of the project. The timing of decommissioning and final reclamation requirements for the WTS and STS ROWs ultimately would be determined by the authorities with responsibility for ROW issuance.

There would be no impacts to historic properties from the existing transmission systems and communication sites (**Table 3.17-26**) because no changes in the operations of the WTS, STS, or communications sites would occur. Additional transmission system components to connect a new photovoltaic generation site on tribal land to the electric grid would be addressed under a subsequent National Environmental Policy Act action.

3.17.4.6.4 Project Impact Summary – All Project Components

Impacts to cultural resources would be the same under the Tribal PFR Alternative as they would be under the Proposed Action 3-Unit Operation or 2-Unit Operation (**Table 3.17-26**). The only project component with identified historic properties and identified potential historic properties that may be impacted by the Tribal PFR Alternative are located in the proposed KMC. The number of resources potentially affected consists of 195 to 214 archaeological sites, 15 TCPs, and 13 human remains (**Tables 3.17-24** and **3.17-25**). These frequencies of resources will likely change depending on the results of the on-going archaeological surveys and TCPs ethnographic studies. The construction of a photovoltaic site and intertie ROW estimated to potentially disturb 1,200 to 3,000 acres (Section 2.3.2.3.) would necessitate the definition of a new area of potential effects that would be subject to federal historic preservation requirements as well as the requirements of applicable state and tribal laws (**Table 3.17-1**). The obligation to address these laws would be handled as a separate action overseen by the responsible federal agency to meet its NHPA Section 106 obligations through the standard 36 CFR Part 800 regulations. Impacts to cultural resources would range from none to major, depending on the facility type and potential for surface disturbance.

3.17.4.6.5 Cumulative Impacts

Cumulative impacts to cultural resources would be the same under the Tribal PFR Alternative as for the Proposed Action 3-Unit Operation or 2-Unit Operation (**Table 3.17-27**) and would occur only for the WTS. The TransWest Express, Southern Nevada Intertie, and Eastern Nevada transmission lines may be constructed in an existing West-Wide ROW adjacent to the WTS from the vicinity of Mesquite to the Eldorado Valley south of Las Vegas, Nevada (**Figure 3.0-4**). Segments of the Lake Powell water pipeline and transmission line are proposed to overlap with the WTS utility corridor in Coconino County, Arizona, west of Lake Powell (**Figure 3.0-3**). The primary potential cumulative impacts to cultural resources would be due to disturbance of previously undiscovered archaeological and burial sites with the overlapping use of existing access roads by construction and maintenance equipment for adjacent utility projects sharing the same broadly defined utility corridor. Any specific proposals to construct new projects and maintain existing facilities would be coordinated through the responsible BLM or other federal and tribal land management agency offices in Nevada, Utah, and Arizona. For the WTS, the impact to cultural resources would be negligible to major due to the geographical extent of the study area for cumulative impacts and the type of the cultural resources potentially affected. For the remainder of the cumulative study area, the impacts would be none to major, the latter due to the contributions of mine-related disturbance.

3.17.4.7 No Action

3.17.4.7.1 Navajo Generating Station

Under the No Action Alternative, power production at NGS would cease after 2019 unless the Navajo Nation continues NGS operations. As described in the NGS O&M Plan (**Appendix 1B**), the NGS and its associated facilities, including the BM&LP Railroad, would be decommissioned. As described in Section 2.3.1.1, operating and support facilities at the plant site would be dismantled and demolished to

ground level over a several year period. The water supply facilities and certain buildings and equipment would remain in place, per the 1969 Lease and Lease Amendment No. 1 with the Navajo Nation (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1) Except for hazardous materials and material salvaged, recycled, or sold for scrap, it is anticipated that demolished structural material would be placed within a landfill area on the NGS site and covered with soil.

As required by the 1969 Lease, the land would be restored as closely as possible to original condition where the surface of any leased land has been modified or improved. The areas that do not contain permanent facilities would have all nonindigenous material removed from the surface, and the area would be filled and graded in order to provide proper drainage; however, there would be no attempt to return the leased lands or the ROW to the preconstruction elevations. All restored land would be covered with local topsoil and revegetated with native plants to meet the lease requirements.

Decommissioning of the BM&LP Railroad would involve removal of overhead power lines, rails, and ties; applying soil to the roadbed; and reseeding. The railroad embankment would not be modified; but would be allowed remain in accordance with the lease provisions.

Given the absence of historic properties within the NGS study area (**Table 3.17-21**) and the duration of historic disturbance since the late 1960s, it is unlikely that archaeological resources would be encountered during demolition, dismantling, salvaging, or scraping of project buildings and structures, as well as grading, closing, and capping of landfills and treatment ponds. Nevertheless, actions related to cultural resources are addressed in the NGS Programmatic Agreement and Reclamation, in consultation with Navajo Nation Heritage and Historic Preservation Department and the BIA-Navajo Region, would ensure that all Section 106 requirements would be met for the decommissioning phase of the project. Therefore, decommissioning activities would have a negligible impact on cultural resources.

3.17.4.7.2 Proposed Kayenta Mine Complex

Under the No Action Alternative, mining operations within the Kayenta Mine lease area would cease before the end of 2019. Final site reclamation will take place 2 to 3 years after cessation of mining. Disposition of mine facilities and lands affected by mining would be expected to take approximately 10 to 15 years after mining ends to allow for the reclamation and bond release period (a minimum of 10 years after reclamation pursuant to SMCRA).

Under this alternative, anticipated impacts from project actions to extant archaeological sites and known TCPs and human remains would be negligible (**Tables 3.17-8, 3.17-9,** and **3.17-11**). Disturbance to an estimated 195 to 214 archaeological sites, 15 or more TCPs, and 13 human burials associated with 7,160 acres (**Table 3.17-4**) under the Proposed Action and all PFR alternatives would be avoided, resulting in greatly reduced impacts to existing cultural resources. Actions related to cultural resources, mine site reclamation, and decommissioning of mine facilities are addressed in the KMC Programmatic Agreement. The OSMRE, in consultation with the Navajo Nation Heritage and Historic Preservation Department, Hopi Tribe's Cultural Preservation Office, BIA-Navajo Region, and BIA-Western Region, would ensure that all Section 106 requirements were met for decommissioning.

3.17.4.7.3 Transmission Systems and Communication Sites

The NGS transmission system is an established part of the western U.S. transmission grid and supports reliability and delivery of power throughout the region, well beyond the power generated by the NGS. Therefore, under the No Action Alternative it is likely that that one, several, or all of the land owners/managers of the transmission line rights-of-way and communication site leases would renew some portion of the facilities to keep the power grid performing as expected.

In the event it is determined that some or all of the transmission systems and communication site ROWs are not renewed, a lengthy study and permitting process would need to occur before any decommissioning is initiated due to the essential and integral nature of these facilities with the western electric grid. As noted in

Section 2.3.3, up to 4,826 acres within and alongside the transmission system corridors could be temporarily disturbed if the entirety of the transmission systems and communication sites were decommissioned and removed.

3.17.4.7.4 No Action Impact Summary – All Project Components

Under the No Action Alternative, project-related impacts to historic properties listed in or potentially eligible for listing in the NRHP would not occur. Potential impacts to cultural resources could occur during decommissioning of project facilities or through construction of new Central Arizona Project transmission lines. The NGS and KMC programmatic agreements address decommissioning for all project components and direct the responsible federal agencies to consult with federal, state, Tribal, municipal and private landowners to address Section 106 requirements.

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Section 3.18

Socioeconomics

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Acronyms and Abbreviations

1969 Lease	Navajo Project Indenture of Lease
BART	Best Available Retrofit Technology
BEA	U.S. Bureau of Economic Analysis
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BM&LP Railroad	Black Mesa & Lake Powell Railroad
BMRB	Black Mesa Review Board
BO	Biological Opinion
CAP	Central Arizona Project
CAWCD	Central Arizona Water Conservation District
CDP	Census Designated Places
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO_2	carbon dioxide
Co-tenants	Salt River Project, Arizona Public Service Company, NV Energy, and Tucson Electric Power Company
Development Fund	Lower Colorado River Basin Development Fund
EIA	U.S. Energy Information Administration
EIS	Environmental Impact Statement
ERA	Ecological Risk Assessment
ESA	Endangered Species Act of 1973
FCPP	Four Corners Power Plant
HHRA	Human Health Risk Assessment
km	kilometer
KMC	Kayenta Mine Complex
kV	kilovolt
kW	kilowatt
M&I	municipal and industrial
MW	megawatt
N-Aquifer	Navajo Aquifer
NEPA	National Environmental Policy Act of 1969, as amended
NGO	Non-governmental organization
NGS	Navajo Generating Station
NGS Participants	U.S. (Reclamation), Salt River Project, Arizona Public Service Company, NV Energy, and Tucson Electric Power Company
NHPA	National Historic Preservation Act
NNEPA	Navajo Nation Environmental Protection Agency
NO_2	nitrogen dioxide
NO_X	nitrogen oxide
NREL	National Renewable Energy Laboratory

NTUA	Navajo Tribal Utility Authority
O&M	operation and maintenance
OSMRE	Office of Surface Mining Reclamation and Enforcement
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PFR	Partial Federal Replacement
PWCC	Peabody Western Coal Company
Reclamation	U.S. Bureau of Reclamation
ROW	Right-of-way
SO_2	sulfur dioxide
SRP	Salt River Project Agricultural Improvement and Power District
STS	Southern Transmission System
TPT	transactions privilege tax
TW	Terawatt
U.S.	United States
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
WTS	Western Transmission System

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3.18 Socioeconomics

This section describes social and economic conditions and assesses the temporary and long-term direct, indirect, and cumulative effects of the Proposed Action, Partial Federal Replacement (PFR) alternatives, and the No Action Alternative. Information is provided for population and demographics, social conditions, and economic and fiscal conditions including those associated with the Navajo Generating Station (NGS) and proposed Kayenta Mining Complex (KMC) (sometimes referred to as the "two facilities").

3.18.1 Regulatory Framework

The National Environmental Policy Act (NEPA) requires that social and economic conditions be addressed, although they are not subject to direct regulation or management by the federal government. The Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of the NEPA state:

> "Human environment" shall be interpreted comprehensively to include the national and physical environment and the relationship of people with that environment. This means that economic or social effects are not intended by themselves to require preparation of an Environmental Impact Statement (EIS). When an EIS is prepared and economic or social and natural or physical environmental effects are interrelated, the EIS shall discuss these effects on the human environment (40 Code of Federal Regulations § 1508.14).

Specific supplemental guidance or requirements for assessing socioeconomic effects of proposed actions and alternatives in the context of an EIS has not been published by U.S. Bureau of Reclamation (Reclamation), Office of Surface Mining Reclamation and Enforcement (OSMRE), Bureau of Indian Affairs (BIA), the Navajo Nation, nor the Hopi Tribe. Social and economic conditions commonly are recognized and assessed as part of a wide variety of federal, state, and local planning and management processes.

3.18.2 Study Area

The study area for the socioeconomic assessment includes the geographic region that encompasses the NGS-KMC Project facilities, nearby areas and communities in which most employees of the existing NGS and Kayenta Mine do and would be expected to reside in the future, those communities most directly affected by economic and fiscal linkages to the two facilities, and those governmental institutions likely to be affected by the Proposed Action or alternatives, including No Action. The study area also encompasses those areas in Arizona, Utah and Nevada transected by the transmission system corridors. The study area recognizes the relationship between the United States (U.S.) share of power from NGS and operation of the Central Arizona Project (CAP) would indirectly affect some social and economic conditions in central and southern Arizona that are far removed geographically and in their social and economic settings from that which characterizes the project locations and surroundings in northeastern Arizona. The result of the above is an expansive geographic area that constitutes the study area for socioeconomics. However, the anticipated effects within the overall study area requires the analysis to be more focused within the broader area.

The geographic area of principal focus for socioeconomics includes the Navajo Nation, Hopi Reservation, and northern Coconino and Navajo counties, Arizona. The primary segment for socioeconomic analysis includes the Navajo chapters surrounding NGS, the proposed KMC and the Navajo chapters and portions of the Hopi Reservation surrounding it, and nearby off-reservation communities in the two counties, particularly Page[1] (**Figure 3.18-1**). This segment of the study area encompasses the region where current direct social and economic effects associated with the NGS and proposed KMC are concentrated, and where changes associated with the Proposed Action and alternatives would be focused. Consideration of key fiscal effects associated with the two facilities focuses on the affected tribal and local governments and public service entities serving the area.

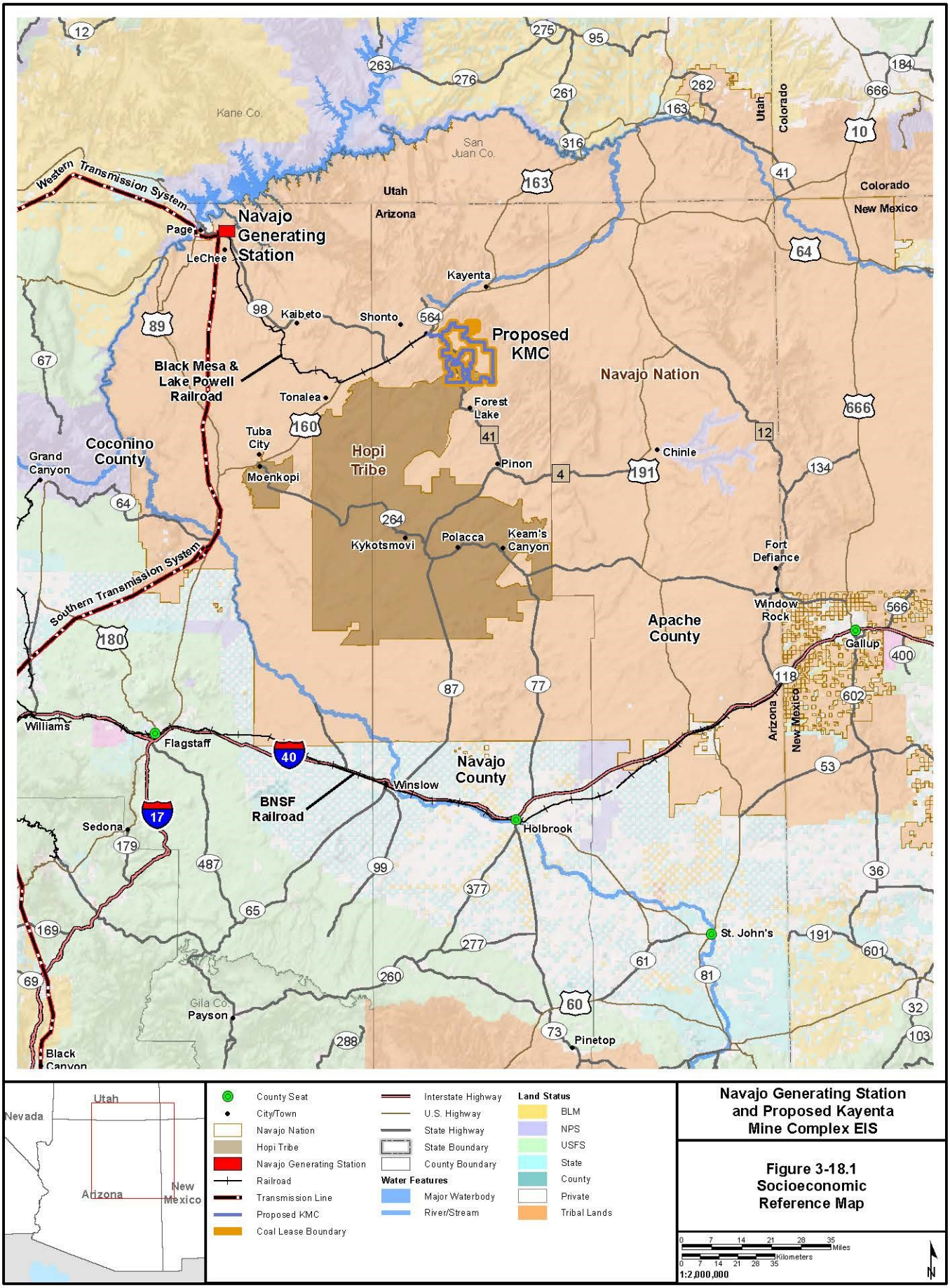
The Navajo Nation encompasses 16.22 million acres in three states – Arizona, New Mexico, and Utah. Approximately 70 percent of that total area is in Arizona. The Navajo Nation is organized into 110 chapters which represent the basis for local governance on the Navajo Nation. The Hopi Reservation, which is located entirely in Arizona, is approximately 1.56 million acres. Most Hopis live in 12 villages, located on three regions on the Hopi Reservation. **Figure 3.18-2** shows the geographical location of the major project components, adjacent and nearby Navajo Nation chapters, the Hopi Reservation and villages, and the nearby off-reservation areas.

The portion of the study area affected by the established right-of-way (ROW) corridors for the existing Western Transmission System (WTS) and Southern Transmission System (STS) systems and the communication sites includes the Navajo Nation, the Kaibab Paiute Indian Reservation (Arizona), and Moapa River Indian Reservation. It also includes Coconino, Yavapai, and Maricopa counties in Arizona; Washington and Kane counties in Utah; and Clark County, Nevada. Collectively the WTS and STS ROWs have a combined length of 532 miles. The majority of the transmission line corridors and substations are in rural areas, although segments of the WTS are located in the Las Vegas metropolitan area and segments of the STS are in the Phoenix metropolitan area.

The portion of the study area where indirect effects are likely includes 10 Indian reservations (**Table 3.18-1**) and the areas within Maricopa, Pinal and Pima counties in central and southern Arizona, encompassing the areas in which the majority of the CAP system and its associated communication and electrical distribution infrastructure are located and where CAP water deliveries are made.[2] The socioeconomic assessment for effects on the CAP system focuses on the indirect effects of changes in electrical power and pumping costs for the CAP and its users, and on the potential effects of changes in contributions to the Development Fund (see Section 1.3).

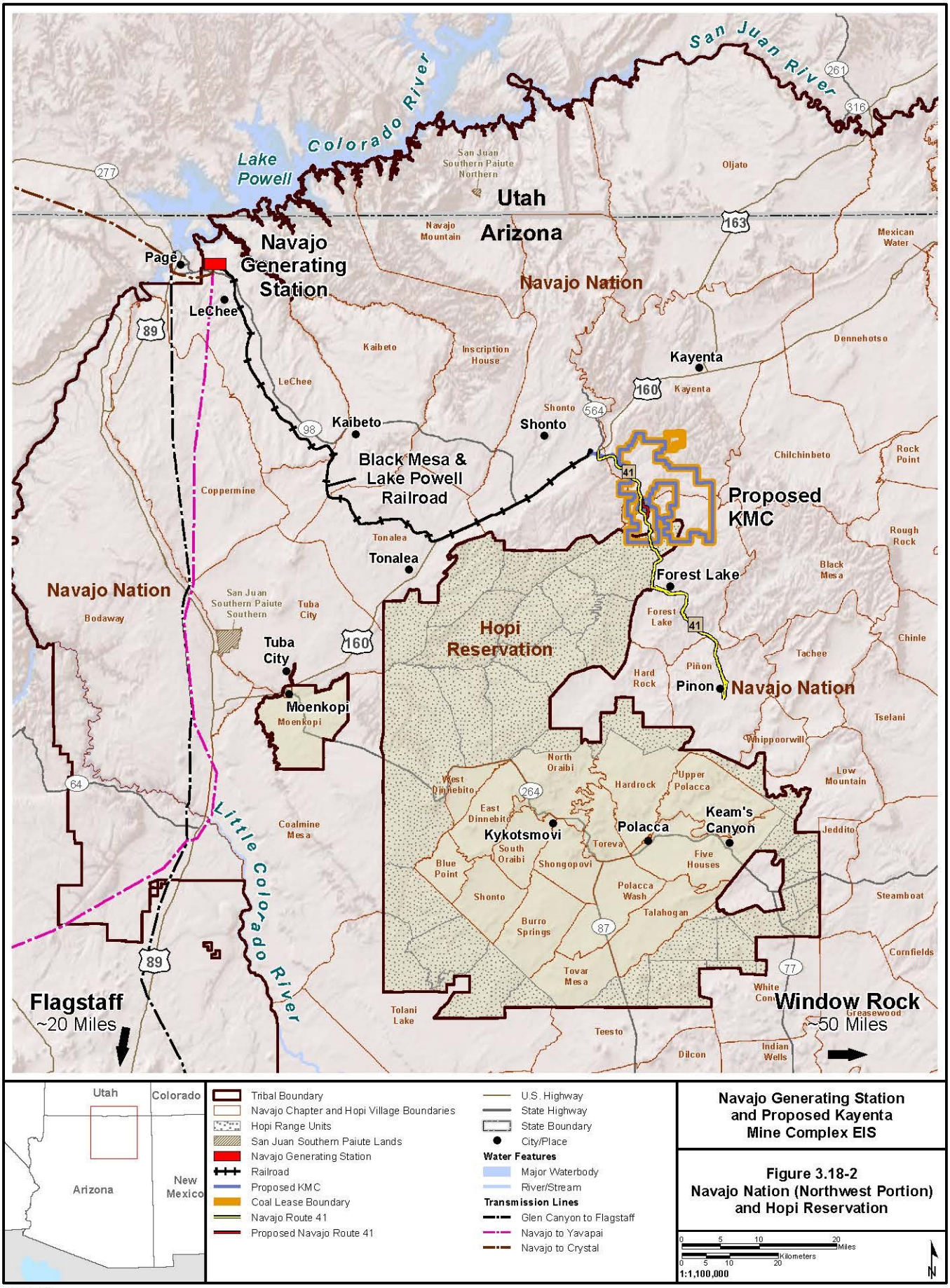
[1] Portions of The Navajo Nation, including the communities of Window Rock and Fort Defiance, are located in the northern portion of Apache County, Arizona. Some economic and demographic information for the county is included in the description of the affected environment because the Navajo Nation tribal headquarters and major administrative offices are located in Window Rock and Fort Defiance. Apache County, however, is not considered part of the primary segment of the study area because few direct socioeconomics effects would be anticipated in conjunction with Proposed Action and alternatives.

[2] The Mark Wilmer intake and pumping plant and approximately 84 miles of the CAP aqueduct system are located in La Paz County. However, no socioeconomic effects would be anticipated in La Paz County under any action alternative because no water deliveries occur in La Paz County and no physical or major operational changes in the CAP and electrical transmission facilities are contemplated under any action alternative.



Navajo Generating Station and Proposed Kayenta Mine Complex EIS

Figure 3-18.1 Socioeconomic Reference Map



Navajo Generating Station and Proposed Kayenta Mine Complex EIS

Figure 3.18-2
Navajo Nation (Northwest Portion) and Hopi Reservation

7/28/2016

Table 3.18-1 Arizona Tribes with CAP Allocations

• Ak-Chin Indian Community	• Fort McDowell Yavapai Nation	• Gila River Indian Community	• Salt River Pima – Maricopa Indian Community
• San Carlos Apache Tribe	• Tonto Apache Tribe	• Yavapai-Apache Nation	• Pascua Yaqui Tribe
• Tohono O'odham Nation			• White Mountain Apache Tribe

Note: Portions of San Carlos Apache tribal land are located in Gila and Graham counties, Tonto Apache tribal land is located in Yavapai County, and White Mountain Apache tribal land is located in Navajo and Apache counties; however, none of the CAP system is located in those counties. The Yavapai Apache Nation and the Tonto Apache Tribe do not currently utilize their CAP allocations.

3.18.3 Affected Environment

3.18.3.1 Navajo Generating Station and Proposed Kayenta Mine Complex – Northeastern Arizona

The foundation for this section is from published secondary information from tribal, state, and federal sources; information gathered during discussions with local and Tribal officials and other stakeholders; insights gained from reviewing local print media; and reviews of numerous other studies related to social and economic conditions in the region. Generally, information for 2013 and 2014 serves as the base year for the analysis, although in some instances the data are more dated due to the data collection frequency and reporting lags inherent in the source (i.e., the detailed demographic data from the decennial Census). However, the information adequately represents the affected environment for purposes of this assessment because the underlying social and economic conditions in the area have changed little in recent years.

As described in Section 1.1, the NGS is located in northern Coconino County, on tribal trust lands leased from the Navajo Nation. The plant is approximately 5 miles east of the City of Page (2010 population 7,247), and 6 and 33 road miles, respectively, from the Navajo communities of LeChee (2010 population of 1,660) and Kaibeto (2010 population 1,522). The bulk of NGS employees – about 75 percent – live in Page, LeChee, and Kaibeto.

The NGS is the largest industrial facility operating in northeastern Arizona. The facility includes the Black Mesa & Lake Powell (BM&LP) Railroad, an electric railway operating between a coal loadout silo near the Kayenta Mine and NGS. The 78-mile-long BM&LP Railroad operates between the two facilities, in a ROW granted by the U.S. Including the railroad loops at each end, the total length of the system is 80 miles. The railroad ROW passes through rural areas of the LeChee, Tonalea, and Shonto chapters. The ROW's closest proximity to existing communities is approximately 1 mile southwest of Kaibeto and just to the south of a settlement near the intersection of State Highway Route 98 and U.S. Highway Route 160.

The proposed KMC is southwest of the Town of Kayenta, in northern Navajo County, on lands leased from the Navajo Nation and the Hopi Tribe. The administrative center of the Kayenta Mine is about 18 road miles from the Navajo Nation community of Forest Lake (2010 population 471). At approximately 40 road miles, the Navajo Nation communities of Kayenta (2010 population 6,211) and Shonto (2010 population 2,124) are more distant but require only slightly longer travel times due to access via better roads.

The settings for both NGS and the proposed KMC are rural, sparsely populated, and with considerable distances separating communities. NGS is located in a rural area with no immediately adjacent housing

or large-scale commercial or industrial development. The nearest residence to NGS is approximately 1 mile southeast of the plant. As of January 2015, there were 114 residences, 6 proposed residences, and 37 vacated residences located within the proposed KMC leasehold boundary, some of which have been relocated by previous mining.

Table 3.18-2 presents 2010 populations and one-way highway travel distances between the two facilities and selected communities and Census Designated Places (CDPs) which correspond closely to Navajo chapters and Hopi Villages of the same name. [3] Flagstaff, the largest regional trade and service center in northeastern Arizona, is more than 130 miles distant from each facility.

Table 3.18-2 2010 Population and Approximate One-way Travel Distances to NGS and Kayenta Mine

Community	2010 Population	NGS (miles)	Kayenta Mine (miles)
Navajo Nation (Arizona portion)	101,835	NA	NA
Window Rock CDP (tribal headquarters)	2,712	227	159
Kayenta CDP	5,189	96	39
Tuba City CDP	8,611	76	61
Kaibeto CDP	1,522	33	51
Shonto CDP	591	60	41
Chinle CDP	4,518	162	94
LeChee CDP	1,443	6	86
Forest Lake (Chapter)	471	75	18
Hopi Reservation	7,185	NA	NA
Kykotsmovi Village CDP (tribal headquarters)	746	126	60 (unpaved)
Moenkopi CDP	964	75	60
Second Mesa CDP	962	136	58 (unpaved)
Coconino County	134,421	NA	NA
City of Flagstaff (county seat)	65,870	131	136
City of Page	7,247	5	85
Navajo County	107,449	NA	NA
City of Holbrook (county seat)	5,053	208	197

CDP = census designated place.

NA = not applicable.

Source: Google.com 2015; U.S. Census Bureau 2010a

3.18.3.1.1 Population and Demographics

As reported by the 2010 census, the population on the Navajo Nation was 173,667; a decline of 6,795 residents (-3.8 percent) as compared to 180,462 reported in 2000. A subsequent estimate

[3] CDPs are closely settled, named, unincorporated communities containing a mixture of residential, commercial, and retail areas similar to those found in incorporated places of similar sizes. Each CDP contains a core area that is associated strongly with the CDP name and houses the majority of the CDP's population, housing, commercial structures, and economic activity.

prepared for the Navajo Office of Economic Development was 212,216 (Navajo Housing Authority 2011). The Hopi Tribe had an on-reservation population of 7,185, a gain of 239 residents (0.3 percent) between 2000 and 2010. The numbers of persons self-identifying themselves as affiliated with the two tribes are substantially higher. The 2010 Census reported 332,139 persons identifying themselves as Navajo by tribal affiliation. Tribal enrollment was reported at 300,048 in 2011. The on-reservation population was equivalent to 58 percent of the total tribal enrollment in 2010 (see **Table 3.18-3**). Another 30,211 Navajo were living in 12 cities or towns on the borders of the Navajo Nation, including 2,356 living in Page and more than 17,000 in either Farmington or Gallup, New Mexico.[4] For the Hopi Tribe, 18,327 individuals indicated an affiliation with the tribe. Total enrollment of the Hopi Tribe was 14,138 as of March 2015, with the on-reservation population equivalent to 51 percent of that total.

Table 3.18-3 Hopi and Navajo Population

Parameter	Hopi	Navajo
Total population reporting tribal grouping, alone or in combination with other tribal groupings or races - 2010	18,327	332,129
Tribal enrollment (date reported)	14,138 (3/2015)	300,048 (2011)
Population on Reservation - 2010	7,185	173,667
On Reservation population as a percent of enrollment	51%	58%

Note: Not all on reservation residents are enrolled members – these statistics are intended to be an indicator only.

Sources: Hopi Tuteveni 2015; Navajo Nation 2014a; U.S. Census Bureau 2012a (January), 2010.

Other communities in the western U.S. are common destinations for Navajo and Hopi living off their respective reservations; in 2010 nearly 47,000 Navajo lived in Phoenix and Albuquerque alone. Pursuit of education, employment, and lack of available on-reservation housing are among the factors cited for emigration (Navajo Housing Authority 2011). Navajo and Hopi family ties, culture and traditions draw many of those living off-reservation back for religious, ceremonial, and clan gatherings, and many of those living off-reservation provide economic support for their extended families living on their respective reservations. That support is vital to maintenance of Navajo and Hopi culture and social stability (Hardeen 2015; Salt River Project Agricultural Improvement and Power District [SRP] 2016).

In Arizona, portions of the Navajo Nation are located in Apache, Coconino and Navajo counties. The Hopi Reservation comprises part of the latter two counties as well. The three counties had a combined population of 313,388 in 2010, a net gain of 30,175, as compared to 2000 (**Table 3.18-4**). The overall growth rate of the three counties between 2000 and 2010 percent, was substantially lower than that of Arizona as a whole.

Table 3.18-4 Population 2000 and 2010

Community	2000	2010	Change	Percent Change
Navajo Nation [1]	180,462	173,667	-6,795	-3.8
Hopi Reservation	6,946	7,185	239	0.3
Two-reservation Total	187,408	180,852	-6,556	-3.8

[4] Flagstaff, Page, Winslow, and Holbrook in Arizona, Farmington, Gallup, Bloomfield, Grants and Aztec in New Mexico, Cortez and Durango in Colorado, and Blanding, Utah.

Table 3.18-4 Population 2000 and 2010

Community	2000	2010	Change	Percent Change
Coconino County [2]	116,320	134,421	18,101	15.6
Navajo County [2]	97,470	107,449	9,979	10.2
Apache County [2]	69,423	71,518	2,095	3.0
Three-county Total	283,213	313,388	30,175	10.7
Arizona	5,130,632	6,392,017	1,261,385	24.6

[1] These counts include the population of the portions of the Navajo Nation in Utah and New Mexico.

[2] These counts include the population residing on the relevant portions of both reservations.

Source: U.S. Census Bureau 2010b, 2000.

Recent trends in Navajo Nation and Hopi Reservation populations are found in **Table 3.18-5**. In 2010, 59 percent of the on-reservation Navajo population lived in the western Arizona portion of the reservation. Census data for 1980 to 2010 indicate that population on the New Mexico portion of the Navajo Nation increased more rapidly than did the population on the Arizona portion.

Table 3.18-5 Population Changes of the Navajo Nation and Hopi Reservation, 1980 to 2010

Community	1980	1990	2000	2010	Net Change	Compounded Annual Rate of Change
Navajo Nation						
Arizona	71,241	87,578	104,565	101,835	30,594	0.9%
New Mexico	28,722	50,657	69,524	65,764	37,042	2.1%
Utah	4,554	5,272	6,373	6,068	1,514	0.7%
Navajo Nation Total	104,517	143,507	180,462	173,667	69,150	1.3%
Hopi Reservation	6,906	7,215	6,946	7,185	239	0.1%

Source: U.S. Census Bureau 2014a, 2010b, 2000, 1992, 1986.

The Census Bureau reported population declines on the Hopi Reservation between 1990 and 2010, and on the Navajo Nation between 2000 and 2010. Factors cited as contributing to the declines include out-migration by younger members of the two tribes to pursue economic opportunities and out-migration following the closure of the former Black Mesa Mine and Black Mesa coal slurry operation in 2005 (Navajo Housing Authority 2011).

The vast majority of employees at NGS report residency in Page, and the LeChee and Kaibeto Chapters of the Navajo Nation (SRP 2014).[5] Similar information for the Kayenta Mine indicated that 63 percent of workers lived in Kayenta, with another 20 percent living in Pinon, Kaibeto, Shonto, Tuba City, or Chinle. Approximately 20 percent of the mine's workforce resided in New Mexico and in Flagstaff, Phoenix, and elsewhere in Arizona.

[5] There is no home mail delivery on the Navajo Nation or Hopi Reservation. Many employees, therefore, use P.O. boxes for mail delivery and addressing. This practice may affect the reporting of residency. Although the extent of the variance is unknown, the reported residency is assumed to be representative of actual residency pattern.

In 2010, the population of the primary segment of the study area was 52,769, a net decline of 8,183 as compared to 2000. The Tuba City, Inscription House and Black Mesa chapters, and City of Page registered population gains between 2000 and 2010. The other Navajo chapters in the area recorded population declines during the same period, with the largest declines in Chinle, Pinon, and Shonto. The closure of the former Black Mesa Mine is thought to been a contributing factor to those declines. The Hopi Reservation as a whole gained population, but declines occurred in several of the individual Hopi districts (**Table 3.18-6**).

Table 3.18-6 Population of the Primary Segment of the Socioeconomic Study Area, 2000 and 2010

Chapter/District/Community[1]	2000	2010	Change: 2000-2010	Compounded Annual Rate of Change
Black Mesa Chapter	398	428	30	0.7%
Chilchinbeto Chapter	1,325	1,165	(160)	-1.3%
Chinle Chapter	8,756	8,005	(751)	-0.9%
Coppermine Chapter	673	590	(83)	-1.3%
Forest Lake Chapter	573	471	(102)	-1.9%
Inscription House Chapter	1,214	1,252	38	0.3%
Kaibeto Chapter	1,970	1,963	(7)	0.0%
Kayenta Chapter	6,315	6,211	(104)	-0.2%
LeChee Chapter	1,890	1,660	(230)	-1.3%
Pinon Chapter	3,066	2,751	(315)	-1.1%
Shonto Chapter	2,419	2,124	(295)	-1.3%
Tonalea Chapter	2,537	2,452	(85)	-0.3%
Tuba City Chapter	8,736	9,265	529	0.6%
Hopi Reservation	6,906	7,185	239	0.3%
City of Page	6,809	7,247	438	0.6%
Total	53,587	52,769	(818)	-0.2%

[1] Chapters listed are Navajo Nation Chapters.

Source: U.S. Census Bureau 2000b and 2010b.

Native Americans, primarily Navajo, were the single largest racial group in northeastern Arizona in 2010. Navajo accounted for over 90 percent of the population of the primary segment of the study area. However, in Page, the community nearest to NGS, the majority of residents were white, with Native Americans accounting for nearly 38 percent of the city's residents (**Table 3.18-7**).

Table 3.18-7 Race and Ethnicity, 2010

Community	Total Resident Population	American Indian Population (alone or in combination)	Race (percent of population)			Hispanic or Latino (percent)
			American Indian (alone or in combination)	White (alone)	Other Race(s)	
Hopi Reservation	7,185	6,912	96.2	2.8	1.0	1.9
Navajo Nation (Arizona only)	101,835	98,851	97.1	2.3	0.6	2.0
City of Page	7,247	2,745	37.9	57.6	4.5	7.3
State of Arizona	6,392,017	353,386	5.5	73.0	21.5	29.6
U.S.	308,745,538	5,220,579	1.7	72.4	25.9	16.3

Source: U.S. Census Bureau 2010b.

In general, the on-reservation populations of the Hopi and Navajo Nation are younger than those of the state and the U.S. Average household sizes for the Navajo and Hopi, 3.45 and 3.47, respectively, are noticeably larger than those across the state and the U.S. The shares of multigenerational/extended family households and those with persons 65 years and over also are higher on the two reservations than for the state and U.S.[6]

The primary segment of the study area is very rural. Population densities in the area are 2.8 and 6.4 persons per square mile in 2010, on the primary segment portions of the Hopi Reservation and Navajo Nation, respectively. By comparison, population density for Arizona as a whole was 56.35 persons per square mile.

3.18.3.1.2 Economic Conditions

This section summarizes labor market conditions and other economic characteristics in the primary segment of the study area. These data provide important perspectives into the current economic contributions of the NGS and Kayenta Mine in the regional economy.

3.18.3.1.2.1 Labor Force Participation, Employment Status, and Poverty

The general economic climate of the Navajo Nation and Hopi Reservation can be described as challenging. In part a response to limited economic opportunities, labor force participation on the Navajo Nation and Hopi Reservation is low in comparison to the statewide and off-reservation areas (**Table 3.18-8**).

[6] "Multigenerational" means three of more generations living together in the same household and can be indicative of strong family structure and also economic dependency.

Table 3.18-8 Labor Force Participation, Employment, and Unemployment, 2009 to 2013

Parameter	Navajo Nation (all)	Hopi Reservation	Apache County	Coconino County [1]	Navajo County [1]	State of Arizona [1]
Labor Force Participation (population 16 years and over)	44.2%	54.0%	44.5%	66.0%	50.6%	60.6%
Civilian Labor Force	55,437	3,086	23,447	70,788	40,239	3,038,226
Unemployed	11,988	522	4,853	6,348	7,828	316,360
Unemployment Rate	21.6%	16.9%	26.1%	9.0%	19.5%	10.4%

[1] These population counts include the population residing on the relevant portions of both reservations.

Source: U.S. Census Bureau 2014.

Unemployment is persistently high among those in the labor force. The 2009 – 2013 American Community Survey estimated unemployment on the Navajo Nation at 21.6 percent, 4.7 percent points higher than on the Hopi Reservation, and 11.2 percentage points higher than the statewide average. Local estimates of unemployment are much higher (e.g., above 50 percent) on the Navajo Nation (Navajo Housing Authority 2011).

High unemployment, low labor force participation, and factors such as reliance on seasonal and part-time employment are manifest in household incomes that are below the statewide and national norms in terms of income distribution, higher than average dependency on public assistance, and poverty rates more than double the statewide rate. In 2010, an estimated 35 percent of Hopi and 38 percent of Navajo residents on the reservations had incomes below the poverty level (**Table 3.18-9**).

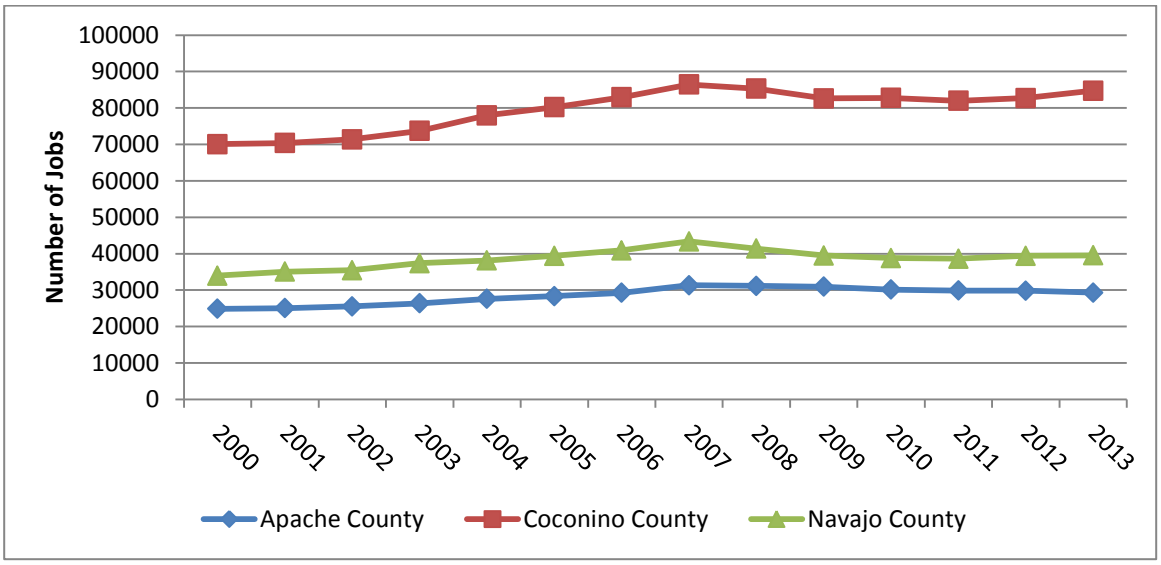
Table 3.18-9 Income Characteristics of Hopi and Navajo Households Living on the Reservations, 2010

Community	Household Income		Households Reporting Income from the Following Sources (percent)[1]			
	Less than $25,000 (percent)	Median	Earnings	Retirement Income	Public Assistance	Persons Below Poverty Level (percent)
Hopi Reservation	34.8	$34,016	79.9	19.6	29.6	35
Navajo Nation (Arizona only)	48.6	$26,401	64.0	15.7	14.7	38
State of Arizona	22.9	$50,448	78.2	18.9	9.8	15
U.S.	23.5	$51,914	79.7	17.5	10.0	14

[1] The sum of these three columns can exceed 100 percent due to households receiving more than one form of income.

Source: U.S. Census Bureau 2012b.

In 2000, total employment in the three northeastern Arizona counties was 128,882, most of which was based in Coconino County. Employment climbed steadily through 2007, with net gains ranging from 23 percent in Coconino County to 27 percent in Navajo County. In Navajo County the gains occurred as growth in the construction, real estate development, health care and other industries, exceeded the job losses following the closure of the former Mohave Generating Station, Black Mesa Mine and Black Mesa Pipeline Company. The net gain between 2000 and 2013 was 4,450 jobs in Apache County, 14,671 jobs in Coconino County and 5,555 jobs in Navajo County (**Figure 3.18-3**).



Source: U.S. Bureau of Economic Analysis (BEA) 2014a.

Figure 3.18-3 Total Full-time and Part-time Employment

Table 3.18-10 displays the top 5 industries in each geographic area, employment by major industry, by place of employment, for each of the counties in northeastern Arizona, both in absolute numbers and as the percentage of total employment. Comparable information are not published for the two reservations due to federal data reporting protocols. Four of the top five, local government, retail trade, health care and social services, and accommodation and food services, are common among the counties and the state, although the rank order differs.

3.18.3.1.2.2 Key Economic Sectors for the Navajo Nation and Hopi Tribe

Based on the published employment and earnings data, local economic development literature, perspectives gained from discussions with local officials, and other data sources, the following sectors are commonly accepted as comprising the region's economic base.

<u>Public Sector</u>

Broadly defined, the public sector includes tribal government, health services, education, utilities, housing authorities and other governmental and quasi-public entities. Although a comprehensive accounting of public sector employment is not available, the public sector is recognized as the single most important source of jobs, income, and services on the Navajo Nation and the Hopi Reservation.

Table 3.18-10 Employment by Industry, 2013

Parameter	Employment (Number of Jobs)			
	Apache County	Coconino County	Navajo County	State of Arizona
Total employment	29,298	84,725	39,535	3,391,722
By industry				
Farm employment	4,426	1,684	3,248	28,927
Nonfarm employment	24,872	83,041	36,287	3,362,795
Private nonfarm employment	13,892	64,493	26,320	2,921,038
Forestry, fishing, and related	249	(D)	193	15,315
Mining	229	(D)	647	23,978
Utilities	(D)	332	76	12,283
Construction	914	3,344	**1,977**	175,361
Manufacturing	612	4,907	397	168,323
Wholesale trade	(D)	1,272	504	110,891
Retail trade	**1,830**	**8,864**	**4,374**	**362,834**
Transportation and warehousing	498	2,092	1,180	97,662
Information	146	691	1,261	52,581
Finance and insurance	243	2,030	888	214,411
Real estate and rental and leasing	909	4,347	1,912	220,972
Prof., scientific, and technical services	474	3,484	933	210,736
Mgmt of companies and enterprises	-	197	283	33,623
Administrative and waste mgmt services	467	2,489	1,450	**277,117**
Educational services	636	1,048	720	71,486
Health care and social assistance	**3,143**	**9,773**	**3,801**	**367,493**
Arts, entertainment, and recreation	347	3,302	598	72,837
Accommodation and food services	**1,271**	**11,745**	**3,339**	**256,178**
Other services, exc. public administration	1,066	3,863	1,787	176,957
Government and government enterprises	10,980	18,548	9,967	441,757
Federal (civilian and military)	**2,869**	3,099	1,930	88,920
State	226	**7,559**	804	85,408
Local	**7,885**	**7,890**	**7,233**	**267,429**

Note: The top five industries in each county, in terms of the number of employees and percent of local jobs, are indicated by the shaded cells with bold entries.

(D) = Data not disclosed due to federal regulations regarding confidentiality.

Source: BEA 2014c.

Tribal Employment

The Navajo Nation and the Hopi Tribe are themselves the largest employers on their respective reservations. Tribal employment of the Navajo Nation in 2015 was 4,823 jobs, not including those jobs associated with tribal enterprises (see below) (Navajo Division of Human Resources 2015). In 2015, Hopi tribal administrative was 491 (Hopi Tribe 2016). Many of the tribal jobs are based at the respective Tribal Headquarters and administrative centers in Window Rock, Fort Defiance and Kykotsmovi.

Tribal Enterprises

Tribal enterprise operations are organizations owned and operated by the tribes whose charters are to provide services or engage in activities that are outside the umbrella of traditional tribal government. The Navajo Nation has chartered 14 enterprise activities. Current employment for these enterprises are not available, but the 2009-2010 Comprehensive Economic Development Strategy reported more than 1,500 jobs (2007 data) with just the first four enterprises above (Navajo Nation 2010). Enterprise activities for the Hopi Tribe include a ranching enterprise and a real estate enterprise.

U.S. Bureau of Indian Affairs

The BIA, the oldest bureau of the U.S. Department of the Interior, provides services (directly or through contracts, grants, or compacts) and is responsible for the administration and management of surface and subsurface minerals estates held in trust by the U.S. for the two tribes. The Navajo Region, headquartered in Gallup, New Mexico, and the Western Region, based in Phoenix, Arizona, are primarily responsible for providing services to the Navajo Nation and Hopi Tribe, respectively. The Navajo Region is comprised of five Agencies, three of which are located in Arizona; the Western Agency located in Tuba City, the Chinle Agency and the Fort Defiance Agency. The major programs/departments within the agencies are Natural Resources, Safety, Roads/Transportation, Real Estate Services, and in the case of the Fort Defiance Agency, Regional Fire Management.

BIA's Division of Real Estate Services, with regional offices in Gallup and Phoenix, has historically been responsible for ensuring that the trust and restricted federal Indian-owned lands are protected, managed, accounted for, developed, and utilized. The Navajo Nation General Leasing Regulations Act of 2013 extends Navajo leasing authority to all tribal surface lands without the approval of the U.S. Secretary of the Interior. Federal approval is still required for mineral and ROW leases (Navajo Nation 2014c). In this case, the parties have stipulated that Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1)requires approval by the Secretary of the Interior pursuant to 25 United States Code Section 415(a).

Primary and Secondary Education

Education is a major employer in northeastern Arizona. More than 60 primary and secondary schools operate on the two reservations and in Page. The total includes schools operated by the Bureau of Indian Education, schools operating under the control of the Navajo Department of Dine Education, and public schools operated by school districts serving the northern portions of Apache, Navajo, and Coconino counties (Navajo Nation 2015a; U.S. Bureau of Indian Education 2015). A number of private and charter schools also operate in the region. The 2009-2010 Comprehensive Economic Development Strategy reported more than 2,100 jobs were associated with the Bureau of Indian Education and community schools on the Navajo Nation.

Indian Health Service

The Navajo Area Indian Health Service is responsible for health services delivery to Native Americans in portions of Arizona, New Mexico, and Utah. The Navajo Area Indian Health Service is primarily responsible for providing health care to members of the Navajo Nation. Comprehensive health care is

centered on 6 hospitals and 22 health centers and health stations. Several of the hospitals on the Nation are operated by non-profit health care organizations contracted with the Indian Health Service pursuant to Public Law 93-638.

The Phoenix Area Indian Health Service Office in Phoenix, Arizona, oversees the delivery of health care to approximately 140,000 Native American users in Arizona, Nevada, and Utah outside the Navajo Nation. Indian Health Service health care facilities in the primary segment of the study area include a new facility nearing completion in Kayenta and the Hopi Health Care Center, located in Polacca. (Indian Health Service 2015a,b).

Tribal Agriculture

Raising livestock and farming are essential elements of the cultural heritage, lifestyle and economic survival of both the Navajo and Hopi peoples in northeastern Arizona. The 2012 Census of Agriculture reported 14,801 farms with 14,456 on the Navajo Nation and another 345 on the Hopi Reservation (U.S. Department of Agriculture [USDA] National Agricultural Statistics Service [NASS] 2014a,b).

Both tribes operate commercial agricultural operations as enterprise activities. The Navajo Agricultural Products Industry, with operations concentrated in the New Mexico portion of the Navajo Nation, produces potatoes, corn, alfalfa, beans, and small grains that are marketed under the brand Navajo Pride (Navajo Agricultural Products Industry 2015). Navajo Beef, another of the Nation's brands, is now served at several Navajo casinos. The Hopi 3 Canyon Ranches program includes five working ranches located south of the reservation that were purchased to regain some ancestral Hopi lands (Gashwazra 2015). The ranches are at the center of a program to provide training opportunities for Hopi youth, help sustain the important role of agriculture in Hopi culture, and to establish and market a premium brand of beef.

For many Navajo and Hopi, livestock, corn, and vegetables are essential subsistence commodities, and important for maintenance of cultural traditions, a source of cash income or a commodity for barter and exchange. In 2012, an estimated 10,735 Native American-operated farms were located in the three-county region, the overwhelming majority operated by Navajo or Hopi. Those farms reported combined sales of approximately $31.9 million, although more than 7,000 of those farms reported no sales for cash, or sales of less than $1,000. Sales of crops accounted for $19.2 million, 59 percent of the total, with the remainder derived from livestock sales. Primary crops raised in the region include corn, beans, squash, melons, and cantaloupe. Dry-land farming techniques are used on the majority of farms due to a lack of irrigation water and infrastructure. Sheep, lambs, horses and ponies were the most common types of livestock raised on the Native American farms in the three counties, with more than 7,000 farms raising sheep and lambs (USDA/NASS 2014a,b).

Mining

The Navajo and Hopi reservations sit atop abundant coal reserves. The Nation currently has limited natural gas production, however, there is potential for discovery of gas reserves depending on the economics of exploration and gas prices. Vast reserves of natural gas also are located on the Navajo Nation. Development of these resources has been vitally important to the tribes because of the jobs they provide and the revenues generated directly and indirectly to support tribal government operations. In addition to the Kayenta Mine and former Black Mesa Mine, the Nation leased areas for coal mining at the Navajo Mine in New Mexico for the Four Corners Power Plant (FCPP) near Farmington, New Mexico. Coal, electricity production, and the associated employment will decrease in response to the shutdown of three generating units at the FCPP (Fonseca 2013; OSMRE 2015).

During and after World War II, uranium mining was a major employer and source of regional economic stimulus for the Navajo Nation. The end of the cold war, along with a rising awareness of human health risks associated with uranium mining, and other factors brought a halt to such mining on the Navajo

Nation. Environmental remediation efforts are ongoing to address some of the residual issues associated with past uranium mining, processing, and waste disposal.

Utilities

Major energy related generation and transmission infrastructure is another vital element of the economic base of the regional economy. In addition to the NGS and its associated Navajo Transmission system (WTS and STS), other facilities include the Coronado and Springerville power plants in Apache County, the Cholla power plant in Navajo County, the FCPP and San Juan Generation Station in neighboring New Mexico, and multiple electrical transmission lines and natural gas pipelines across the Navajo Reservation.[7] Cholla's unit #2 will be taken off line in 2016 and two other units are scheduled to be converted to natural gas.

On the Navajo Nation, the Navajo Tribal Utility Authority (NTUA) supplies electricity, water, natural gas, wastewater treatment and solar power to residents, tribal government, and other commercial and industrial customers. NTUA's customers include the Kayenta Mine. NTUA serves nearly 40,000 customers with electricity and water, mostly in the larger communities. NTUA estimates that 15,000 families on the Nation are without access to electricity and many more are without access to running water, telephone and natural gas services. NTUA has a staff of 619 regular and temporary employees, 605 of whom are Navajo (NTUA 2015).

Tourism

Outdoor recreation and tourism are important contributors to the regional economy of northeastern Arizona, attracting millions of visitors from across the nation and abroad. Grand Canyon National Park and Lake Powell are among the primary travel and tourism attractions in the region and Interstate 40 is a major conduit for travel and tourism. Other attractions include Monument Valley, the Kayenta-Monument Valley Scenic Road, Canyon de Chelly and Wupatki National Monuments, the Hopi Cultural Center (Second Mesa) and Navajo Nation Museum (Window Rock). Hopi and Navajo artisans are world-renowned for their jewelry, weavings and other crafts.

Flagstaff offers the largest base of trade, services, and hospitality-oriented businesses in northeastern Arizona. Within the primary segment of the study area, the communities with the largest base of establishments serving the tourism and travel markets are Page, Tuba City/Moenkopi, Kayenta and Chinle; Page being the largest. Other communities in the region are much smaller, each hosting one or more motels, dining establishments, and/or convenience stores/gas stations.

The Navajo Nation voters approved gaming in 2004. The Navajo Nation Gaming Enterprise, a wholly owned business enterprise of the Navajo Nation operates four casinos, three in New Mexico and the Twin Arrows Casino east of Flagstaff (Navajo Gaming 2015). Under Arizona's Tribal/State Gaming Compact the Navajo Nation is approved to develop three more casinos.

The Hopi have twice defeated measures to approve gaming (Gashwazra 2015).

3.18.3.1.2.3 Earnings and Personal Income

In 2013, residents of the three counties comprising northeastern Arizona had combined total personal income of $9.67 billion, representing 3.9 percent of the statewide total (**Table 3.18-11**). Approximately half that total accrued to residents of Coconino County. Per capita incomes in Apache, Navajo, and the non-urban portion of Coconino counties are below the statewide average.

[7] The Coronado, Springerville and Cholla power plants are not located on the Navajo Nation.

Table 3.18-11 Personal Income in Northeastern Arizona, 2013

Parameter	Apache County	Coconino County	Navajo County	State of Arizona
Total Personal Income – 2013 (000s)	$ 1,894,109	$ 4,906,294	$ 2,869,655	$ 245,070,457
Per Capita Income – 2013	$26,331	$35,933	$26,739	$36,983
County Per Capita Income as a Percent of Statewide Per Capita Income	71%	97%	72%	100%

Source: BEA 2014a.

In 2013, earnings accounted for less than half of the income in Apache and Navajo, compared to 62 percent statewide and 64 percent at the national level (**Table 3.18-12**). Although earnings in Coconino County are comparable to the statewide average, the overall average is not representative of income on the portion of the two reservations located in the county, but more reflective of income in Flagstaff and Sedona. Income from personal current transfers, which include unemployment, social security, and other government assistance payments, was higher, particularly in Apache and Navajo counties.

Table 3.18-12 Personal Income by Major Source, 2013

Income Source	Apache County	Coconino County	Navajo County	State of Arizona	U.S.
Earnings from employment	44%	63%	45%	62%	64%
Dividends, interest, and rent	14%	18%	16%	18%	19%
Personal current transfer receipts [1]	42%	19%	39%	20%	17%

[1] Personal current transfer receipts are benefits received by persons for which no current services are performed. Those benefits include retirement and disability insurance (mainly Social Security), medical benefits (mainly Medicare and Medicaid), income maintenance, unemployment insurance compensation, veterans' benefits, and federal education and training assistance received from government (BEA 2014b).

Source: BEA 2014b.

In addition to the fact that earnings generally account for lower shares of personal income, residents of northeastern Arizona are more heavily dependent on government income than are residents of the state as a whole. Government sources, including the Navajo and Hopi tribal governments, BIA, Bureau of Indian Education and Indian Health Service, and the state and federal governments account for 18 percent of nonfarm earnings across the state, but as much as 61 percent in Apache County (**Table 3.18-13**). The latter reflects the dominant role of the Navajo Nation government in the Apache County economy. The shares of earnings from government employers in Coconino and Navajo counties are about double the statewide average.

Table 3.18-13 Nonfarm Income from Private and Government Sources, 2013

Income Source	Apache County	Coconino County	Navajo County	State of Arizona
Private nonfarm	39%	66%	63%	82%
Government and Government enterprises	61%	34%	37%	18%

Source: BEA 2014b.

The average annual payearoll expense per employee for NGS and Peabody Western Coal Company (PWCC), approximately $145,000 and $138,000, respectively, are widely recognized as among the highest in the region. Those compensation levels, which include wages, salaries, the value of fringe benefits and other supplements, are approximately four times the corresponding averages for all employees in the three counties.

The NGS and Kayenta Mine are among the most economically significant employers in the primary segment of the study area for the Navajo Nation and for the Hopi Tribe. The economic contributions of those two establishments include the lease, royalty and other public sector revenues they pay, the jobs and payearolls they provide for tribal members and others, and the indirect and induced jobs, income and revenues supported by their operations.

3.18.3.1.2.4 Economic Contributions of the Navajo Generating Station

Total annual operation and maintenance (O&M) expense (including fuel) for the NGS ranged between $396 million and $498 million over the 4-year period 2010 through 2013, averaging $448.0 million. Major capital expenditures, which vary year-to-year, are in addition to the O&M expenditures.

Fuel expense, primarily coal, but also electricity, and motor vehicle fuel, is the single largest expense category. Annual spending for fuel averaged $287.7 million over the 4-year period 2010 to through 2013, with year-to-year fluctuation primarily reflecting differences in the quantity of coal delivered. Electrical power to operate the BM&LP Railroad is generated at NGS. Approximately 23.5 gigawatt hours (about 0.13 percent of the power generated at NGS annually) is used to operate the railroad (SRP 2014).

Labor expense is the second largest category of operating expense for NGS. NGS reported a total of 495 workers in the 4th quarter of 2014; 396 at the plant and 99 assigned to the BM&LP Railroad, 25 fewer than the approved full-staffing level of 520. The International Brotherhood of Electrical Workers represents about 400 employees at NGS. The payearoll expense for NGS in fiscal year 2014 was $71.8 million; $52.4 million in wages, salaries, sick leave, holiday and vacation compensation and $19.4 million in Federal Insurance Contributions Act, retirement, and other benefits. The total equates to an average payearoll and benefits costs of nearly $145,000 per employee (SRP 2014).

All of SRP's regular employees at NGS are full-time, either salaried or on an hourly wage basis, and are eligible for SRP's comprehensive benefits package. Among the workforce, 41 percent have 20 years or more tenure with SRP, a comparable number have between 6 and 20 years of tenure, and the remainder less than 6 years. Approximately 18 positions are filled annually in response to retirement, termination for cause, or voluntary departure by the employee (SRP 2014).

In 2015, 86 percent of the NGS workforce was Native American, including 65 percent of all managerial and supervisory staff (**Table 3.18-14**). Under terms of the existing lease with the Navajo Nation, qualified Navajo benefit from a hiring preference for available jobs. Native Americans hold managerial and non-managerial positions in all departments.

Table 3.18-14 Managerial and Non-Managerial Positions at NGS Held by Native Americans, 2015

Job Category	Share of All Such Positions Held by Native Americans (percent)
Managerial/Supervisory	65
Non-managerial	90
Total	86

Source: SRP 2015.

Adding to the economic contributions associated with NGS operation and its employees are the current retirement payments to former employees and the future payments to current employees.

SRP conducts extensive ongoing training for all employees and regularly offers specialized courses to support advancement for its employees. It also has provided introductory training for members of the community desiring to apply for employment.

Workforce residency in 2014, tabulated by mailing address zip code, indicated that 75 percent of the employees resided within a 50-mile radius of the plant, primarily in Page, Le Chee, and Kaibeto chapters.[8] Extending the radius to 75 miles captures nearly 85 percent of the total (**Table 3.18-15**). Ten percent of the workforce reported residency in Flagstaff, Phoenix, and various locations elsewhere in Arizona beyond the 75-mile radius (SRP 2014).

Table 3.18-15 Place of Residence for NGS Employees, 4th Quarter 2014

Community / Chapter	Number	Percent	Community / Chapter	Number	Percent
Page	294	59	Phoenix Metro Area	10	2
LeChee	50	10	Flagstaff and Nearby	5	1
Kaibeto	30	6	Arizona – Elsewhere	33	7
Tuba City	21	4	Utah – All	9	2
Red Lake	14	3	New Mexico – All	6	1
Kayenta	11	2	Elsewhere	1	0
Shonto	11	2	**TOTAL**	**495**	**100**

Source: SRP 2014.

Contract waste haulers and security contractors working at NGS employ another 38 on site and regular deliveries of limestone, motor vehicle fuel, and other materials and supplies employ an unknown number of long-distance truck drivers elsewhere.

In addition to fuel and labor, annual O&M at NGS averaged over $88 million over the past four years. A large portion of that total is the cost of the scheduled overhauls at the plant. Each generating unit undergoes scheduled shutdowns on 3-year cycles; once for about 4 weeks to complete a minor overhaul and then again 3 years later for about 8 weeks for a major overhaul, the net result for the 3-Unit plant being that an overhaul occurs annually. Each overhaul employs between 800 and 1,200 contractor and NGS temporary workers, generating contractor services and payearoll payments of approximately $9.5 million (minor) and $24.4 million (major) per overhaul. Outlays for equipment, machinery rentals, materials and other expenses raise the total costs to approximately $19.8 million (minor) to $46.0 million (major) (SRP 2015, 2014). These maintenance activities provide important recurrent economic infusions to the Page and Navajo Nation economies (Diak 2015; Hardeen 2015).

San Antonio, Texas-based Zachry Construction has been the prime contractor for the annual maintenance overhauls for more than 25 years, employing many local workers who return year-after-year. Like all of the labor contracts at NGS, the overhaul contracts incorporate a preference clause for hiring qualified Navajo workers. The maintenance shutdowns are scheduled for February and March to coincide with lower seasonal electrical system demand and the off-season for Page tourism, filling

[8] Residences on the Navajo Nation and Hopi Reservation do not receive mail delivery, instead using post office box addresses. As a result, not all individuals listing a particular community of residence necessarily reside in that community. However, it is reasonable to expect a high degree of correspondence between the listed zip code and approximate location of residence.

otherwise vacant lodging and generating retail, dining and fuel sales and the associated taxes. Several SRP employees indicated that the wages earned during these overhaul activities is a key source of earned income for many local contractor and temporary NGS employees, and that the income commonly provides vital support for an extended family.

The non-federal NGS Participants pay substantial taxes and in lieu of tax payments to support the Navajo Nation tribal government, local governments and other taxing districts, and public education. Property taxes on the plant and use taxes on major purchases from outside Arizona are the two major categories of taxes paid directly. As a political subdivision of Arizona, SRP is exempt from property taxes, but makes contributions in lieu of property taxes (in lieu) as outlined in Arizona Revised Statutes 48:241-248 (AZ Rev. Stat 2015). In addition, the non-federal NGS Participants make payments to the Navajo Nation equal to 50 percent of their annual tax payments to local taxing authorities. The combined in lieu, property tax and payments to the Navajo Nation total approximately $8.0 million annually, of which $2.7 million flows to the Navajo Nation, the remainder accruing to the local school district, state education equalization fund, Coconino County and local special purpose and service districts. These revenues support payrolls, service provision and infrastructure.

As a federal agency, Reclamation is exempt from paying state, local and tribal property, sales, and use taxes associated with the U.S. share in NGS.

Under the terms of the existing lease, an annual NGS lease payment of $608,400 is made to the Navajo Nation. NGS and employees at NGS provide approximately $325,000 in educational scholarships and contributions to community service groups and programs (Indenture of Lease 1969; SRP 2014).

As part of a renegotiated coal lease with the Hopi, NGS and PWCC make an annual Generation Performance Payment to the Hopi. In 2015 the payment totaled $1,365,000. Those funds were designated by the Hopi Tribal Council for deposit into the Hopi Educational Endowment fund. The fund provides financial assistance to Hopi students pursuing higher education goals (Hopi Tutuveni 2015).

3.18.3.1.2.5 Economic Contributions of the Kayenta Mine

PWCC's Kayenta Mine is the second largest industrial facility operating in northeastern Arizona. PWCC operates the mine under a "cost plus" type contract with SRP, providing a negotiated margin above the cost of production. Outlays for labor, royalties, subcontractors, utilities and local taxes totaled more $160 million in fiscal year 2014, representing a large portion of overall production costs (PWCC 2014).

In the 4th quarter of 2014, company employment at the Kayenta Mine was 440, virtually all of whom were on a full-time salaried or hourly wage status and eligible for the company's comprehensive benefits packages (PWCC 2014). Approximately 320 employees at the mine are represented by the United Mine Workers of America Local 1924. Members of the United Mine Workers of America Local 1924 ratified a 6-year contract in 2013; that contract is set to expire in September 2019.

Among the workforce, 69 percent had more than 20 years of tenure, 9 percent had 6 to 20 years tenure, and the remaining 22 percent had been at the facility 5 years or less (PWCC 2014). Over the long term PWCC fills approximately 5 positions annually in response to retirement, termination for cause, or voluntary departure by an employee. Ninety-six percent of the mine's workforce is Native American, including 77 percent of the managerial and supervisory staff (**Table 3.18-16**). Qualified Native Americans receive hiring preference for available jobs.

Table 3.18-16 Managerial and Non-Managerial Positions at the Kayenta Mine Held by Native Americans, 2015

Job Category	Share of All Such Positions Held by Native Americans (percent)
Managerial/Supervisory	77
Non-managerial	99
Total	96

Source: PWCC 2015a.

Labor is a substantial operating expense for PWCC. The company's $60.8 million payearoll expense in fiscal year 2014, included $34.6 million in wages, salaries and $26.2 million in retirement and fringe benefits such as sick leave, holiday and vacation compensation. The total equates to an average payearoll and benefits cost of nearly $138,000 per employee (PWCC 2014). Adding to the economic contributions associated with PWCC's local operations are the current retirement benefits paid to former employees and future payments to current employees. Four hundred seventy-eight (478) individuals currently receive retirement payments based on service at the Kayenta and former Black Mesa mines and administrative operations, 266 of whom were employed at the Kayenta Mine at the time of their retirement. Of the 478 total, 382 reside in Arizona, including 171 in Kayenta (PWCC 2015b).

Workforce residency at the end of 2014, based on mailing address zip code, indicated a more dispersed residency pattern at the Kayenta Mine than at NGS, with 75 percent of the workers residing within a 75-mile radius of the plant. Kayenta, Tuba City, Shonto, and Pinon are the four top places of residency (**Table 3.18-17**). Beyond that distance, 107 listed places of residence elsewhere on the two reservations or Arizona. Seven percent of the mine's workforce commute from New Mexico or Utah.

Table 3.18-17 Place of Residence for Kayenta Mine Employees, 2014

Community / Chapter	Number	Percent	Community / Chapter	Number	Percent
Kayenta	235	53	Ganado	3	1
Tuba City	25	6	Many Farms	3	1
Shonto	23	5	Dennehotso	2	0
Pinon	19	4	Kykotsmovi	2	0
Flagstaff and Nearby	17	4	Cameron	1	0
Page	12	3	Elsewhere in Arizona	47	11
Chinle	10	2	New Mexico – All	20	5
Kaibeto	10	2	Utah – All	7	2
Teec Nos Pos	4	1	**Total**	**440**	**100**

Source: PWCC 2014.

Sixteen contractors and vendors hold long-term contracts to provide maintenance, reclamation and security services at the mine, with a total of 79 employees assigned to the mine. In 2013 those contracts had a combined value of $11.6 million.

Royalties paid to the tribes by PWCC averaged $40.6 million a year over the 3-year period 2011 to 2013; The distribution of payments between the two tribes can vary year-to-year based on production, but will average 67 percent to the Navajo and 33 percent to the Hopi over the long term.

PWCC makes annual bonus payments to the two tribes. These payments are established by contract and triggered and paid by any production within one year. Annual coal bonus payments to the two tribes from 2005 to 2014 averaged $7.5 million (PWCC 2015c).

In 2014, PWCC provided $435,000 in educational scholarships and more than $900,000 in donations to community, activities and program. Employees of the mine made additional monetary contributions and also volunteered time to various causes and programs.

PWCC reported payments of $25.3 million in other taxes and fees in 2013. The total includes local property taxes paid to Navajo County and other local taxing jurisdictions and transactions privilege tax (TPT)/sales taxes.

PWCC's lease agreements with the Navajo Nation and Hopi Tribes provide for the use of groundwater. While the specific financial terms of the agreements are confidential, fees are paid monthly and are subject to escalation over time. Over the past 5 years, PWCC paid an average of $1.3 million in water fees per year, based on average annual use of 1,400 acre-feet (PWCC 2015a,j). An increase in water fees, retroactive to 2015, is pending approval by the Hopi Tribal Council and the Secretary of the Interior. The closure of the former Black Mesa Mine and Black Mesa coal slurry pipeline in 2005 resulted in substantial reductions in water use and water fee revenue.

NTUA supplies the electrical energy used at the mine. PWCC payments for electrical power have averaged $9.9 million per year over the past 3 years.

PWCC makes payments into the federal Abandoned Mine Land Reclamation and the Black Lung Disability Benefit programs. Payments into these programs are based on production at the Kayenta Mine and rates established by Congress. Coal producer payments into the Black Lung Disability Trust Fund are the lower of $0.55 per ton or 4.4 percent of the sales price. Assuming the $0.55 per ton rate applies to the Kayenta Mine, Peabody's annual payments in the fund would be $4.56 million, based on annual production of 8.1 million tons (Internal Revenue Service 2005).

The Abandoned Mine Land fund was established in the Surface Mining Control and Reclamation Act of 1977 and most of the reclamation fees collected return to states and tribes in the form of grants to fund Abandoned Mine Land reclamation projects. PWCC's annual payments into the Abandoned Mine Land are about $2.55 million based on annual production of about 8.1 million tons at the Kayenta Mine. The Navajo Nation has been awarded $30.1 million in Abandoned Mine Land grants during the 4-year period 2011 through 2014. Awards to the Hopi during that period total $4.1 million (OSMRE 2015a,b).

3.18.3.1.2.6 Overview of the Navajo Nation Budget

For fiscal year 2014, the Navajo Nation recorded total revenues of $883.25 million and total expenses of $565.43 million. Operating and capital grants and contributions, the majority of which come from the federal government and are earmarked for use in specific programs, accounted for more than $342.4 million of the revenue. Included in those totals were net general fund revenues of $231.9 million and current year expenses of $208.0 million (Navajo Nation 2014b). The difference is accounted for by transfers to other funds, changes in fund balances and year-end encumbrances. The general fund revenues are vitally important to the Navajo Nation as they are what allow the Nation to exercise its sovereignty (Navajo Nation 2015).

Tax revenues, including sales and possessory interest taxes, the latter akin to a property tax, totaled $90.7 million. Mining related revenues, including royalties and bonus payments derived from the Kayenta Mine, but also the Navajo Mine in New Mexico, totaled $63.8 million, or 27.5 percent of the total revenues. Those revenues were nearly equaled by the $58.8 million in similar revenues from oil and gas produced from the Nation's resources. Lease, rental and other revenues derived from land, buildings, and ROWs was the fourth major category of revenues, accounting for $64.3 million. ROWs for oil and

gas pipelines have accounted for substantial increases in such revenues in recent years (Navajo Nation 2014b).

Expenditures for general government, including the operations of the executive, legislative and judicial functions totaled $85.1 million, which was 41 percent of the 2013 total general fund expenditures (**Figure 3.18-4**). These functions include the overall administration and management for the Nation. Community and rural development (18 percent), natural resources (13 percent), and education and training (11 percent) are the other major functions accounting for more than $20 million in total expenditures (Navajo Nation 2014b).

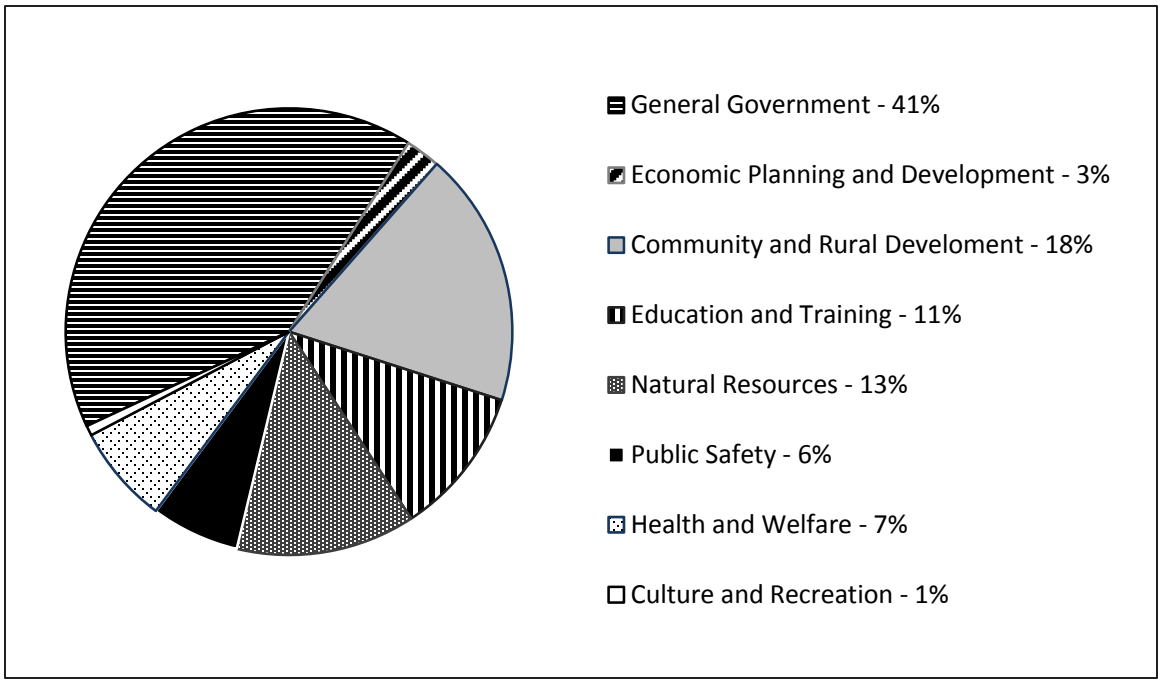


Figure 3.18-4 Percentage Distribution of General Fund Expenditures by the Navajo Nation, 2013

The expenditures shown above do not include the budgets for the Navajo Tribal Utility Authority, Navajo Agricultural Products Industry, Navajo Nation Hospitality Enterprise, Navajo Housing Authority and other enterprise activities that are legally separate from, but financially accountable to the Nation. Budget data for these enterprise activities are not publicly available.

3.18.3.1.2.7 Overview of the Hopi Tribe Budget

In 2005/2006, mining related revenues derived from the combined operations of the Kayenta and former Black Mesa mines and Black Mesa coal-slurry pipeline were reported to account for 50 to 55 percent of the Hopi general operating budget. In 2010, following reductions in budgetary adjustments associated with the closure of the Black Mesa Mine and Black Mesa coal-slurry pipeline, the Hopi reported that mining related revenues represented approximately 88 percent of the Tribe's annual budget (Hopi 2010). Although the specific percentage value may vary year-to-year, the tribe remains heavily dependent on revenues related to operation of the mine.

The Hopi Tribal Council approved a 2015 General Fund budget of $23.49 million. The general fund is the primary operating fund for the tribe, providing funding to each of the villages, the legislative, executive

and judicial branches, and other operating departments and offices. Details regarding the sources of revenue are not available; however, the royalty and bonus revenue derived from operations of the Kayenta Mine are the single major source of general fund revenues. Other sources of revenues include grants, investment earnings, and revenues from business licenses, charges for services, reserves, other miscellaneous revenues, and transfers from the Tribe's enterprise activities.

3.18.3.1.3 Housing Characteristics

Housing availability, affordability, and conditions are important elements of communities and also important indicators of socioeconomic conditions. Drawing on information from the U.S. Census Bureau, Navajo Housing Authority and Navajo Land Department, the following characterize important information regarding housing on the Navajo Nation and Hopi Reservation (**Tables 3.18-18** and **3.18-19**).

- The housing stock on the Navajo Nation includes more than 8,000 public rental and homeownership units managed by the Navajo Housing Authority.
- Despite high reported vacancy rates, housing need is high on both reservations as many of the vacant homes are substandard.
- Homeownership rates in the region are equal to or higher than across the state as a whole. However, since the underlying land cannot be held as private, the equity value of homes is lower in comparison to off-reservation homes.
- Mobile homes comprise larger shares of the existing inventory of housing on the two reservations than they do across the state as a whole.
- More than 15 percent of occupied homes on both reservations do not have access to a motor vehicle and the frequency of occupied homes having an average of more than 1.5 occupants per room is substantially higher than the statewide average of 1.3 percent.
- Of the occupied homes, more than 15 percent of those on the Hopi Reservation and 20 percent of those on the Navajo Nation reported lack of complete plumbing facilities, complete kitchen facilities, and/or telephone service; these rates are as much as 25 times the statewide averages.
- More than 60 percent of the occupied housing units on the Navajo Nation and the Hopi Reservation rely on wood for heating, 30 times the statewide average statewide (those on the reservations constituting the majority of the statewide total).
- Wood and coal are used for heating in some homes on the two reservations; those using coal may obtain it for free or for a fee at the Kayenta Mine or purchase it from local vendors who buy and resell coal produced at the mine.
- Single room homes are much more common on the reservations, particularly on the Navajo Nation, than elsewhere in the state. This reflects the continued use of hogans, the traditional Navajo dwelling.

Table 3.18-18 Housing Occupancy and Vacancy, 2010

Geographic Area	Total Housing Units	Number of Occupied Units	Percent Owner Occupied Units	Number of Vacant Units	Percent Vacant	Percent Mobile Homes
Navajo Nation	68,945	43,623	63.3	25,322	36.7	19.8
Hopi Reservation	2,782	1,991	74.6	791	28.4	16.4
Arizona	2,859,768	2,370,289	64.4	489,479	17.1	10.7

Source: U.S. Census Bureau 2010b.

Table 3.18-19 Selected Characteristics of Occupied Housing Units, 2010

Geographic Area	Occupant Has No Vehicle Available	More than 1.5 Occupants per Room	One Room	Lack Complete Plumbing Facilities	Lack Complete Kitchen Facilities	No Telephone Service Available
Navajo Nation	15.2%	9.6%	22.7%	21.4%	17.1%	23.2%
Hopi Reservation	19.3%	7.5%	7.9%	17.2%	18.3%	3.7%
Arizona	6.9%	1.3%	2.2%	0.8%	0.9%	3.0%

Source: U.S. Census Bureau 2010b.

3.18.3.1.4 Educational Attainment

More than twice as many Navajo adults did not complete high school compared to the Arizona statewide average. (**Table 3.18-20**). The percentage of Navajo and Hopi adults completing high school but not continuing to college is higher than the statewide average. Consequently, the percentages of Navajo and Hopi having a bachelor's or advanced degree are substantially lower than the 26.9 percent of all Arizona residents.

Table 3.18-20 Educational Attainment of Individuals 25 Years of Age and Older

Geographic Area	Did Not Complete High School	High School or Equivalent, No College	Some College or Associate Degree	Bachelor's or Advanced Degree
Navajo Nation	30.0%	33.5%	28.8%	7.7%
Hopi Reservation	16.8%	32.2%	41.7%	9.3%
Arizona	14.3%	24.5%	34.3%	26.9%

Source: U.S. Census Bureau 2014.

Both Tribes have tribal scholarship and financial assistance programs to assist members achieve their educational goals. NGS and PWCC both make annual contributions to support those programs and both conduct extensive training programs to help employees advance their careers.

3.18.3.1.5 Factors that May Contribute to Socioeconomic Changes through 2019

The NGS currently is authorized to operate through 2019. The socioeconomic affected environment must therefore consider possible near-term changes in socioeconomic conditions. Although no well-defined, committed major projects or actions have been identified that could substantially alter northeastern Arizona socioeconomic conditions by 2019, the following trends, projects, or other economic and community development activities could affect socioeconomic conditions in some areas.

3.18.3.1.5.1 General Population Growth

Recent population projections prepared by the Arizona Department of Administration indicate moderate to strong growth (between 13 and 20 percent) could occur in the State of Arizona through 2020 (**Table 3.18-21**).

Table 3.18-21 Population Forecasts for the State of Arizona, 2010 to 2020

Projection Scenario	2010	2020	Absolute Change 2010 – 2020	Percent Change
Low Growth	6,392,017	7,225,100	833,083	13
Medium Growth	6,392,017	7,485,400	1,093,383	17
High Growth	6,392,017	7,698,200	1,306,183	20

Source: Arizona Department of Administration 2012a.

The population projections for northeastern Arizona anticipated much lower growth; the net changes range from 5 percent (16,212 residents) under the low series to 8 percent (25,112 residents), under the high series (**Table 3.18-22**). Coconino County is anticipated to realize the largest share of growth under all of the scenarios; up to 11,200 additional residents under the high series. Most of that growth would likely occur in the Flagstaff area, although some could occur in Page and the portions of the Navajo Nation and Hopi Reservation located within the Coconino County borders (Arizona Department of Administration 2012b).

Table 3.18-22 Population Forecasts for Northeastern Arizona, 2010 to 2020

		Projected Population in 2020		
	2010 Census	Low Growth	Medium Growth	High Growth
3-CountyTotal	313,388	329,600	334,600	338,500
Net Change 2010-2020	NA	16,212	21,212	25,112
Net Change (percent)	NA	5%	6%	8%

NA = not applicable.

Source: Arizona Department of Administration 2012a.

3.18.3.1.5.2 Potential Economic and Community Development Activities

The following ongoing and potential future activities are located in or could involve regional-level actions or programs affecting the Tribes and thereby affect the affected environment in the primary segment of the study area through the end of 2019.

<u>Other power plants and coal mines in the region</u>: Three existing power plants and several coal mines are located outside of primary segment of the study area, but collectively contribute to the region's economic base and to the fiscal and economic stability of the region. Several of these are or have recently undergone retrofits, closing of one or more units, conversion to natural gas, or changes of ownership. The socioeconomic implications of these changes is unclear, but generally underscore the importance of the jobs, income and tribal revenues associated with the NGS and the Kayenta Mine, particularly in the future if the contributions from these other sources decline.

- Four Corners Power Plant and Navajo Mine (New Mexico)
- San Juan Generating Station and San Juan Mine (New Mexico)
- Cholla Power Plant (Navajo County)
- Other projects: In addition to NGS, FCPP, San Juan and Cholla generating stations, the Escalante, Coronado, and Springerville generating stations and El Segundo, Navajo, and Lee's Ranch mines operate in northeastern Arizona and nearby northwestern New Mexico.

New Hopi Villages: The Hopi have announced plans to develop one or more new villages as part of the tribe's long-term community and economic development strategy. New residential and commercial development is sought to accommodate future population growth and to allow off-reservation Hopi to return. Any related activity before 2019 would most likely involve further planning and perhaps initial site preparation and utility construction. Such activities would not substantially alter socioeconomic conditions in the primary segment of the study area.

Potable water development project near the Kayenta Mine: The Many Mules Water Project is designed to deliver water to residents in the Kayenta and former Black Mesa mines lease and surrounding area (this project is discussed further under the *Sociocultural Setting* heading below). Construction of Phase I is anticipated to begin in 2016 with initial deliveries in 2018.

Development in the former Bennett Freeze Area: Originally enacted by the BIA in 1966, the "Bennett Freeze" effectively prohibited new development, including extension of utilities, road improvements, and even maintenance and repairs of existing properties across the southwestern portion of Navajo-Hopi Partitioned lands. In 2009, President Obama signed a law repealing the Bennett Freeze (Section 10(f) of Public Law 93-531), paving the way for efforts to address the many needs of the region's residents. At the time of this assessment, no comprehensive development strategy is in place, making any large-scale activities by 2019 uncertain. As a result, activities before 2019 are unlikely to substantially affect socioeconomic conditions in the primary segment of the study area.

Proceeds of the Cobell Indian Trust Settlement: In 2014, the Navajo Nation reached a $544 million settlement with the federal government, as part of a settlement of a larger class-action suit, *Cobell v. Salazar,* regarding the alleged mismanagement of funds and natural resources on the Navajo Nation. Since the settlement, the Navajo Nation has been engaged in a process to define and prioritize potential uses of the funds. In January 2016, the 23rd Navajo Nation Council approved $180 million for water and sanitation system improvements across the Navajo Nation (Navajo Nation Council 2016). Plans for the remaining funds have not been released. Activities related to the use of those funds are unlikely to substantially affect socioeconomic conditions in the primary segment of the study area prior to 2020.

General Leasing Act Implementation for the Navajo Nation: In 2014, the Interior Department approved the Navajo Nation General Leasing Regulations Act of 2013. That act extends Navajo leasing authority to all tribal surface lands without the approval of the Secretary of the Interior. Federal approval is still required for mineral and ROW leases. Although future development could occur prior to 2020, no specific changes are considered as part of the affected environment.

3.18.3.1.6 Sociocultural Conditions and Trends

This section describes recent and current relevant sociocultural conditions and trends for the area that includes NGS, the Kayenta Mine, and the former Black Mesa Mine. Concerns about historic and current operations of these facilities expressed during scoping and in contacts with local residents and tribal and community officials also are discussed. As noted above, the primary segment of the study area includes the Navajo Nation, Hopi Reservation, and northern Coconino and Navajo counties, Arizona, with a focus on the Navajo chapters surrounding NGS and the Kayenta Mine lease area, and the nearby off-reservation community of Page. The area is predominantly rural with a number of dispersed communities ranging from about 400 residents to about 9,000 residents.

NGS and the Kayenta Mine have been in operation for over 40 years; consequently the historical operations of these facilities and the related effects are considered part of the affected environment for this socioeconomic assessment. Because of this long history, the economic contributions and concerns about environmental, health, and sociocultural effects of these facilities are well known. The Navajo Nation and the Hopi Tribe, along with OSMRE, BIA, Indian Health Service, SRP, PWCC, and other agencies and institutions have ongoing initiatives and mechanisms to address many of these effects and

concerns. The experience with current and historical operations of the two facilities provides useful insights into potential sociocultural effects of the Proposed Action and alternatives.

In general, sociocultural conditions are anticipated to remain relatively unchanged through 2019, with the exception that some predominately Navajo households near NGS that are presently unserved by electricity may receive service and some homes within and near the Kayenta and former Black Mesa Mine lease areas may receive residential water service as part of Phase 1 of the Many Mules Water Project (discussed further in the following section).

3.18.3.1.6.1 Sociocultural Setting

The sociocultural setting in the primary segment of the study area has been influenced by a long and complex history of interactions between the Navajo Nation and the Hopi Tribe, between each tribe and the federal government, and between each tribe, SRP and PWCC. Each tribe's traditional cultural beliefs and values,[9] and socioeconomic trends including poverty, limited employment opportunities, high unemployment, housing shortages, and lack of infrastructure are major influences on sociocultural conditions.

Sociocultural trends on the Navajo Nation and Hopi Reservation over the past century include population growth, emigration to off-reservation locations, an increasing reliance on wage and salary employment, a change to on-reservation education as opposed to off-reservation boarding schools,[10] increased use of English as both a primary and secondary language, and the establishment of Tribal governments (Hopi Office of Community Planning and Economic Development 2001; Lyon 2003). For the Navajo, sociocultural trends have been influenced by livestock reduction programs of the 1930s and 1940s.

In the part of the Navajo Nation that includes the Kayenta Mine lease area, and in the northeastern part of the Hopi Reservation, sociocultural trends have been influenced by the passage of the 1974 Navajo-Hopi Land Settlement Act as amended in 1980. Implementation of that Act resulted in the relocation of thousands of residents from the designated "partitioned lands." Although some Hopi were relocated, the majority (99 percent) of relocations were Navajo (U.S. Department of the Interior 2014).

Today, members of the Navajo Nation and Hopi Tribe may work in contemporary occupations both on and off reservation while maintaining aspects of their culture, customs and traditional lifestyles (Black Mesa United, Inc. 2005; Hopi Office of Community Planning and Economic Development 2001).

Grazing is the primary land use within the proposed KMC permit area while farming is a minor use; both are important from an economic and a cultural standpoint. Mining activity at the Kayenta Mine has resulted in displacement of some grazing within the permit area. Permittees whose grazing is displaced receive compensation from PWCC under arrangements developed in consultation with the Navajo Nation. As mining and reclamation is completed, PWCC works with the grazing permittees and chapters to reestablish grazing in the area and to implement sustainable grazing practices (see Section 3.14, Land Use). The resulting grassland communities are intended to increase the livestock carrying capacity and improve the potential for grazing management (OSMRE 2011). Forage production for livestock could increase substantially over the original forage productivity of the land (OSMRE 1990). Surveys completed during the mid-1980s identified 31 small fields on the leasehold, primarily for growing corn. The total acreage of the fields was approximately 138 acres. These plots were typically located on terraces adjacent to major drainages that are not normally disturbed by mining activities. Many were located near individual or clustered home sites. Some of these areas have been withdrawn for mining over the past 30 years.

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[9] Navajo and Hopi traditional values are discussed in a later subsection.

[10] A result of the Indian Self-Determination Act of 1972.

Poverty has been a persistent problem on both the Navajo Nation and the Hopi Reservation. As shown in **Table 3.18-9**, poverty rates for both tribes are more than double the national average. The availability of jobs on the Navajo Nation and the Hopi Reservation has not kept pace with the number of Navajo and Hopi entering the workforce, resulting in persistent high unemployment and fostering off-reservation emigration. Consequently, existing jobs, particularly well-paying jobs such as those at NGS and the Kayenta Mine, are an important source of income and economic activity in the primary segment of the study area. Even the temporary jobs associated with the annual overhauls are highly valued among the Navajo in Page and the northwestern portion of the Navajo Nation. Equally important are the tribal services and employment supported by NGS and Kayenta Mine-related taxes, royalties and other payments (Etsitty 2014; Honanie 2014). Direct, indirect, and induced employment associated with NGS and the Kayenta Mine allows many Navajo and Hopi workers to remain on or return to the two reservations, or live in nearby Page.[11] On both reservations, many employed workers support an extended family, increasing the standard of living for multi-generational families of workers (Arizona Rural Policy Institute 2012; Black Mesa United, Inc. 2005).

The economic and fiscal importance of NGS and the Kayenta Mine notwithstanding, there are Navajo and Hopi who are deeply concerned about cultural, environmental, and health effects of the two facilities. These concerns have given rise to social and environmental activism and the formation of organizations that advocate for cultural, environmental, and health issues, particularly in the Black Mesa area. A number of these individuals and organizations also advocate for a transition to renewable energy generation to replace NGS and help support the tribal economies.

3.18.3.1.6.2 Contemporary Sociocultural Issues

Given the 40-year history with NGS and the proposed KMC, there has been extensive discourse about the two facilities in a variety of studies, articles, interest group websites, and other secondary sources. These issues have been expressed in government-to-government consultations with the tribes, scoping comments to the EIS (see Section 1.11), and in two meetings with residents of the Kayenta and former Black Mesa mine lease area hosted by Reclamation and OSMRE at the Kayenta Mine. Reclamation provided a Navajo language interpreter at these meetings to allow residents to express their concerns in Navajo if they so desired.[12] Follow-up interviews using a Navajo language interpreter were conducted with a number of lease area residents to further explore these issues. Interviews also were conducted with tribal and off-reservation local government officials.

The following summarizes the discourse on these topics. Issues involving both NGS and the Kayenta Mine are discussed first, followed by existing conditions and specific concerns associated with NGS and the Kayenta Mine individually. The summary places the issues in the contemporary sociocultural context and, where appropriate, the discussion identifies current Navajo Nation, Hopi Tribe, federal government, SRP, and PWCC efforts to monitor and address these issues, and provides references to other sections of the EIS that address these topics.

<u>Economic Importance to the Navajo Nation and Hopi Tribe</u>

The Navajo Nation relies heavily on employment from NGS and the Kayenta Mine, and the associated lease and royalty payments (Etsitty 2014). According to former Navajo Nation President Ben Shelly, “NGS is an essential component of the Navajo Nation’s economy and our energy portfolio, and must remain viable, for the sake of the Nation and our people, for years to come” (Shelly 2011).

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[11] In November of 2014 almost 89 percent of NGS employees lived on the Navajo Nation or in Page and over 79 percent of Kayenta Mine employees lived on the two reservations or in Page (PWCC 2014; SRP 2014).

[12] There are no Hopi living within the lease area.

The Hopi Tribe views NGS[13] and the Kayenta Mine as "an essential and vital element of the Tribe's current and future economy (Shingoitewa 2010), and believes that the royalties and bonuses paid by PWCC to the Tribe are an important and integral part of the Hopi economy" (Honanie 2014). In 2008, the Hopi and SRP entered into a generation performance agreement which addresses payments made by SRP to the tribe in conjunction with NGS operations (see **Appendix 1A**).

As the sources of more than 830 jobs held by Native Americans (primarily Navajo[14]), NGS and the Kayenta Mine are major employers in an area of chronically high unemployment. Purchases by NGS and the Kayenta Mine, and those by NGS and mine employees in turn generate indirect and induced jobs on the two reservations and in nearby off-reservation communities. In addition to the full time jobs at NGS, the annual overhaul activities provide between 800 and 1,200 temporary jobs, a substantial portion of which are routinely filled by members of the Navajo tribe (SRP 2016).

NGS and Kayenta Mine employees reside mainly in the northwest part of the Navajo Nation and in nearby Page, Arizona. Consequently, the direct economic effects of the two facilities' employment are fairly localized. NGS and Kayenta Mine lease payments, royalties, taxes, and other revenues also support a large percentage of the tribal jobs and programs that provide services across the two reservations. Consequently the secondary economic, employment, and service effects of the two facilities are distributed throughout both reservations.

<u>Economic Importance to Coconino and Navajo Counties and the City of Page</u>

NGS and the Kayenta Mine provide substantial contributions to the economies of Coconino and Navajo counties, in terms of employment, purchases of goods and services, and generation of tax revenues and other payments. Page is particularly dependent on NGS for the robustness of its economy and for its contributions to the social fabric of the community. Because of its year-round operations, NGS provides an important counterbalance to Page's other major industry – tourism and outdoor recreation, which is seasonal. The annual overhauls at NGS, which occur in the off-season for tourism, provide an important boost to local merchants and lodging and dining establishments. As a regional trade center, plant and mine employees purchase goods and services in Page. NGS workers hold political office (five Page mayors have been NGS employees) and serve on boards and committees. Spouses of NGS workers are an important source of employees for local government, schools, and businesses. Additionally NGS and its employees donate funds and volunteer time to local charitable and civic initiatives (Diak 2015; SRP 2014).

Kayenta, Tuba City, Flagstaff, Winslow, and Prescott also benefit from NGS and Kayenta Mine employee purchases of goods and services. NGS in lieu, property tax and voluntary payments are important for Coconino County, the Page Unified School District, and local special purpose and service districts. The Kayenta Mine is fiscally important for Navajo County, and the large number of mine workers (53 percent) who live in Kayenta help diversify the tourism economy in that community.

3.18.3.1.6.3 Navajo Generating Station

Concerns about NGS generally focus on the potential effects of plant emissions on air quality, visibility, climate change, and human and ecological health, including effects on endangered species. There is concern that emissions may be contaminating soil, water, and food sources. This is important to the Navajo and Hopi because some rely on subsistence farming, livestock grazing, hunting, and gathering of

[13] The Hopi Tribe views NGS and the Kayenta Mine as a single economic complex, with Hopi coal important to the overall success of the complex (Shingoitewa 2010).

[14] The Hopit Tunatya' at 2000: The Hopi Strategic Land Use and Development Plan estimated that 24 Hopi were employed at the Black Mesa and Kayenta Mines in 2000 (Hopi Office of Community Planning and Economic Development 2001).

traditional plants for part of their diet. Air quality impacts are discussed in Section 3.1, Air Quality. Agricultural and food chain effects related to NGS are discussed in Section 3.16, Public Health and Human Health Risk Assessment.

Several scoping comments expressed concern for the effects of coal combustion waste on groundwater near NGS. As noted in Section 2.2.4.4, NGS is designed to be a zero discharge facility, and has a groundwater protection plan in place. Effects of coal combustion waste are discussed in Section 3.15, Public Safety and in Section 3.7, Water Resources.

3.18.3.1.6.4 Kayenta Mine and Former Black Mesa Mine Lease Areas

As shown in **Figure 3.18-5**, most of the proposed KMC is located within the Navajo Nation. The northern part of the lease area is in the Kayenta Chapter, a small segment on the east side is in the Shonto Chapter, and the southern part is in the Forest Lake Chapter and an area of the Hopi Reservation designated as Range Unit 263.

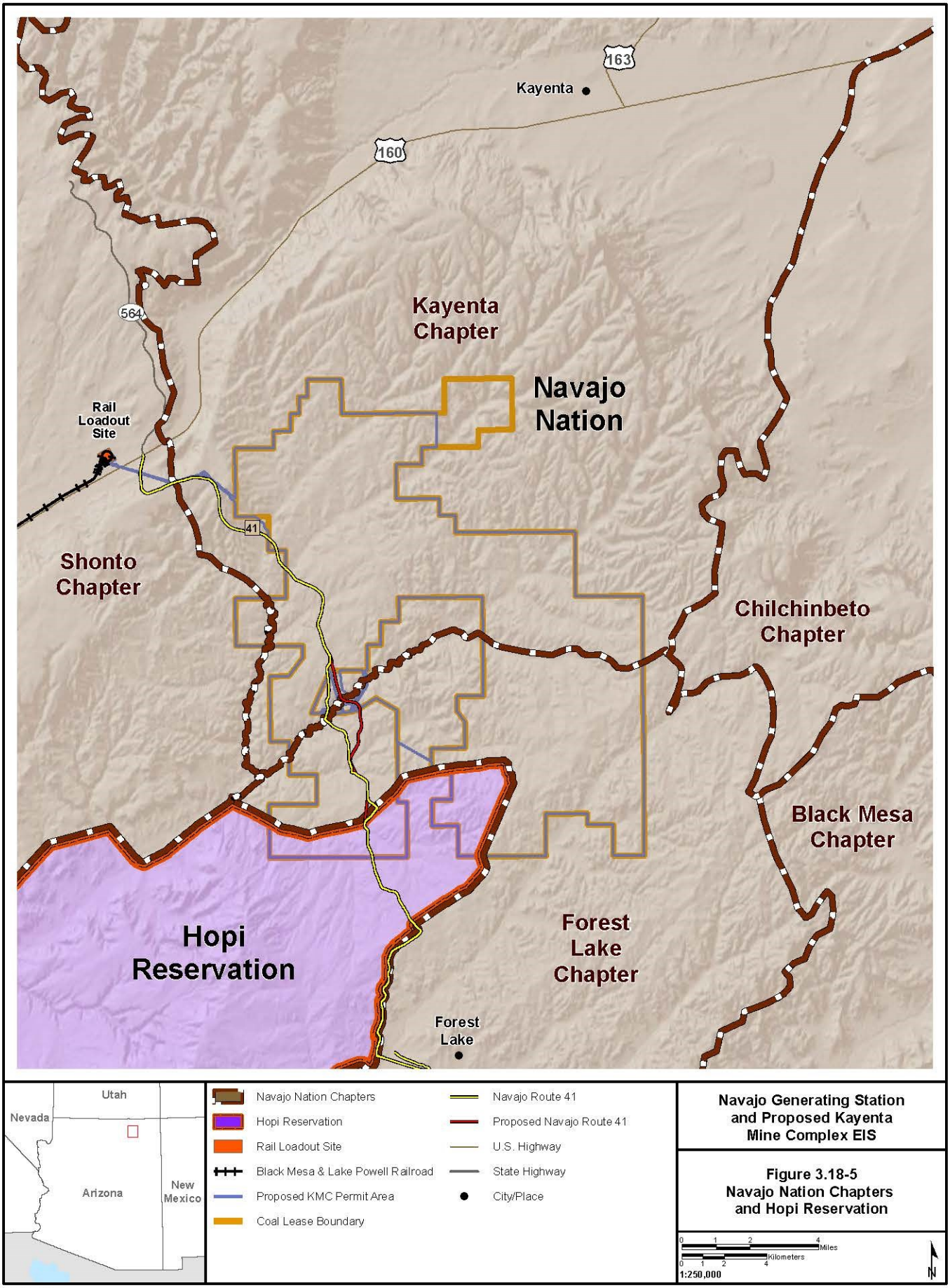
Prior to the beginning of coal mining, Black Mesa was, like much of the Navajo Nation, a remote and sparsely populated area. Residents lived in dispersed home sites, grazed livestock and raised native corn and other crops. Grazing continues in the lease area, which also supports limited, mostly subsistence-scale farming, gathering of plants, hunting, and some commercial trapping. These traditional activities are important, as are the jobs provided by the mine (Black Mesa United, Inc. 2005).

When the original coal leases were negotiated in the early 1960s, approximately one dozen extended families lived on what is now the Kayenta and former Black Mesa Mine lease area. In the intervening years, the number of households in the lease area has increased to more than 100, many of which house multiple generations and families and include the adult children or grandchildren of the original residents. Many current residents of the area work or have worked for PWCC, which has allowed them to remain in the area. (Black Mesa United, Inc. 2005; PWCC 2015d).

Within and adjacent to the lease area, residents have coexisted with surface mining since the early 1970s. Prior to the closure of the Black Mesa Mine in 2005, PWCC employed about 750 workers at the two mines. Since the closure, the Kayenta Mine has produced an average of 8 million tons of coal per year, employing over 400 workers, most of whom are Navajo, including some lease area residents. PWCC provides a variety of services for lease area residents including free coal, water, emergency fire and medical response, and road maintenance.

Lease area residents who participated in the Reclamation-sponsored meetings and interviews were of the opinion that few, if any, local residents read or spoke English when the initial lease agreements were negotiated. Local familiarity with mining came from two small nearby underground coalmines that ceased operations in the 1950s. Residents at that time reportedly believed the new mines would be similar to those small operations and would allow continued grazing in areas that would be mined. Some of the residents assert that the area's original residents also were promised jobs, new homes, electrical and water service, paved roads, and other community services (Black Mesa United, Inc. 2010).

Beyond providing an important source of income, mining has transformed the local landscape and displaced cultural resources, traditional cultural properties, and burial sites. Lease area residents experience mining activities, heavy equipment and workforce traffic, blasting and other noise, and dust on a daily basis. Mining has displaced some residents from their homes and customary grazing areas.



Navajo Generating Station and Proposed Kayenta Mine Complex EIS

Figure 3.18-5
Navajo Nation Chapters and Hopi Reservation

7/28/2016

PWCC-supported Services and Water System Plans

Lease area residents receive a number of PWCC-supported amenities and services. Some residents of surrounding Navajo chapters and Hopi villages also receive free coal and access PWCC-provided watering stations.

All but five homes in the lease area have electrical service, but none have water service (PWCC 2015e). Lease area residents, like those in many rural parts of the Navajo Nation, must haul water for their homes and livestock. PWCC provides two public use water stations within the lease area and hauls water to some livestock tanks and residents unable to haul their own water (PWCC 2015e). Persons from outside the area also use the water station because the water is free, in contrast to that at some water stations operated by chapters, which charge for water.

The Many Mules Water Project is designed to deliver water to dispersed home sites in and near the Kayenta Mine lease area (Black Mesa Review Board [BMRB] 2015). Phase 1, of a planned four phase project, is scheduled to begin construction in 2016 and will deliver water to approximately 60 residences. PWCC agreed to allow use of an existing mine well to supply water for the project (Navajo Nation 2011). In 2013, the Navajo Nation approved $5.2 million for the project, using funds received as part of its lease agreement with PWCC (Navajo Nation 2013a). As of January 2106, an additional $4.5 million was dedicated by PWCC for Phase 2 of the Many Mules project (PWCC 2015). The BMRB (described in the following Kayenta/Black Mesa Lease Area Oversight and Planning subsection) was awarded a $300,000 Abandoned Mine Land program grant to construct bathroom additions and install plumbing in homes to be served by the Many Mules Project (BMRB 2010). Completion of the remaining three phases is contingent upon further funding (BMRB 2015).

Coal from the Kayenta Mine is made available to Navajo and Hopi from mid-October to mid-March for home heating (OSMRE 2011). Wood salvaged during clearing of areas to be mined also is made available to lease area residents free of charge. Lease area residents receive coal card coupons allowing them to obtain up to six pickup loads per year at no cost. Navajo chapter governments also are provided coupons, which are intended for distribution to the elderly and disabled. The Hopi tribe is provided 3,500 coupons per year, for distribution through the village governments. All others are charged a fee for coal. Some Navajo and Hopi purchase coal, repackage it and sell it at roadside stands or markets. PWCC has distributed over 13,000 tons of coal annually in recent years. PWCC distributes a flyer regarding the safe use of coal in the home at the coal distribution site (PWCC 2015d).

PWCC has more than 40 trained first responders on staff to respond to accidents, wildfires and emergency medical situations in and near the lease area. The Kayenta Mine first aid station is open on a 24-hour per day basis, and staffed by certified personnel. Although the station primarily is for PWCC employees, it is available to the public in life threatening situations. The station is not staffed by doctors or nurses, nor is it intended to treat routine medical conditions. PWCC hosts an annual health fair for employees and area residents, which provides routine screening such as body mass index, blood pressure, blood sugar, and blood testing for other health indicators. Flu shots also are available. Indian Health Services participates in the health fair (PWCC 2015f,g).

Including road maintenance, snowplowing, the provision of gravel, charitable contributions, and sponsorship for community events, PWCC has averaged between $750,000 and $800,000 per year in in-kind and monetary contributions to the Navajo Nation and Hopi Tribe in recent years.

Air Quality, Human Health and Safety, and Ecological Health

A common concern among lease area residents is the reported high incidence of respiratory disease, which they attribute to dust, coal dust,[15] blasting emissions, coal conveyance, and smoke from indoor heating. Many households use or have used wood and coal for heating, also a potential cause of respiratory disease. Lease area residents also are concerned about the risk of cancer from mining activities. No epidemiological studies have specifically examined health impacts resulting from mining operations in the Black Mesa area (National Renewable Energy Laboratory [NREL] 2012b), although a human health risk assessment was prepared for this EIS (see Section 3.16, Public Health and Human Health Risk Assessment). Some residents note that although mine employees have health insurance, many residents do not, but, like other Navajo living in the area, all must travel to Indian Health Service clinics in Kayenta, Tuba City, and elsewhere for health care.

There also is concern that emissions, coal dust, and fugitive dust from the mine are contaminating soil, water, and food sources for residents in and near the lease area because some rely on subsistence farming, livestock grazing, hunting, and gathering of traditional plants for part of their diet (see Section 3.16, Public Health and Human Health Risk Assessment, for a discussion of depositional effects of KMC emissions). A number of scoping comments raised concern about the effects of mining on plants and animals in and near the lease area. There are particular concerns for effects on endangered species and that mining activities may alter habitat and migration patterns for some species. These issues are discussed and addressed in Sections 3.10 through 3.13. Generally, ecological health is linked to air quality, water quality and quantity, habitat and migratory corridor use, and reclamation which are discussed in the corresponding sections of the EIS.

Although security gates prevent public access to roads in the active mine areas, some area residents have voiced concerns about traffic accidents and the risk associated with heavy equipment and personal vehicles sharing access roads leading to mine facilities and active mining areas.

Water Quantity and Quality Concerns

A number of Navajo, Hopi, and non-governmental organizations (NGOs) expressed concern that ongoing water use at the Kayenta Mine combined with historic pumping of the Navajo Aquifer (N-Aquifer) to supply the former Black Mesa Mine and Black Mesa coal-slurry pipeline has substantially depleted the N-Aquifer, with associated adverse effects on springs, seeps, and wells in the Black Mesa area.

The arid climate, periodic drought, concern about climate change, and traditional values regarding water heighten the importance of water issues in the Black Mesa area. The N-Aquifer is the primary and in many instances, the only source of drinking water on the Hopi Reservation, and on parts of the Navajo Nation on and near Black Mesa. Moreover, springs and seeps in the area are culturally important and water in general has a key religious significance for both tribes (see the Native American Traditional Values sub-section below). Some lease area residents also are concerned that surface mining has altered aquifers, resulting in loss of springs.

Section 3.7, Water Resources, describes the surface water and groundwater monitoring programs in place at the Kayenta Mine. These programs are administered by the Navajo Nation, the Hopi Tribe, OSMRE and U.S. Environmental Protection Agency. Section 1.7.2.1 describes water control facilities associated with the Kayenta Mine.

[15] Coal stockpiles and coal handling facilities are cited by some residents as sources of coal dust.

Relocation and Compensation

The relocation of Navajo living within the Kayenta Mine and former Black Mesa Mine areas is a concern for some lease area residents. Navajo are traditionally a matrilineal and matrilocal society, meaning property descends through females, daughters establish homes close to their mothers, and their husbands come to live on their wife's lands (Lyon 2003). Traditionally, a baby's umbilical cord is buried near the birthplace, and according to Navajo culture, that practice creates a strong attachment to a person's home area. Family members who move away for educational or employment purposes often return to live near their families, which promotes family cohesion and allows the transmittal of traditional cultural practices from one generation to the next.

In the Kayenta and former Black Mesa Mine area, PWCC leases with the tribes require that residents are relocated if their residences fall within the required minimum separation distance between mining activities and occupied buildings. PWCC, in cooperation with the affected parties and according to tribally approved procedures, either provides a replacement home on a mutually agreed upon location, or compensates the owner with a negotiated lump sum payment for the value of all structures. The resident is given the choice of relocation to a replacement home or monetary compensation. PWCC negotiates directly with the homeowner for relocation of households. To date there have been no involuntary relocations within the lease area. In instances involving relocation, PWCC works with the Navajo Nation Land Department to help the homeowner secure a new homesite lease and pays for surveys, cultural and environmental clearances, and site grading. In addition to constructing new residences and improvements, PWCC installs cisterns and septic systems, and prepares the home for water and electrical service. PWCC attempts to relocate residents within their customary use areas (i.e., where grazing takes place or where sociocultural ties exist); however, some residents have chosen to be relocated to distant communities such as Kayenta, Chinle, Window Rock, and elsewhere (PWCC 2015e,h).

Since 1970, 27 households have relocated and received replacement residences and improvements, and another five have relocated temporarily. A total of 13 households have received lump sum compensation for their residences and 56 have been compensated for other improvements. Four households were compensated for inconvenience during the 1980s (PWCC 2015h).

During the 1970s and early 1980s, most residents chose to receive lump sum compensation for residences and improvements on land withdrawn for mining use. A few chose to be relocated and provided with replacement homes. Most residents who were compensated or received replacement homes during that period are now deceased (PWCC 2015e,h). PWCC compensated residents for the appraised value of existing homes. Some residents who were compensated for their homes during the 1970s and 1980s have stated that the compensation was inadequate to fund construction of new homes.

Some lease area residents who were relocated said that they had springs or ponds at their original locations but water was not available at their replacement home site. Others report moving more than once due to mining activities. Some residents state that although their lands were not taken for mining, the proximity to mining activities compelled them to move.

When grazing lands are to be withdrawn for mining, PWCC coordinates with the grazing permit holder and the Navajo Nation Land Department. PWCC compensates grazing permit holders for any acreage withdrawn from a customary use area for mining. The rate of compensation for such withdrawals was determined in discussions between PWCC and the Navajo Nation. Currently compensation is paid in 5-year increments at the beginning of each 5-year period, until mining is completed and the land is reclaimed and returned to the Navajo Nation (PWCC 2015e).

3.18.3.1.6.5 Homesite Leases

Individual Navajo households may construct a home on rural portions of the Navajo Nation. To build a home or receive electrical or water service to an existing home on the Navajo Nation requires a Navajo Nation Land Department homesite lease. If the desired homesite is located within a grazing permit area, as most dispersed housing is, the prospective homeowner must obtain permission from the Chapter grazing board and the grazing permit holder. The lease applications undergo review by the Navajo Nation Environmental Protection Agency, Navajo Department of Fish and Wildlife, and the Navajo Nation Historic Preservation Department. These agencies review human health considerations, and potential impacts to biological and cultural resources, when issuing homesite leases (Navajo Nation 2015b). The Navajo Nation has authority to issue homesite leases under the General Leasing Act; however, currently the BIA continues to issue the leases.

Obtaining a homesite lease is reportedly difficult across the Navajo Nation. Within the PWCC lease area, homesite leases are not currently being approved (PWCC 2015d,e).

According to some lease area residents, the inability to obtain homesite leases has resulted in overcrowding of residences and stress on families whose adult children desire to establish residences near their parents' homes.

3.18.3.1.6.6 Structural Damage to Homes

Some residents of the Black Mesa area report broken windows and cracks in their walls and foundations, which they attribute to mining-related blasting.

Blasting operations at the Kayenta Mine are conducted in accordance with Federal law, applicable regulations, and the approved mine permit application. Under federal requirements (30 Code of Federal Regulations Part 816.62), a resident or owner of a dwelling or structure inside or within 0.5 mile of the permit area may request a pre-blasting survey be conducted. Upon receipt of such a request, Peabody conducts a survey analyzing the conditions of the structure prior to blasting activities, documenting any pre-blasting damage and other physical factors that could be affected by the blasting. A written report is prepared and copy provided to the OSMRE and the person requesting the survey.

Procedures for controlling adverse effects of blasting are specified under 30 Code of Federal Regulations Part 816.67. Although federal law and regulations allow mining up to 300 feet from an occupied dwelling, the Kayenta Mine permit prohibits blasting within 0.5 mile of an occupied dwelling. Residents are notified in advance of the blasting schedule, notices are posted in public locations, and residents near the blasting area are evacuated prior to any blasting. Blasts are monitored for air blast and ground vibration twice per year in June and December. PWCC monitors air blast and ground vibration for all shots exceeding the scaled distance equation, as well as any required by the regulatory authority at their requested location. OSMRE reviews Kayenta Mine's blasting records monthly during field inspections (PWCC 2012 et seq.).

3.18.3.1.6.7 Employment

The Kayenta Mine is by the dominant private sector employer in the area, providing well-paying jobs that would be otherwise unavailable locally. At the time of this assessment, many lease area residents have, or have had jobs with PWCC or its contractors. Mine-related employment is economically important and has raised the material standard of living for many lease area households. More than 400 mining jobs were lost when the former Black Mesa Mine closed.

Some lease area residents report difficulties in obtaining employment at the mine. PWCC's requirements for new hires vary depending on the position being filled. Some require prior experience, education, and training, others require only a high-school education. PWCC fills approximately five positions annually in

response to retirement, termination for cause, or voluntary departure by the employee. Most current employees have over 20 years tenure at the mine and turnover rates are low (PWCC 2014).

3.18.3.1.6.8 Lease Area Roads

As noted in Section 2.3.1.4, PWCC maintains the paved portion of N-41 from its intersection with U.S. Highway 160 to the former Black Mesa Mine; the remainder of the route is not routinely maintained. Overall, PWCC maintains 173 miles of roads within the lease area. All roads are signed and maintained through periodic grading and dust suppression. Security gates prevent public access on roads in the active mine areas. PWCC security vehicles escort school buses and delivery vehicles within the gated parts of the mine (OSMRE 2011). After a snowstorm, PWCC first plows N-41, then school bus routes, and then other roads including those leading to dispersed home sites. Roads to home sites may not be plowed for several days after a large snowstorm (PWCC 2015f). PWCC is not obligated to plow roads leading to homesites, but does so as a courtesy to lease area residents.

Some residents state that N-41, from the former Black Mesa Mine facilities to the southern lease area boundary, and the Kayenta Mine road should both be paved for safety and dust control reasons. Residents also would like to see the paved portion of N-41 realigned and improved to higher standards.

Dust in the southern portion of the lease area is often associated with trucks hauling gravel from the southern part of the lease area for the Red Dog Gravel Project, an intergovernmental partnership of the Navajo Nation Department of Transportation, Navajo County, BIA, PWCC, the Pinon and Kayenta school districts, and 10 local chapters (Navajo Nation Office of the President and Vice President and Navajo County Board of Supervisors 2013).

No formalized agreement for maintenance of the paved portion of N-41 exists with the BIA, but PWCC maintains roadway shoulders and drainage, and coordinates with the Navajo Nation Department of Transportation for repaving or seal coating of the route. PWCC graveled 13 miles of N-41 from the end of the pavement south to Dinnebito Wash and prepared it to be paved. The Navajo Nation Road Department has considered completing the paving, but project funding has not been identified (PWCC 2015e).

Local residents noted that some roads and drainage crossings in the lease area become impassable following heavy rains, and although main access roads are quickly repaired, repairs on other roads frequently take longer, preventing residents from entering or leaving their homes and property. As noted above, PWCC is not obligated to repair roads leading to homesites, but does so as a courtesy to lease area residents.

3.18.3.1.6.9 Cultural Resources

Some residents and others have expressed concern for past treatment of cultural properties, the adequacy of cultural surveys, and the disturbance of TCPs and sacred/historic sites. Some but not all Navajo and Hopi would like to see items and burial remains that have been stored off-reservation returned to the respective tribes. According to some lease area resident comments, sacred sites and burials that residents were told would not be disturbed have been removed or destroyed by mining activities.

Section 3.17, Cultural Resources, describes the legal framework for documentation, evaluation, and protection of cultural resources, and describes historic and current programs for: 1) inventorying cultural resources, and 2) resolving adverse effects on historic properties.

3.18.3.1.6.10 Reclamation and Grazing

Some lease area residents are concerned about the pace and adequacy of reclamation of previously mined areas. Concerns include insufficient topsoil and inadequate erosion control. Some residents have

stated a preference for a primary reclamation for grazing; others prefer returning disturbed land to its original vegetative state using nursery-grown native plants. Some residents have voiced concern about the current status of reclamation of former Black Mesa Mine buildings and facilities. Some residents also are concerned that mining has altered the terrain to the point that springs have stopped flowing and flooding occurs in new places.

PWCC's existing reclamation program, including ongoing monitoring and restoration for the reclaimed areas at the former Black Mesa Mine, is included in **Appendix 1D**. Environmental monitoring and reclamation activities are reported annually by PWCC to the OSMRE in a joint report prepared for the Kayenta and former Black Mesa Mine area. All Kayenta and former Black Mesa Mine reclaimed areas are managed to return a stable, productive and sustainable resource that meets post-mine land use goals of grazing, wildlife habitat, and restoration of plants that have cultural, medicinal, and ceremonial significance to the Navajo Nation and Hopi Tribe. PWCC is responsible by regulation and lease commitments to reclaim lands disturbed by mining to a condition compatible with and capable of supporting the post-mining land uses (Black Mesa United, Inc. 2010).

Livestock raising and grazing are culturally important for traditional Navajo. Overgrazing has been an ongoing concern throughout the Navajo Nation for years (Redsteer et al. 2015). A shortage of grazing lands and available forage have resulted in some Navajo having to purchase hay or transport their livestock to other areas for grazing, increasing costs to the point that raising livestock is no longer viable for some. Overgrazing and trespass on grazing areas are particularly troubling within the lease area because of the need to allow reclaimed areas to reestablish, and because withdrawal of grazing land on the lease area has resulted in competition for grazing land in other areas. As noted above (see the Relocation and Compensation subsection), PWCC compensates grazing permit holders for acreage withdrawn from a customary use area for mining.

In 2015, PWCC, with the support of BIA, the Navajo Nation, and working efforts from local community chapters, temporarily suspended grazing on all reclaimed areas to allow reclaimed land to recover from the effects of drought and overgrazing (PWCC 2015i).

3.18.3.1.6.11 Hopi Employment at the Navajo Generating Station and Kayenta Mine

The Hopi Tribe has expressed concern that few Hopi have jobs at NGS or the Kayenta Mine, in contrast to the large number of Navajo workers at both facilities. The small number of Hopi workers is in part attributable to the Navajo preference at NGS, and the long travel distances between Hopi villages and both NGS and the Kayenta Mine, and the poor condition of the roads that provide access to the mine from most locations on the Hopi Reservation.

3.18.3.1.6.12 Equity Concerns

A key concern for some lease area residents involves the perceived inequity of mining coal on Black Mesa for the generation of power for use in distant cities and to support the pumping of water to Phoenix, Tucson, and surrounding farms and reservations, while lease area residents do not have water service to their own homes, and are subject to the effects and risks of mining. The power and water delivery made possible by coal from the Kayenta Mine enables economic growth and an improved quality of life for residents of those distant municipal, tribal, and agricultural areas, and the economic and fiscal benefits of coal production accrue to the Navajo Nation, Hopi Tribe and other residents of North Central Arizona. Conversely, the effects of mining, some of which are locally perceived as adverse, fall on the people living near the Kayenta and former Black Mesa mines.

The Navajo Nation Energy Policy of 2013 states that "Communities impacted by energy development will have the opportunity to provide input on and indicate their support for such projects, and where substantially and adversely impacted by the development, to share in a portion of the financial benefits of such projects" (Navajo Nation 2013b).

As noted earlier in Section 3.18.3.1, in Navajo Nation and Hopi Tribe scoping comments and elsewhere, the Kayenta Mine contributes substantially to the economies and operations of the Navajo Nation and Hopi Tribe, through direct employment (primarily Navajo workers), benefits paid to retired workers in the area, and royalties, bonuses, and other payments, which support many jobs and services throughout the Navajo Nation and Hopi Reservation. Although Navajo tribal services are available to all Navajo living on the Navajo Nation, residents of dispersed areas, including the Kayenta and former Black Mesa Mine lease area, must travel considerable distances to access those services.

Residents of the Kayenta and former Black Mesa Mine lease area receive some PWCC-provided services and benefits including free coal, access to free water and to distribution sites, road maintenance, and emergency medical services, and some but not all households within and near the lease area have a family member employed at the mine.

3.18.3.1.6.13 Social and Community Change

Social and community change across the Navajo Nation and Hopi Reservation has resulted in part from the influences identified in the above Sociocultural Setting subsection. The introduction of mining has resulted in additional changes in the Kayenta and former Black Mesa mine lease area.

Changes noted by lease area residents include the improved access to the area, which has made it easier to get onto Black Mesa for residents and nonresidents alike. A number of local residents observed that nonresidents who come to the lease area to obtain free firewood or water, to purchase coal, or for other reasons sometimes dump trash, cut fences, and abandon dogs and cats.

Residents observed that closure of mining areas and withdrawal of grazing lands has resulted in tension between permittees and trespass on customary use areas. Closure of active mining areas also complicates access across the lease area. A number of older lease area residents report that the lease area community is less cohesive today than before mining.

While some lease area residents have jobs at the mine, others do not. Some lease area residents report tension between residents that support and those that oppose mining. But a substantial percentage of lease area residents who offered comments in the listening sessions stated that while mining jobs and PWCC-provided amenities and services were important, they were concerned about the mine's impact on their health, and wanted more jobs for residents, road improvements, improved road safety, and in-home access to water. Many residents stated that they wanted a voice in the way that mining occurs on their traditional lands.

3.18.3.1.6.14 Mine Lease Area Oversight and Planning

The BMRB, established by Navajo Tribal Resolution (CN-101-72), is chartered to "advocate for fair and just compensation for Navajo families within the five Navajo Nation chapters[16] whose socio-economic and environmental interests are adversely affected or impacted by coal mining and related operations of PWCC, as authorized and provided for by the company's two coal mining leases with the Navajo Nation… The Board may make appropriate recommendations to the President of the Navajo Nation, the Navajo Nation Council, the Resources Committee of the Navajo Nation Council, or to PWCC, concerning the health, social welfare, education, and environment of the Navajo People affected by any of PWCC's mining and post mining or related operations" (2 N.N.C. §901-910). The BMRB vision statement is "… to advocate for the best interest of the local families within the leased area of PWCC and to utilize the available resources to enhance the quality of life and restore harmony and balance for the people and the land."

[16] Black Mesa, Chilchinbeto, Forest Lake, Kayenta, and Shonto.

There are concerns that while the BMRB is charged with advocating for lease area residents, the funding provided by the Navajo Nation is not adequate to carry out the BMRB's mandate (BMRB 2015; Black Mesa United, Inc. 2010). Recent activities for the BMRB have included planning and seeking funds for the Many Mules Water Project as described in a preceding subsection.

The Navajo Nation, in cooperation with residents of the Kayenta/Black Mesa lease area have conducted land use planning for the post mining use of the lease area. Beginning in 2003, the Speaker of the Navajo Nation Council met with lease area residents to discuss the future closure of the two mines. The Black Mesa– Kayenta Lease area Land Use and Community Development Plan (Plan) was subsequently authorized and completed in December of 2005.

The first goal of the Plan is to "Provide the ability to address needs through a self-governing body for the leasehold community." In January 2007, the BMRB adopted implementation of the plan as its primary goal. In November 2008, BMRB hosted a meeting for Kayenta/Black Mesa lease area residents to promote the establishment of a self-governance organization. The lease area was divided into sectors and each sector was encouraged to start meeting and to elect officers. As a result of these grassroots meetings, Black Mesa United-Dzilijiin Bee Ahota Incorporated (Black Mesa United, Inc.) was created on November 15, 2009, and officially incorporated under the Arizona Corporation Commission on December 22, 2009. Black Mesa United, Inc. applied and received a Navajo Nation Corporation Code Certificate of Authority on March 30, 2010 (Black Mesa United, Inc. n.d.). The organization is working toward achieving non-profit status under Section 501(c) (3) of the U.S Internal Revenue Code, and currently functions as an advocacy group for lease area residents. As with the BMRB, a lack of funding and professional staff has impeded progress toward the goals of the 2010 plan.

3.18.3.1.7 Native American Traditional Values and Concerns

This section addresses traditional values of affected Native American communities, to the extent that such values have been identified during scoping, government-to-government consultations, and/or community and individual interviews. The Navajo and Hopi, the two primarily affected tribes, provided substantial comments and input relative to traditional values and that information serves as the basis for much of the analysis in this section. Concerns about effects on traditional values of the tribes affected by transmission and communication sites and the CAP have not been identified for any alternative. Reclamation will continue to accept and consider input on effects to traditional values from any affected tribe for any aspect of the NGS-KMC Project.

3.18.3.1.7.1 Regulatory Overview

In addition to the regulation and guidance noted in Section 3.18.1, the following federal guidance is particularly pertinent to the consideration of traditional values.

- The Secretarial Order on American Indian Tribal Rights, Federal-Tribal Trust Responsibility, and the Endangered Species Act (SO 3206) states, "…Long-standing Congressional and Administrative policies promote tribal self-government, self-sufficiency, and self-determination, recognizing and endorsing the fundamental rights of tribes to set their own priorities and make decisions affecting their resources and distinctive ways of life. …The Departments shall be sensitive to the fact that Indian cultures, religions, and spirituality often involve ceremonial and medicinal uses of plants, animals, and specific geographic places (Secretary of the Interior and Secretary of Commerce 1997).
- Reclamation's Indian Policy states "Reclamation will provide Indian tribes the opportunity to be involved early in the process when considering actions that may affect their religion or culture. Reclamation will show respect for tribal cultural values" (Reclamation 1998).

3.18.3.1.7.2 Tribal Regulations, Policies, and Plans

While not always applicable to NGS based on the Covenant Not to Regulate in the1969 Lease (see **Appendix 1A**), tribal law provides important context to traditional views and values, as summarized below for the Navajo and Hopi.

Navajo Nation Cultural Resources Protection Act

The Navajo Nation Cultural Resources Protection Act [Navajo Tribal Code CMY-19-88] applies on surface lands controlled by the Navajo Nation. The Navajo Nation Cultural Resources Protection Act states that "…the spirit and direction of the Navajo Nation are founded upon and reflected in its cultural heritage; The cultural heritage of the Navajo Nation should be preserved as a living part of our community life and development in order to give a sense of orientation to the Navajo People; The preservation of this irreplaceable cultural heritage is in the interest of the Navajo Nation and its people so that its vital legacy of cultural, educational, esthetic, inspirational, economic, and energy benefits will be maintained and enriched for future generations of Navajos." It establishes as policy the use of appropriate measures to foster conditions under which modern Navajo society and its cultural resources can coexist in productive harmony to fulfill the social, economic, and other requirements of present and future generations. It also ensures the protection of cultural properties by mandating consultation with and approval from the Tribal Historic Preservation Officer of all ground disturbing activities.

Navajo Nation Environmental Policy Act

This Navajo act establishes that the Navajo Nation's policy is to "promote harmony and balance between the natural environment and people of the Navajo Nation, and to restore that harmony and balance as necessary. To this end, the Navajo Nation Council declares that the protection, restoration and preservation of the environment is a central component of the philosophy of the Navajo Nation; that the quality of life of the Navajo People is intimately related to the quality of the environment within the Navajo Nation." This act embodies the importance of sustainability of the natural environment while serving the Navajo Nation people's best interest in areas such as economic development and growth revenue.

Navajo Nation Energy Policy

The Navajo Nation's 2013 Energy Policy, Section 5, states "Chapter 2 of the Navajo Nation Code entitled The Foundation of the Dine', Dine' Law, and Dine' Government describes the four sacred elements of life as air, light/fire, water, and earth/pollen and provides that in all their forms [they] must be respected, honored, and protected for they sustain life. Recognizing the sacredness of these elements, the Nation desires to establish a sustainable energy economy based on the Nation's human capital, natural resources, capital resources and the exercise of its inherent sovereign authorities. A sustainable Energy Economy ensures an acceptable quality of life for Navajo people; proper planning and management by governmental officials; energy security; environmental stewardship; adequate rents, royalties, bonuses and taxes to ensure benefits for a sustainable Nation" (Navajo Nation 2013).

Hopi Ordinance 26: Ordinance for the Protection of Places and Objects of Sacred, Historical and Scientific Interest on the Hopi Reservation

As noted in Section 3.17.2 and **Table 3.17-2**, Hopi Ordinance 26 applies on surface lands controlled by the Hopi Tribe. The purpose of this law is to protect sites, locations, structures, and objects of a sacred, historical, or scientific interest or nature on lands within the jurisdiction of the Hopi Tribe from desecration, destruction, theft, or other harm or interference.

Hopit Pötskwaniat (Hopi Tribal Consolidated Strategic Plan) 2011

The Plan was adopted by the Hopi Tribal Council on November 29, 2011, to serve as the principle direction for the Hopi Tribe. The goals for Mineral Resources are:

- To ensure proper management of energy and mineral resources on Hopi lands.
- To diversify energy development.
- Create a Department/Company to Develop Energy and Mineral Resources.

3.18.3.1.7.3 Navajo Traditional Values

The official expression of Navajo traditional values is embodied in Traditional Law, Customary Law, Natural Law, and Common Law. Collectively, these four laws declare the fundamental beliefs and traditional practices that must be honored and protected to ensure the continuance of the Navajo people. Among these are the responsibilities of the Diné to the universe and its resources by practicing the Diné Life Way, and the obligation of the Diné to uphold ceremonial and oral histories for the protection and preservation of the beauty, harmony, and balance of the natural world for future generations, Nihook'a Dine'e' Bila Ashdla'ii, or the earth surface people as referred to within Diné culture, have intimately interacted within the landscape known as Dzil Ijiin or Black Mesa, as ecological stewards and ceremonial custodians since time immemorial. Historical Diné ways of interacting with the land-base can be understood through the fundamental, natural and sacred ceremonial laws bestowed upon the Diné since the beginning of the emergence of the first world or Ni hodilil (Black World).

3.18.3.1.7.4 Hopi Traditional Values

This portion on Hopi traditional values is excerpted from the Hopi Worldview Summary (Hopkins et al. 2016), which was prepared with the participation of the Hopi Cultural Preservation Office.

> "Hopi traditional teachings underscore the necessary and intrinsic relationship that exists between the earth, the elements, plants, animals, and humans. Hopi culture has developed in interdependence with the earth and its elements, and Hopis believe that the central role of their religious practices is to keep the universe in balance. Hopis view the earth as sacred, and they view themselves as stewards rather than masters."

The Hopi world view and traditional values specifically assign special importance to water, ancestral sites and human remains, plants, animals, minerals, and the spatial context of cultural knowledge.

3.18.3.1.7.5 Navajo and Hopi Traditional Values in the Context of Coal Mining and Electric Power Generation

Based on scoping comments received from Navajo and Hopi individuals, the Hopi Tribe, from individual Navajo residents of the proposed KMC area during listening sessions, and review of articles, interest group websites, and other secondary sources, some Navajo and Hopi clearly consider mining and burning coal for electric power generation to be incompatible with their respective traditional values.

Other comments, the aforementioned review, and the 40-year history of Navajo and Hopi tribal governments approving leases for NGS and the Kayenta and former Black Mesa mines, indicate that there is a continuum of opinions ranging from 'compatibility' to 'incompatibility' with traditional values of mining and electrical power generation amongst some Navajo and Hopi. For some Navajo and Hopi, the economic, employment, and fiscal benefits associated with mining and electrical power generation also are important when considering the use of tribal resources. In the case of the Navajo, Sections 4, 5, and 9 of the 2013 Navajo Nation Energy Policy, which was passed by a majority of the Navajo Nation Council, suggest that this is the case.

The numbers of Navajo and Hopi who believe that mining and burning coal for electric power generation is or is not compatible with their respective traditional values, or who believe such activities can be compatible and also merit consideration for their economic, employment, and fiscal benefits are not known. This topic has been a source of controversy within each of the tribes for decades.

3.18.3.2 Transmission Systems and Communication Sites

As noted in Section 1.8, the WTS and STS transmission systems traverse land owned or managed by a combination of private, tribal, and governmental agencies. There are 19 radio communication sites supporting operations of the plant, railroad, and transmission systems. Construction of the transmission and communications facilities occurred in the 1970s, coinciding with the in-service dates of the NGS. Together these systems provide redundant capacity to the CAP and the reliability necessary to meet the CAP's continuous pumping demand. No new major construction is foreseen through 2019. Routine and emergency maintenance approved by previous licensing will continue.

The WTS is approximately 275 miles in length, on an alignment across northern Arizona and southern Utah, passing south of Kanab (Utah), Fredonia (Arizona) and St. George (Utah), crossing a portion of Pipe Springs National Monument in the process. West of St. George the WTS is collocated with pipelines and other transmission lines in a Bureau of Land Management (BLM) corridor through the Virgin River Gorge and along the Interstate 15 corridor northeast of Las Vegas. From there the alignment runs west of the Lake Mead National Recreation Area, terminating at the McCullough substation southwest of Boulder City, Nevada. The WTS ROW crosses portions of the Navajo, Kaibab Paiute, and Moapa Paiute reservations, the latter within a BLM reserved ROW corridor. The ROW crosses BLM, U.S. Forest Service, and state leased and private lands in Coconino County, Arizona, Kane and Washington counties in Utah, and Clark County, Nevada.

The STS is approximately 257 miles in length and located entirely within Arizona. The STS alignment generally runs south from NGS through four Navajo Nation chapters, before turning westerly in the vicinity of Cameron passing to the north and west of the San Francisco Peaks and Flagstaff. The ROW continues southward through the Kaibab and Prescott National Forests, terminating at the Westwing (Arizona Public Service Company) substation in the northwestern portion of the Phoenix metropolitan area. The area surrounding that substation was relatively rural when the power line and substation were built but has since become urbanized. Along its route, the STS ROW crosses portions of the Navajo Nation and federal, state and private lands in Coconino, Yavapai, and Maricopa counties.

SRP records indicate there is a total area of approximately 15,849 acres of ROW for the two transmission lines, associated substations and the communications sites. Of the total, approximately 25.9 percent is tribal land, principally on the Navajo Nation, 46.8 percent is federally managed land, and the remainder is a combination of state, municipal and private lands (SRP 2015).

No new major construction is foreseen before 2020. Current and foreseeable economic activity associated with these systems consists of normal operations and routine and emergency maintenance. Typically these functions are coordinated from centralized office, with crews dispatched to specific locations as necessary. Consequently, these activities would not be expected to result in additional local employment, changes in population, housing demand, demands for public facilities and services or changes in fiscal conditions.

Transmission and generation facilities generate land use revenues to property owners and local and federal land holding agencies on which the ROW are located. This is true for the WTS and STS, although a provision of the Secretarial agreement authorizing the use of BLM and U.S. Forest Service lands provided for special treatment of revenues due for use of those lands. The provision allowed the Regional Director of the Bureau of Reclamation to determine whether rents due should be paid, or should be credited against the obligation of the U.S. for its portion of the construction and operation of the project, and this crediting option has been exercised. Total annual land use revenues for all landowners and agencies are not known, as there is no consolidated reporting of these payments. However, an annual land use rental fee of $100 per acre can be accepted as an approximate average value over the project, and annual land use rentals to all parties can be assumed to be in the $400,000 to $500,000 range. There is no anticipation that land use charges would change through 2019.

To the extent not exempted by statute or regulations, transmission lines and communications facilities are subject to local property taxes. Exemptions include the federal share of the two lines as well as SRP's share, the latter due to SRP's status as an agricultural improvement district under Arizona law. SRP voluntarily adopted a policy to remit payments in lieu of taxes to local property taxing entities, including the Navajo Nation. The other co-tenants are responsible for submitting payments to the appropriate counties and tribal entities. As with the lease payments, there is no readily available central or consolidated reporting of the property tax payments for the transmission systems and communications sites. Such payments would continue through the end of 2019.

3.18.3.3 Central and Southern Arizona – Area of Indirect Socioeconomic Effect

The 336-mile-long CAP system originates at the Mark Wilmer pumping plant on Lake Havasu in La Paz County. Water deliveries are made to municipal and industrial (M&I) water users, agricultural users, and CAP tribes in Maricopa, Pinal, and Pima counties, Arizona.[17] The CAP was authorized by the 1968 Colorado River Basin Project Act; construction began in 1973 and was substantially completed 20 years later. The original vision for the CAP was primarily to deliver water for use as agricultural irrigation water and thereby reduce demand for groundwater pumping that contributed to subsidence across the region. Higher than anticipated construction costs and rising demand for M&I water associated with rapid population growth in central Arizona raised the emphasis on M&I project (Reclamation 2000).

The Central Arizona Water Conservation District (CAWCD) is the operating entity of the CAP. CAWCD is a special district created to manage, operate and maintain the CAP and provide a means to repay the federal government for the CAP's reimbursable construction costs, including interest. CAP's annual Colorado River withdrawals averaged about 1.6 million acre-feet per year in recent years. The majority of CAP's water deliveries occur in the Phoenix area. Between 1985 and 2010 the combined population of Maricopa, Pinal and Pima counties more than doubled to 5.2 million (BEA 2014a). Water availability has been critical to that economic expansion and population growth.

In 2010 the 10 tribes with CAP water allocation had a combined on-reservation population of 57,973. That total represented a combined gain of 1,954 (3.5 percent) as compared to 2000. The White Mountain Apache had the largest on-reservation population, 13,409, the Tonto Apache the smallest, 120 residents. Among the 10 reservations, four had population declines between 2000 and 2010; the others registering gains (**Table 3.18-23**).

Table 3.18-23 Population 2000 and 2010, Indian Tribes with CAP Water Allocations and Counties in Central and Southern Arizona

Tribe/Community	Population			Percent Change
	2000	2010	Change	
CAP-affected Tribes				
Ak-Chin	742	1,001	259	34.9
Fort McDowell Yavapai	824	971	147	17.8
Gila River Indian Community	11,257	11,712	455	4.0
Salt River Pima – Maricopa	6,405	6,289	-116	-1.8
San Carlos Apache [2]	9,385	10,068	683	7.3
Tonto Apache [2]	132	120	-12	-9.1
Yavapai Apache [2]	743	718	-25	-3.4

[17] Additional information regarding the CAP and its relationship to the NGS is contained under Background, Section 1.3 in the body of the EIS.

Table 3.18-23 Population 2000 and 2010, Indian Tribes with CAP Water Allocations and Counties in Central and Southern Arizona

Tribe/Community	Population			Percent Change
	2000	2010	Change	
Pascua Yaqui	3,315	3,484	169	5.1
Tohono O'odham	10,787	10,201	-586	-5.4
White Mountain Apache [2]	12,429	13,409	980	7.9
Combined Population of the Reservations	**56,019**	**57,973**	**1,954**	**3.5**
Counties				
Maricopa County, Arizona [1]	3,072,149	3,817,117	744,968	24.2
Pinal County, Arizona [1]	179,727	375,770	196,043	109.1
Pima County, Arizona [1]	843,746	980,263	136,517	16.2
Three-county total	**4,095,622**	**5,173,150**	**1,077,528**	**26.3**
Arizona	5,130,632	6,392,017	1,261,385	24.6

[1] The populations shown for these counties include residents living on the relevant portions of the reservations located in the county.

[2] These tribes/reservations are located outside of the CAP service area and could only receive CAP water via an exchange; therefore, the counties in which they are located are not included in the lower portion of this table.

Source: U.S. Census Bureau 2010, 2000.

The 10 CAP-affected tribes have reservations with a combined land area totaling 6,765,982 acres and annual CAP water allocations of 575,906 acre-feet per year (**Table 3.18-24**). These allocations carry high seniority that effectively insulate the tribes from curtailment except under extreme shortage conditions on the Colorado River. Agricultural irrigation is the primary intended use for most Indian allocations, the remainder intended to sustain the water needs of a tribal homeland. Such needs are largely discretionary and can include residential, commercial and industrial uses, and cultural and recreation uses. Some tribes have the option to lease their water rights to other users, which several tribes have done.

Table 3.18-24 Tribes with CAP Water Allocations

Tribe / Reservation	County	Reservation Land Area (acres)	Annual CAP Water Allocation (acre-feet)	Obtained through Water Settlement
Ak-Chin Indian Community	Pinal	21,840	75,000 [1] (up to 85,000 if available)	Yes
Fort McDowell Yavapai Nation	Maricopa	24,680	18,233	Yes
Gila River Indian Community	Maricopa and Pinal	371,933	311,800	Yes
Pascua Yaqui Tribe	Pima	892	500	No
Salt River Pima-Maricopa Indian Community	Maricopa	52,729	39,200	Yes
San Carlos Apache Tribe	Gila and Graham	1,853,841	30,845 [2]	Yes

Table 3.18-24 Tribes with CAP Water Allocations

Tribe / Reservation	County	Reservation Land Area (acres)	Annual CAP Water Allocation (acre-feet)	Obtained through Water Settlement
Tohono O'odham Nation	Pinal and Pima	2,774,370	74,000	Yes, except for 8,000 acre-feet
Tonto Apache Tribe	Gila	85	128	No
White Mountain Apache	Navajo, Gila, Apache	1,664,972	25,000	Yes
Yavapai-Apache Nation	Yavapai	640	1,200	No
TOTALS	**—**	**6,765,982**	**575,906**	

Residents on the CAP-related Indian reservations, generally report household incomes below comparable statewide and national values, poverty rates above the statewide and national rates, and higher dependency on public assistance (**Table 3.18-25**). Poverty rates and median household incomes on the reservations also were substantially higher and lower, respectively, than those of the general populations in Maricopa, Pinal and Pima counties.

Table 3.18-25 Income Characteristics of CAP-related Indian Reservation Residents

Tribe / Geographic Unit	Median Household Income	Household Income Less than $25,000 in 2010 (%)	Households With Public Assistance (%)	Persons Below Poverty Level (%)
Ak-Chin	$32,022	37.9	30.6	42.4
Fort McDowell Yavapai	$51,157	32.4	1.7	18.8
Gila River Indian Community	$28,779	44.6	33.3	47.8
Pascua Yaqui	$31,875	41.8	49.4	14.8
Yavapai-Apache	$27,600	37.8	20.7	42.4
Salt River Pima-Maricopa	$31,892	36.9	13.0	21.5
San Carlos Apache	$26,915	46.0	44.3	46.0
Tohono O'odham Nation	$27,040	45.5	35.4	41.2
Tonto Apache Tribe	$16,667	71.4	(na)	51.8
Maricopa County	$55,054	20.1	8.3	13.9
Pinal County	$51,310	21.6	10.3	13.5
Pima County	$45,521	26.4	11.0	16.4
State of Arizona	$50,448	22.9	9.8	15.3
U.S.	$51,914	23.5	15.8	13.8

3.18.3.3.1 Economic Conditions

Arizona's economy produced an estimated average gross domestic product of approximately $270 billion from 2010 through 2013. The state's economy primarily is service-oriented, including tourism, with agriculture, natural resources and manufacturing providing some economic diversity. An analysis of the economic contributions of the CAP to Arizona, commissioned by the CAWCD examined the direct, indirect, and induced effects of the construction of the CAP as well as the economic contributions of

CAP's water delivery to the state's overall economic development (Seidman Institute 2014). Results of the statewide analysis included the following:

- CAP water deliveries represented approximately 30 percent of statewide M&I water deliveries and 11 percent of water used for agriculture between 2007 and 2009.
- Contributions to the statewide gross domestic product associated with those deliveries accounted for an estimated 32 percent of the total statewide gross domestic product during that same period.
- Had CAP water not been available during that period, and an equivalent amount of water not been available from another source, there would have been 1.09 million fewer jobs in the state.
- The estimated economic contributions associated with the CAP water deliveries increased by nearly 50 percent in 2010, but a basis for the dramatic increase was not reported.

The analysis did not prepare estimates of CAP-related economic contributions for individual counties or for the CAP-related tribes. Neither did the study address the relationship between CAP construction and subsequent water availability to population growth, although as noted above, the population of the three metropolitan counties in central Arizona more than doubled growth between 1985 and 2010.

3.18.3.3.1.1 Agriculture

As previously noted, the initial vision for the CAP was primarily to provide irrigation water for agriculture in central and southern Arizona. Major scale urbanization and conversion of land use has occurred in the years since CAP was built; resulting in reallocation of water use. As a result, the economic contributions from agriculture have been surpassed by those from other industries, but agriculture remains an important economic element in the region. According to the 2012 U.S. Census of Agriculture, the most current available, a total of 4,272 farms encompassing nearly 4.3 million acres of land operated in Maricopa, Pima and Pinal counties (**Table 3.18-26**) (USDA, NASS 2014a). The farm operations in the three counties are generally more intensively used and more productive than those in the remainder of the state. CAP water serves an important role supporting the irrigated lands, although groundwater and water from other surface sources also are used. Farms in the 3-county area sold more than $2.0 billion in crops, livestock and other agricultural products in 2012, producing $272.9 million in net income.

Table 3.18-26 Selected Characteristics of Agriculture in Arizona, 2012

	3-County Region	Arizona	Regional Share of the State Totals
Total Number of Farms	4,272	20,005	21%
Land in Farms (acres)	4,262,644	26,249,195	16%
Value of products sold	$2,028,499,000	$3,732,113,000	54%
Net cash farm income from operations	$272,932,000	$600,395,000	45%

Source: USDA, NASS 2014a.

Agriculture is an important economic undertaking for the Ak-Chin, Gila River Indian Community, and the Tohono O'odham Nation these three tribes receive direct deliveries of CAP water. Among these three tribes were roughly 110 farms having a total of 50,580 irrigated acres involved in farming operations. (**Table 3.18-27**). Barley, corn, cotton, melons, nuts, potatoes and livestock forage were the primary crops raised on the farms on tribal lands. Fort McDowell Yavapai Apache and the Salt River Pima-Maricopa

Indian Community also conduct significant farming operations but they do not currently utilize CAP water in those operations, allowing them to direct their CAP allocations for other purposes.[18]

Table 3.18-27 Selected Characteristics of Farming on CAP-affected Reservations in Central Arizona, 2012

Reservation	Number of Farms	Irrigated Lands (acres)	Total Market Value of Sales (2012)	Primary Crops Harvested
Ak-Chin	4	15,000 (est)	Not reported	Not reported
Fort McDowell Yavapai	9	2,000 (est)	Not reported	Barley, Corn, Cotton, Pecans
Gila River Indian Community	41	27,152	Not reported	Barley, Forage
Salt River Pima-Maricopa	15	27,056	$72,538,000	Wheat, Barley, Cotton, Corn
Tohono O'odham Nation	64	8,428	$10,153,000	Barley, Cotton, Corn, Melons

Source: USDA, NASS 2014b.

Total market values of sales and the net income of farming operations of the 5 tribes were not disclosed in the 2012 Census.

3.18.3.3.1.2 Central Arizona Water Conservation District Operations and Finances Related to the Navajo Generating Station

The CAP uses about 3,000,000 megawatt hours of energy (MW hours) annually to lift, transport and deliver about 1.6 million acre-feet of water from the Colorado River to central Arizona. The net elevation change along the aqueduct is about 1,900 feet. However, because the water flows down gradient between each of the 14 pumping plants, the CAP pumps operate 'around the clock' providing total lift of approximately 3,000 feet. The continuous operations mean that much of CAP's energy portfolio must be provided by baseload resources that are available 24 hours a day. Currently, NGS fills that requirement, supplying approximately 90 percent of the CAP system's total power demand (CAWCD 2015b).

NGS power used for CAP pumps represents about 64 percent of the U.S.' share of NGS power; the remainder is available to be marketed to generate revenues for the Lower Colorado River Basin Development Fund (Development Fund). Revenues accruing to the Development Fund are used to pay certain fixed O&M funds attached to the water allocations for tribes and the CAWCD's repayment obligation to the federal government. The linkages between the availability of excess power, surplus revenues, the repayment obligation, and energy costs are a source of substantial concern for the CAWCD and its tribal and non-tribal customers.

CAP pumping and water deliveries occur year-round to support M&I deliveries. Agricultural and higher M&I deliveries occur during spring and summer. In 2014, CAP water deliveries of 1,525,960 acre-feet of water were made to 77 customers, 50 of which were M&I customers and 16 of which received water deliveries from Indian water allocations.[19] [20] Total deliveries for M&I use accounted for 39 percent of the total deliveries, those deliveries serving about 50 percent of the municipal water supply in the three

[18] The remaining tribes either do not engage in farming, or did not participate in the 2012 Census of Agriculture.

[19] An acre-foot of water equals approximately 326,000 gallons, enough to serve the average annual demand of 3 homes in the CAP service area.

[20] The 16 customers receiving water from Indian allocations include non-tribal entities that have leased water from one of the tribes.

counties (CAWCD 2014). Water deliveries allocated to CAP-affected tribes accounted for 35 percent of the 2014 water deliveries. Non-tribal agricultural deliveries, which are contingent upon the availability of sufficient quantities of water, and water used in CAP's recharge program accounted for the remaining 26 percent of deliveries. The recharge program stores water underground for future withdrawal during periods of reduced supplies (CAWCD 2015b). Over time, the availability of excess water for non-tribal agricultural deliveries is anticipated to decline as future population growth results in higher M&I use. **Table 3.18-28** summarizes CAWCD's customer base, water deliveries, and water delivery revenues for calendar year 2014.

Table 3.18-28 CAWCD Water Deliveries and Net Water Delivery Charges, 2014

Customer Category	Number of Customers	Quantity Delivered - acre-feet (Range)	Total Quantity Delivered - acre-feet	Net Water Delivery Charges Generated
Municipal and Industrial	50	3 to 142,315	503,518	$ 71,167,812
Federal and Indian	16 [1]	178 to 254,126	534,281	75,828,463
Agricultural Settlement Pool [2]	17	66 to 126,978	400,741	20,071,993
Recharge Program	8	1,230 to 54,839	87,420	8,806,506
Total	77 [3]	3 to 254,126	1,525,960	$ 188,290,754

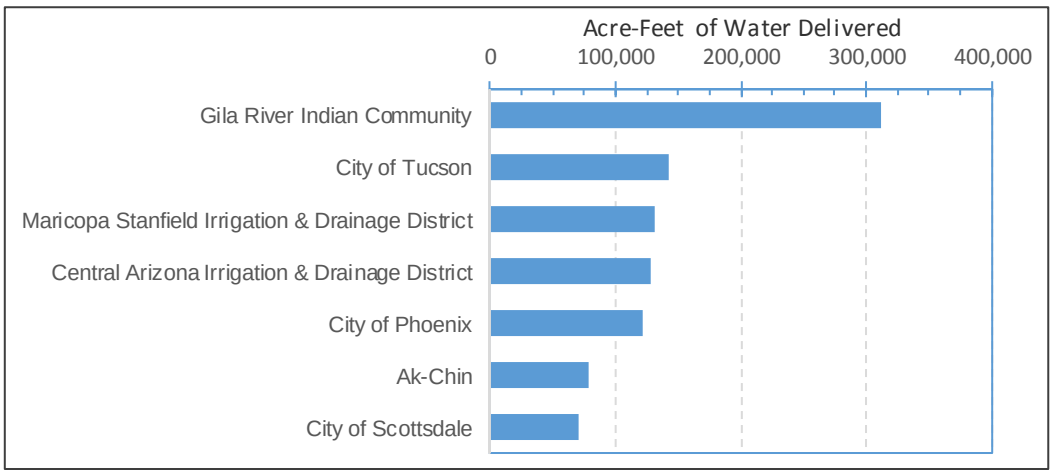
[1] Includes non-tribal entities that have leased water from tribes with CAP allocations.

[2] The agricultural settlement pool refers to a group of agricultural customers who agreed to relinquish water rights in exchange for water deliveries via the CAP, those deliveries to be billed at the cost to CAWCD of pumping energy only. The pool is currently 400,000 acre-feet per year, decreasing to 300,000 acre-feet per year in 2017, 225,000 acre-feet per year in 2024 and 0 in 2031 (CAP 2015).

[3] Total accounts for customers that receive water under more than one category.

Source: CAWCD 2015b.

The seven largest customers, in terms of water deliveries in 2014, are shown in **Figure 3.18-6**. The combined water delivery to these customers was over 928,000 acre-feet, approximately 61 percent of the total deliveries. Two of the seven are Indian tribes, including the Gila River Indian Community which took delivery of 254,126 acre-feet of water.



Source: CAWCD 2015b.

Figure 3.18-6 Customers with Highest CAWCD Water Deliveries, 2014

Expenses to operate and maintain the CAP system in 2014 totaled $253.8 million. Of that total, $227.4 million was operating expenses and $26.4 million was non-operating expenses. The latter is primarily comprised of the interest portion of CAWCD's federal debt repayment obligation.

Together, pumping power and salaries and related labor costs account for the majority of annual operating costs (**Figure 3.18-7**). The CAWCD has a staff of approximately 470 employees who are collectively responsible for the O&M of the CAP.

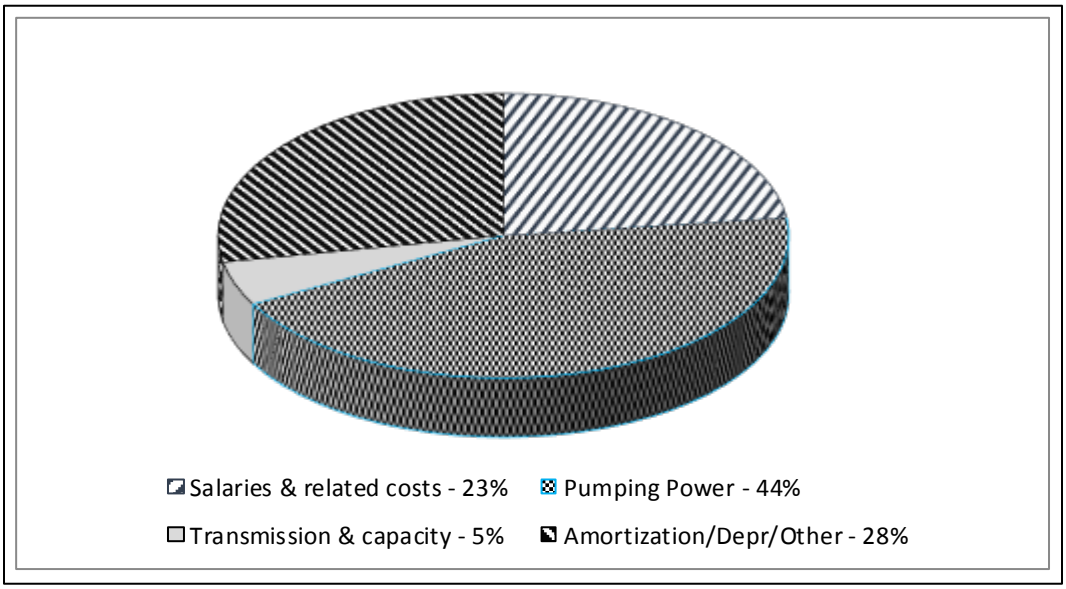


Figure 3.18-7 CAWCD Operating Expenses by Major Category, 2014

In addition to funding the annual O&M expenditures, CAWCD's liabilities include its contractual repayment obligation to the U.S. The repayment agreement requires annual payments over a 50-year period, commencing in 1993 with a final payment due in 2045. In 2007, through a Stipulated Settlement, the CAWCD and the U.S. established the principal amount of CAWCD's repayment obligation for the CAP system and storage facilities at $1,646,462,500 in conjunction with delivery of 667,724 acre-feet for federal use. This Settlement also provided that future net miscellaneous revenues and net revenues from surplus power sales, which accumulate in the Development Fund, will be credited annually against the repayment obligation due from CAWCD. The CAWCD's annual repayment obligation in 2014 was $57.8 million. At the end of 2014 the remaining balance on the repayment obligation was approximately $1,203,793,000. Average annual payments for the period 2014 to 2019 are $56,340,800.

CAWCD's total budgeted revenues for 2014 were $339.26 million (**Table 3.18-29**). Water delivery charges, reimbursements, other revenues, and to the extent needed, property taxes and interest income are used to pay operating costs associated with delivering water and capital expenditures. Water and energy revenues and property taxes, the two largest categories of revenues, are anticipated to provide 75 percent of all revenues. Development Fund surpluses, which are credited to the CAWCD as revenues to be applied to its repayment obligation to the federal treasury, are projected at $34.4 million.

Table 3.18-29 CAWCD Budgeted Revenues, 2014

Source of Revenue	2014 Budgeted Revenues	Percent of Total
Water and energy revenues	$190,444,000	56.1
Water service capital charges	$14,858,000	4.4
Development fund revenues	$34,435,000	10.1
Reimbursements and other	$28,835,000	8.5
Property taxes	$63,984,000	18.9
Interest Income and other	$6,708,000	2.0
Total Budgeted Revenues	$339,264,000	100.0

Source: CAWCD 2015b.

Water rates are set to generate necessary revenues to meet operating expenses, debt service and capital expenses. Water delivery rates vary by category of customer and are set on a per acre-foot basis, with the total rates for a customer comprised of as many as three components: a fixed O&M charge, charge to cover costs of pumping energy, and capital charges. These charges are described below.

Fixed O&M charges are non-energy costs associated with ongoing system operation. All customers, other than those in the agricultural settlement pool, are assessed O&M. Energy transmission and distribution charges incurred by CAWCD are included as part of the O&M. The O&M charges also include a rate stabilization component – essentially a credit used to protect customers from mid-season rate adjustments if the price of energy fluctuates outside the expected range. Excess credits are applied to the following year's charges. For M&I subcontractors, the charge is applied to each contractor's delivery volumes and include a take or pay provision. The U.S. pays the O&M on behalf of some Indian tribes and funds available from the sale of excess energy may be used to pay these charges. The O&M charge for 2014 was $79 per acre-foot.

Energy charges include the cost of energy delivered to the CAP system to pump water from the Colorado River through the CAP system. All customers pay energy charges. The 2014 energy charge was $67 per acre-foot and included a rate stabilization component – essentially a credit used to protect customers from mid-season rate adjustments if the price of energy fluctuates outside the expected range. Excess credits are applied to the following year's charges.

Capital charges are assessed on non-tribal customers that do not have fixed annual entitlements (e.g., contractors who purchase excess water). Capital charge revenues are used to amortize project capital charges. Indian contractors of CAP water do not pay water service capital charges because the capital charges associated with their water deliveries are not included in the reimbursable costs to be paid by CAWCD. The capital charge for 2014 was $20 per acre-foot.

Table 3.18-30 below shows the overall rates by customer category, and the composition of the rates. The rates for 2014 deliveries ranged between $67 and $166 per acre-foot.

In 2014, 43 percent of CAWCD's total water and energy revenues in 2014 were derived from deliveries of allocations to Indian tribes, parties that have leased water from a tribe, or other allocations to the federal government. As an individual category, M&I customers accounted for 41 percent of the total water and energy revenues. The agricultural settlement pool and excess water customers accounted for 16 percent of the total water and energy revenues (**Figure 3.18-8**).

The CAWCD is authorized to levy two ad valorem taxes on all taxable property within its boundaries. The first, not to exceed $0.10 per $100 of assessed valuation, can be used to fund CAWCD's operations and

payment of its repayment obligation to the U.S. The second, not to exceed $0.04 per $100 of assessed valuation can support operations, repayment, or be used to provide for water storage. In 2014, CAWCD levied both taxes at their maximum permissible rate. Together the two taxes yielded $63.98 million.

Table 3.18-30 CAP 2014 Rates Per Acre-Foot of Delivered Water

Rate Component	Customer Category				
	Municipal and Industrial Long-term Subcontract	Excess Water (non-subcontract) [1]	Federal / Indian	Agricultural Settlement Pool	Recharge
Fixed O&M	$79	$79	$79	NA	$79
Pumping Energy	$67	$67	$67	$67	$67
Capital Charges	NA	$20	NA	NA	$20
Total	$146	$166	$146	$67	$166

[1] Excess water (non-subcontract) customers are those with options to take delivery of water that can become available when the amount of water exceeds contracted deliveries under long-term contracts and subcontracts.

NA = not applicable.

Source: CAWCD 2015b.

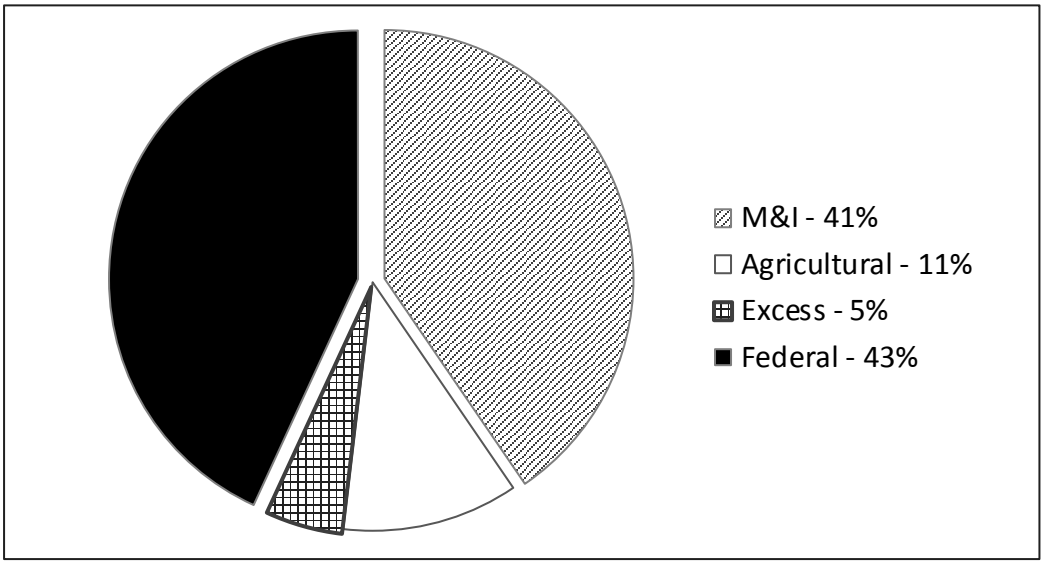


Figure 3.18-8 Water and Energy Delivery Revenue by Major CAWCD Customer Category, 2014

3.18.3.3.1.3 Lower Colorado River Basin Development Fund

The Lower Colorado River Basin Development Fund (Development Fund) is a separate fund within the U.S. Treasury established by Congress in the Colorado River Basin Project Act, which authorized construction of the CAP. Revenues deposited into the Development Fund include the sale of power from NGS that is surplus to CAP pumping needs; a surcharge on power sold in Arizona from Hoover Dam and the Parker and Davis Dams; and other miscellaneous revenues from CAP operation (43 United States Code § 1543).

The Arizona Water Settlements Act allows the Development Fund to be available to fund the Gila River Indian Community Water Rights Settlement, the Southern Arizona Water Rights Settlement and future Indian water rights settlements in Arizona. By law and contract, those funds are credited each year against CAWCD's repayment obligation for the CAP. After the money in the Development Fund has been credited against CAWCD's repayment obligation, those funds may be used, without further appropriation, by Reclamation, which administers the Development Fund, for other specific purposes defined in the Act.

Any funds not used in the year they become available are carried over to the following fiscal year and are again available for the purposes outlined above. Under the Arizona Water Settlements Act, Development Fund revenues not needed to meet current requirements may be invested and the interest income used for the same purposes.

3.18.3.3.2 Sociocultural Conditions

As outlined above, CAP is economically important to Arizona, its largest population centers and a large portion of its agricultural sector. The availability of CAP water, while not the driving factor for the economic and population growth experienced in the Phoenix and Tucson areas in recent decades, was an important enabling factor. Moreover, the availability of a reliable water supply is a key contributor to the economic vitality and quality of life enjoyed by people in the communities and reservations served by the CAP, which is over 80 percent of the population in the state (CAWCD 2014). A study of the CAP's economic contributions estimated that the CAP contributed to almost half of Arizona's gross state product in 2010 (Seidman Institute 2014).

The CAP water serves important cultural, social and economic functions for the tribes that receive water from Indian water rights, which were secured through water rights settlements and secretarial decisions allocating water to tribes. Prior to European settlement, water supported hunting, fishing, gathering, agriculture and cultural ceremonies on lands occupied and used by the CAP-affected tribes. In several cases these tribes had elaborate and sophisticated irrigation systems. As reservations were established, and European settlers diverted waters that formerly fed rivers and streams that flowed through and near some reservations, water was no longer available to sustain the traditional uses for many of these tribes (Gila River Indian Community n.d.; Lewis and Hestand 2006; Pueblo of Zuni 1999; Tohono O'odham Nation 2014; Waldman 2006). In some cases, the lack of water on reservations resulted in economic dependency, malnutrition and disease (Gila River Indian Community n.d.; Lewis and Hestand 2006).

Most American Indian water rights are determined under the *Winters* Doctrine which arose out of the 1908 federal case, *Winters v. United States*, in which the Court held that when Congress set aside lands for a reservation, it implicitly reserved sufficient water to fulfill the purposes of the reservation. Historically, the purpose of most reservations was designated as agricultural, and tribes were granted rights to the amount of water necessary to irrigate all land on the reservation that could feasibly and economically be irrigated. In 2001, the Arizona Supreme Court concluded that Indian reservations were established as homelands, and the court articulated a homeland standard for the measure of reserved water rights based on tribal economic development plans, cultural needs, and historic water uses (Cosens 2002).

As noted above, CAP-affected tribes use their CAP water for agricultural, residential, commercial, industrial, recreational, and cultural purposes, and some tribes lease their water rights to other users as a means of generating revenues to support tribal government and programs. CAP-affected tribes also have plans to support future agricultural and development uses and population growth, to accomplish their economic development and tribal self-determination goals. Some tribes feel that water rights settlements and the availability of CAP water at affordable rates will allow reestablishment of traditional irrigation-based agriculture on their reservations (Gila River Indian Community n.d., 2014; NREL 2012a).

Concerns of CAP-affected tribes concerns about the Proposed Action and Alternatives mainly are focused on the cost of water, but water cost has important social and cultural implications as well. For example revenues gained from the various uses of CAP water currently are used to fund tribal services and for some tribes, increases in the cost of delivery of CAP water affect their ability to provide other services to tribal members (Yucupicio 2014). CAP-affected tribes are concerned that changes to the NGS would make CAP water uneconomical for some uses, thereby calling into question some of the assumptions that informed past and future water rights settlements (CAWCD 2014).

3.18.3.3.3 Factors that may Contribute to Socioeconomic Change through 2019

3.18.3.3.3.1 Prospect of Stage I Water Shortages on the Colorado River

Continuing drought in the southwestern U.S., combined with below average precipitation and run-off in the upper Colorado River basin have resulted in declining water storage volumes in Lake Powell and Lake Mead, and reduced water flows in the Colorado River basin. Under an agreement between the lower basin states and the Department of the Interior, the Secretary will declare a shortage if the water elevation in Lake Mead falls below certain levels, subsequently reducing the amount of water that each lower basin state can withdraw. The first trigger, termed Stage I, is at a pool elevation 1,075 feet at which point Arizona's deliveries would be reduced by 320,000 acre-feet per year. Additional shortage triggers are at pool elevations 1,050 feet (Stage II) and 1,025 feet (Stage III), with corresponding reductions of 400,000 and 480,000 acre-feet for annual Arizona water deliveries. Absent substantial conservation, increased water runoff, or cooler temperatures, the Department of the Interior has advised the lower basin states that a Stage I shortage could be declared for 2017. In the event of shortage, water deliveries are reduced in order of priority. In a Stage 1 shortage, deliveries of excess water and the agricultural settlement pool are reduced while tribal and municipal pool are reduced while tribal and M&I priorities are not affected. CAP's pumping energy requirements and associated energy and transmission costs would decline, increasing the availability of excess energy for sale to generate surplus revenue.

3.18.3.3.3.2 Changes in Central Arizona Water Conservation District Water Delivery Rates

CAWCD has established rates for water deliveries in 2016 that include a $6 per acre-foot increase in fixed O&M cost and $9 per acre-foot increase in energy costs for its M&I and Federal-Indian customers, as compared to the comparable rates in 2014. The combined increases represent a 10.2 percent increase. Capital charges paid by some customers will increase by an additional $3 per acre-foot. **Figure 3.18-9** shows the 2016 rates, by major component, along with current, recent and forward-looking advisory rates through 2020.

CAWCD prepares forward-looking advisory rates as part of its financial budgeting process. The advisory rates reflect foreseeable changes in energy, operating, and maintenance costs. CAWCD provides these rates to its customers for use in their long-term financial planning programs. The current advisory guidance for 2019 per acre-foot delivery rates for M&I and Federal-Indian customers in 2019 are $178 per acre-foot, a 22 percent increase over the $146 per acre-foot in 2014 (**Table 3.18-31**) (CAWCD 2015).

According to CAWCD, declaration of shortage on the lower Colorado River would reduce the delivery volumes and require rate increases to cover the fixed O&M.

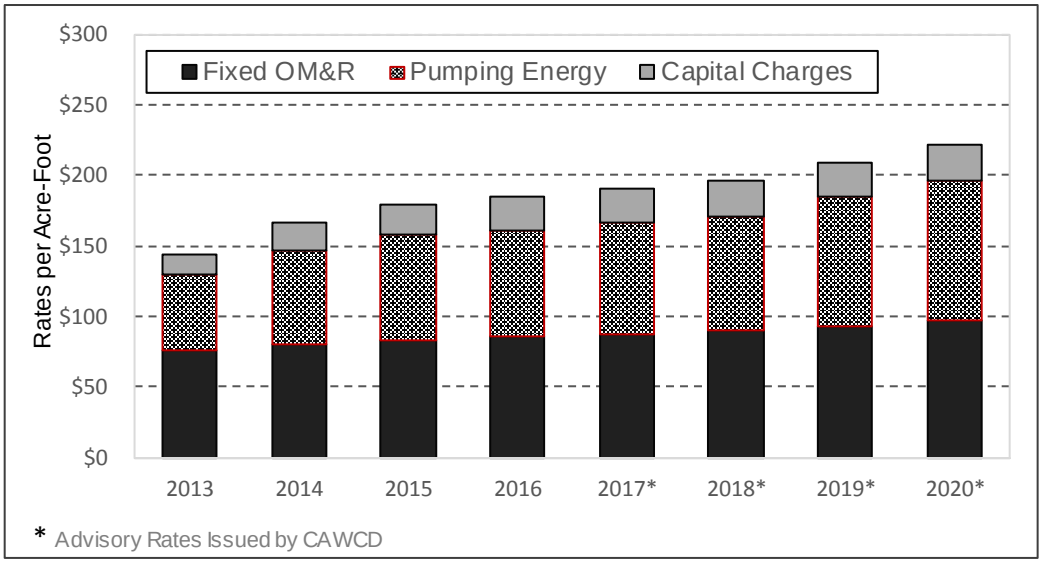


Figure 3.18-9 CAWCD Firm and Advisory Water Delivery Rates, 2014 to 2020

3.18.3.3.3.3 Projected Population Growth in the Area of Indirect Effects

Long-term population forecasts prepared by the state reflect an outlook for continued strong regional growth through the period of historical operations, through 2019. Under the medium growth series, the combined population for Maricopa, Pinal and Pima counties, that together encompass the Phoenix and Tucson metropolitan areas, would increase to 6,100,100 by 2020, a gain of more 910,000 over the total in 2010. Of the 6.1 million projected residents in the region, more than 4.5 million would reside in Maricopa County (**Table 3.18-31**). Under the high series, the combined population of the three counties would rise to 6,297,000, approximately a 17 percent increase in a decade and equaling the growth experienced during the decade 1990 to 2000.

Table 3.18-31 Population Forecasts for Central and Southern Arizona, 2010 to 2020

	2010	2020	Chg. 2010 – 2020	Total Change (percent)
Maricopa County	3,824,100	4,506,900	682,800	18
Pinal County	376,400	493,200	116,800	31
Pima County	981,200	1,100,000	118,800	12
Regional Total	5,181,700	6,100,100	918,400	18

Source: Arizona Department of Administration 2012a.

3.18.3.3.3.4 Land Use Conversion Associated with Growth

Population and economic growth in central Arizona has triggered major conversion of land from rural undeveloped and agricultural use. An example of such conversion is provided by data from the U.S. Census of Agriculture indicating a net reduction of more than 700,000 acres of farmland in Maricopa, Pinal and Pima counties between 1997 and 2012, a period of strong population growth and urbanization

in the Phoenix and Tucson metropolitan areas. Such conversion and development will likely continue through the end of 2019. Some changes in water use, including conversion from agriculture to M&I, also may occur, but the changes would not be expected to fundamentally change socioeconomic conditions in central Arizona.

3.18.4 Environmental Consequences

3.18.4.1 Issues

- Impacts of power plant and mine operations on regional employment and wages, particularly as related to the Navajo and Hopi tribes.
- Impacts on demographic, economic, attitudes, and social organization trends on Navajo and Hopi populations.
- Impacts of the current and future financial contributions of coal mining and electrical generation (royalties, permit and lease fees, payments to communities) to the Navajo Nation and Hopi Tribe.
- Impacts to the social fabric and values that provide incentives for younger tribal members to remain on the Reservation.
- Impacts of current and future costs of power required for CAP pumps. Economic impacts if there are reductions in surplus revenues for the Development Fund, and to fund Indian water settlements.
- Impacts related to the social cost of carbon. This issue is addressed in accordance with current federal guidance in Section 3.2, Climate and Climate Change.

3.18.4.2 Assumptions and Impact Methodology

- Implementation of a PFR Alternative presupposes concurrent operation of the NGS, proposed KMC, and continued use of the transmission lines and communications sites.
- The PFR Alternatives address only the federal share of NGS power and energy. No other changes in ownership, allocations of energy and power, or other characteristics of the NGS and other facilities are assumed in the EIS.
- Approval of the Proposed Action or action alternative would result in a series of future economic and social effects that are in large measure a continuation of similar effects that are associated with the existing operations.
- Non-federal participants continuing in NGS would continue to draw their full share of energy and power from NGS (i.e., they would not seek long-term curtailments of energy and power).
- In the event that a PFR Alternative is approved as part of the Record of Decision, the remaining participants in NGS would reach agreement allowing Reclamation to seek long-term curtailments of the federal share consistent with the specified PFR alternative. The terms of the agreement could specify the maximum allowable curtailment; (i.e., 100 megawatts [MW] to 250 MW). The impacts for intermediate values within that range would be proportional to those evaluated herein.
- To assess the potential effects of the Proposed Action, it is assumed that NGS would operate for the full 25-year period.
- The employment and income effects of the Proposed Action operations are estimated using a version of the IMPLAN model, calibrated for northeastern Arizona, in conjunction with employment and income information provided by SRP and PWCC. IMPLAN is a widely accepted commercial economic model. IMPLAN Group, the model's developer, prepares data

sets for every county and state in the nation, based on economic data from the U.S. Bureaus of Economic Analysis, Labor Statistics, and the Census.

- Economic impacts for the PFR alternatives are scaled from those associated with the Proposed Action operations, based on changes in energy production, annual coal production and changes in direct employment. Estimates of the latter were provided for the two Proposed Action operations by SRP and PWCC.
- The future costs of pumping energy for the CAP are estimated using projections of the base costs of NGS energy, the incremental costs that would be incurred at NGS after 2019, assuming operations would continue, and the projected costs of energy from lower-emitting alternative sources. **Technical Supplement 3.18-A**, located at the end of this section, describes the methodology and results of the analysis. The key results for each alternative are reported in the body of this section.
- Effects on sociocultural conditions were assessed based on the review of 1) historic and current sociocultural trends, 2) scoping comments and an analysis of community input from Kayenta and former Black Mesa mine area resident listening sessions, and 3) published journal articles, print media articles, and affected interest group websites. Interviews were conducted with tribal officials, Kayenta and former Black Mesa mine area residents, and off-reservation local government officials to further explore sociocultural conditions, trends and potential effects from the Proposed Action and alternatives.
- The socioeconomic effects of the PFR alternatives would be the combined effects attributable to Proposed Action and the incremental changes in effects of the specific PFR alternative.
- From an operational perspective, output at NGS would be curtailed under the PFR alternatives, (i.e., scaled back), to lower output by the amount of energy corresponding to that supplied by the replacement source. Section 2.2.3.2 and **Appendix 2A** for additional detail regarding the assumed operation and energy output of the PFRs.[21] Curtailing output at NGS would reduce the amount of coal combusted, direct labor requirements, and certain revenues paid by NGS and PWCC to the tribes and local governments.
- The generating sources for replacement power that would be purchased under the Natural Gas and Renewable PFR alternatives are assumed in existence in 2020. Temporary effects associated with construction of a new photovoltaic solar facility on tribal land are assumed to occur in 2023 and 2024 such that the new capacity is operational in 2025.
- The 100-MW and 250-MW increments of energy delivery are used as the basis for assessing the differences in effects that could result under the PFRs. Those increments should not be considered as discrete options, but rather as lower and upper limits of the reasonable range within which the actual project capacity and quantity of replacement energy and power for a PFR Alternative would be defined in the future. (Section 2.2.3.2 and **Appendix 2A** provide additional details regarding the energy delivery characteristics of the PFs.)
- Differences in effects associated with a specific partial replacement alternative are compared to those for the corresponding configuration of the Proposed Action; i.e., the incremental changes associated with the Natural Gas 250-MW PFR are based on the Proposed Action 3-Unit Operation. Differences between the socioeconomic effects of the Proposed Action 3-Unit Operation and 2-Unit Operation are addressed separately under the Proposed Action.

[21] Under existing arrangements with the NGS Co-tenants (SRP, Arizona Public Service Company, NV Energy, and Tucson Electric Power Company), Reclamation is able to curtail 100 MW. Curtailments exceeding 100 MW would require additional technical, engineering, and cost studies to determine the impact on plant operations, efficiencies, and maintenance. It is anticipated that due to cost and generation implications, additional agreements among the NGS Co-tenants and Reclamation would be necessary prior to curtailments above 100 MW.

- Summary findings of the socioeconomic impacts are presented for each alternative. The findings include a qualitative descriptor that considers magnitude, duration, intensity, and context. A brief statement of the rationale for the finding also is presented. The qualitative descriptors for socioeconomics are described below.
  - *Negligible*: Impacts to local and regional economic and social conditions, including employment opportunity, personal income, community and social stability, and tribal fiscal status would be at or below the levels of perception or detectable only through indirect means.
  - *Minor*: Impacts to local and regional economic and social conditions, including employment opportunity, personal income, community and social stability, and tribal fiscal status would be detectable but would not be outside the typical range of variability. The impact could be short-term or infrequent, of higher intensity, geographically localized, and affect few residents and governmental institutions, or for a longer period of time but of lower intensity, and affecting a broader population.
  - *Moderate:* Impacts to local and regional economic and social conditions, including employment opportunity, personal income, community and social stability, and tribal fiscal status would be readily apparent or observable across a wider geographic area, affect many residents and governmental institutions, and could have noticeable effects on the established economic or social conditions over the long term, or the impacts could be substantial but of a short duration with no permanent impacts to social and economic conditions. It is anticipated that mitigation, if implemented, would be successful with a high degree of certainty, based on prior examples with similar effects, and documented mitigation outcomes.
  - *Major:* Impacts to regional economic and social conditions, including employment opportunity, personal income, community and social stability, and tribal fiscal status would be readily apparent or observable across a wider geographic area, affect many residents and governmental institutions, and would result in substantial impacts to the resource. Mitigation, if implemented, would be uncertain in its success, or ineffective with consequent long-term and permanent changes in the availability or natural recovery of the resource.

3.18.4.3 Proposed Action

3.18.4.3.1 Navajo Generating Station

Approval of the Proposed Action would allow the NGS to continue operating from 2020 through 2044. Future operations would be consistent with historical operations including the use of coal supplied by the proposed KMC and transported by the BM&LP Railroad, use of water from Lake Powell for cooling, ash disposal in the on-site landfill or offered for sale for off-site use, and periodic overhauls.

Approval and implementation of the Proposed Action would trigger three key changes that would alter socioeconomic effects associated with the NGS plant as compared to those that would characterize the period of historical operations, through 2019. Those changes include:

The provisions of Lease Amendment No. 1 between the Navajo Nation and NGS Co-tenants (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1) would become effective;

- Changes in work force, scheduling of overhauls, scheduling of power deliveries and other operating parameters would occur should the 2-Unit Operation be implemented; and
- Selective Catalytic Reduction installation on 2 or 3 units for operation beyond 2030.

In addition to the continuation of ongoing programs and benefits, the connections between these changes and future socioeconomic consequences are described below.

Amendment #1 to the Indenture of Lease (Lease Amendment No.1): Under the terms of this amendment (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1), the Navajo Nation would realize substantial increases in payments from the NGS participants from those received under the 1969 Lease. The additional revenues consist of: 1) increases the annual lease payments for the 323 ROW grant to $9,000,000, 2) an additional payment of $34,000,000 per year; 3) increases the support for scholarships to approximately $250,000 per year; 4) an annual community payment of approximately $180,000; and, 5) a one-time payment for timely execution of the agreement. The first four of these elements would be subject to escalation based on the Consumer Price Index. For 3-Unit Operation the changes would yield a 1,400 percent increase in payments to the Navajo Nation over the 1969 Lease. Under 2-Unit Operation, the net increase would be nearly 1,000 percent because the additional payments would be scaled back to $22.7 million based on a rated capacity of 1,500 MW for the two remaining operational generating units. The $9,000,000 base lease, scholarship support and community payments would be unaffected.

Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1) affords the Navajo Nation an option to acquire an ownership interest in the NGS. However, the potential socioeconomic implications of this action are not addressed in this section because the timing, costs and other contractual and fiscal arrangements involved with exercise of that option are uncertain.

The Hopi Tribe is not a party to the NGS lease and therefore would not be directly affected by the terms of Lease Amendment No. 1.

Operation of NGS in a 2-Unit Operation: Retiring one of NGS's existing generating units would scale back the facility's work force requirements, quantity of coal purchased and used, frequency of coal deliveries, eliminate the need for a minor and a major overhaul in each 6-year cycle, lower the plant's valuation for property tax purposes, and reduce the coal royalties paid to the Navajo Nation and Hopi Tribe, among other effects. Each of these changes would have socioeconomic effects, often indirect. The analysis focuses on socioeconomic parameters likely to be affected by the continuation of existing programs and benefits together with any future changes in operations at NGS to differentiate the socioeconomic effects of alternatives.

Under a 2-Unit Operation, the federal share of NGS power would be 540 MW, 7 MW less than under the 3-Unit Operation. The reduction would have relatively little effect on Reclamation's operations as they relate to the availability of power to supply CAP's energy needs and as surplus for sale. However, Reclamation's share of power during overhauls would be approximately 270 MW, less than CAP's baseload requirement. The shortfall could be addressed by obtaining power from other sources. The shortfall also would limit the availability of surplus energy during that period.

Future installation of selective catalytic reduction on the operating units: Operation of the NGS beyond 2030 would ultimately lead to a need to install selective catalytic reduction to meet air quality standards. The approximate cost of such installation was estimated at $554 million to $1.23 billion if installed on all 3 units (NREL 2012a). Installation costs of $796 million are assumed for purposes of the energy rate cost analysis (see **Technical Supplement 3.18-A**). Installation would involve a temporary influx of workers and associated economic boost in the local economy, perhaps a few additional full-time workers on staff at NGS, and increase the facility's tax valuation for property tax purposes.

The initial changes in payments to the Navajo Nation associated with Lease Amendment No. 1 and the 2-Unit Operation may occur relatively quickly, but the full implications of those payments could take time to manifest themselves in the regional economic and community setting. Under the Proposed Action, installation of selective catalytic reduction equipment to meet air quality emissions standards is

envisioned as being necessary between 2022 and 2027 under the 3-Unit Operation and between 2026 and 2029 for the 2-Unit Operation in order for operations to continue beyond 2030. Implementation of a PFR Alternative could affect the timing of selective catalytic reduction installation due to the effects of curtailment in reducing future NO_X emissions. However, the extent and timing of such effects are dependent upon site specific information that is not available now and would be analyzed in future NEPA if the Tribal PFR Alternative is selected.

Selected socioeconomic parameters associated with continued operation of NGS under either a 3-Unit Operation or 2-Unit Operation are shown in **Tables 3.18-32**, **3.18-33,** and **3.18-34**. Operation of the BM&LP Railroad, using the existing rail line, loadout, unloading and storage yards would continue in use under either Proposed Action operation. In some instances the parameters shown are indicative of the initial change, but also a measure of the cause of subsequent socioeconomic effects. For example, the direct employment at NGS under the 3-Unit Proposed Action operation, 521 workers, is shown in **Table 3.18-32**, as is the corresponding direct work force of 398 for the 2-Unit Operation. The difference of 123 direct jobs represents the estimated reduction of NGS and on-site contractor jobs associated with retiring one unit.

Decommissioning would provide temporary support for an unspecified number of additional direct and secondary jobs for several years following final shutdown when the plant is taken off-line (see **Appendix 1B**). Also shown in the tables are the total number of jobs, including jobs supported through indirect and induced spending and the estimated tribal employment that could be supported by the payments to be made by the NGS participants; a total of 1,643 additional jobs under the 3-Unit Proposed Action operation and 1,218 additional jobs for the 2-Unit Proposed Action operation.

Implementation of the Proposed Action under the 2-Unit Operation would generally result in many of the same socioeconomic effects associated with the Proposed Action under the 3-Unit Operation, but at scaled back or reduced levels. In some instances the scaled back parameters cause changes that vary markedly from those under the 3-Unit Operation; for example, Proposed Action 3-Unit Operation sustains the current population in Page and nearby Navajo Chapters, while Proposed Action 2-Unit Operation would support fewer jobs and potentially promote population emigration from the region.

3.18.4.3.1.1 Operations and Employment

Table 3.18-32 focuses on operational and employment measures associated with the Proposed Action. The more noteworthy effects of the two operations are described following each table.

Approval and implementation of the Proposed Action 3-Unit Operation, with selective catalytic reduction installed would sustain the facility's role as a major economic element in the northeastern Arizona economy, continuing to provide energy and power to supply CAP and other electrical energy needs in Arizona. The federal amount and share of the power from NGS would remain at present levels under Proposed Action 3-Unit Operation.

Ongoing O&M of NGS would support an estimated 2,164 jobs in the regional economy, but excludes employment at the proposed KMC, which is addressed in a subsequent section. Over the 25-year period of extended operations, those jobs would represent 54,100 job-years of employment. The majority of that employment would represent continuation of existing jobs in the region that would be lost if NGS operations cease.

Table 3.18-32 NGS Operational and Employment Impacts of the Proposed Action

Parameter	3-Unit Operation (Total 2,250 MW, Federal: 547 MW)	2-Unit Operation (Total: 1,500 MW, Federal: 540 MW)
Operational		
Annual NGS Energy Production	17.34 TW hours	11.50 TW hours
Federal share of energy	4.17 TW hours	4.12 TW hours
Energy allocated to CAP	2.70 TW hours	2.70 TW hours
Energy available for Sale as Surplus	1.47 TW hours	1.42 TW hours
NGS-related Employment		
Operating and Maintenance		
NGS direct (plant and BM&LP Railroad)	521	398
On-site contractors (year-round)	38	33
Overhaul contractors (annual equivalent)	124	87
Tribal jobs	253	187
Indirect/induced jobs [1]	1,228	911
Total jobs	2,164	1,616
Temporary/Construction		
Overhauls Number of employees: Duration of activity Frequency of overhauls Yearly equivalent jobs [2]	~800 to ~1,200 ~4 wks. to 8 wks. per year Annually, alternating between minor and major 161	~800 to ~1,200 ~4 wks. to 8 wks. per year Four of every 6 years, alternating between minor and major 107
Selective catalytic reduction installation Number of employees: Duration of activity	Range: 13 to 494, ave. 240 Approx. 6 years. total, 4 years. of higher construction activity	Range: 100 to 421, ave. 253 Approx. 5 years. total, 3 years. higher construction activity
Decommissioning	Unknown number of jobs, for several years after closure.	Unknown number of jobs for several years.
Total job-years (2020 to 2044)	54,100, plus decommissioning	40,400, plus decommissioning

[1] Estimates of the indirect and induced jobs derived using an IMPLAN calibrated for northeastern Arizona.

[2] Reflects the average annual full-time equivalent jobs, including indirect and induced, over the 6-year schedule.

Under the Proposed Action 3-Unit Operation, BM&LP Railroad train operations would average about 21 round-trips per week. A capital investment program to replace locomotives, rolling stock, upgrade the catenary system, and improve the road bed would be implemented. Employment associated with the BM&LP Railroad would total 227 jobs; the same as current conditions. There would be no discernible changes in effects on population, housing, local retail and service establishments, or public facilities and services, as compared to existing conditions. Future BM&LP Railroad operations under the Proposed Action 2-Unit Operation would be approximately one-third lower than anticipated in conjunction with the Proposed Action 3-Unit Operation. Train operations would average about 14 round-trips per week, resulting in time-of-day or day-of-week schedule changes in comparison to the 3-Unit Operation. The lower frequency of train operations could ease any social concerns regarding safety at at-grade crossing.

The future employment totals include an allowance for more than 400 new jobs, or a comparable number of existing jobs that would otherwise be lost in the event of reductions in revenue from other sources, that could be directly and indirectly supported by the additional revenues received by the Navajo Nation

under the terms of Lease Amendment No.1. Many, if not most, of any new tribal positions would be filled by Navajo. The geographic distribution of those jobs is uncertain; however, many would likely be located in those communities hosting tribal agency offices. Businesses in those same communities would see gains in consumer expenditures for goods and services. Businesses in off-reservation communities, including Flagstaff, Page, Gallup, Winslow, Holbrook and Farmington, among others, also would see changes in consumer spending.

In addition to the above would be short-term economic infusions associated with overhauls that would be scheduled to occur in 2017, 2018, and 2019, assuming Proposed Action 3-Unit Operation is implemented. Those overhauls may be scaled back or cancelled absent approval of the Proposed Action or action alternative. The job, income and local spending effects foregone due to such actions would be short-term but nonetheless important to the Page economy.

Implementation of the Proposed Action 2-Unit Operation with selective catalytic reduction installed, also would sustain the facility's role as an important economic element of the regional economy, but at a reduced scale as compared to operations under a Proposed Action 3-Unit Operation. Reclamation's share of NGS power under a 2-Unit Operation would be 540 MW (a -7 MW or -1.3 percent difference). As a result of the cutback in capacity, NGS power could supply CAP and other electrical energy needs, but the availability of excess energy for sale to support the Development Fund would be approximately 0.06 terawatt (TW) hours per year less (4 percent).

Ongoing O&M of the plant would support an estimated average of 1,616 jobs in the regional economy, the majority of which would represent the continuation of then-existing jobs. The total number of jobs would be 548 fewer (-25.3 percent) than under the 3-Unit Operation. The majority of those jobs would represent the continuation of then-existing jobs. Over the 25-year period of extended operations, those jobs would represent 40,400 job-years of employment in the regional economy, a difference of 13,700 job-years as compared to Proposed Action 3-Unit Operation. Achieving the cutbacks in NGS staffing from the levels anticipated at the end of 2019 would be effected through attrition, retirements, voluntary separations, transfers, and possibly lay-offs. The lower number of jobs under the Proposed Action 2-Unit Operation would contribute to lower economic support to maintain local population, housing demand, and consumer demand for local retail and service businesses. Local government could experience reduced revenues and demand for most services, although demand for some social services may increase temporarily.

Payments to the Navajo Nation for the 2-Unit Operation under Lease Amendment No.1 would be lower than under the 3-Unit Operation, but higher than those to be made in 2019 under the existing 1969 Lease. The future payments could support additional jobs that would offset some of the differences in NGS-related employment under the 2-Unit Operation.[22] However, there would likely be differences in geographic distribution between the jobs lost (more Page-centric) and jobs gained (Window Rock and Navajo Nation agency/service communities). Business in other off-reservation communities (i.e., Page and Gallup) also would see changes in consumer spending. The magnitudes of the changes and whether the net effects would be gains or losses are unclear.

3.18.4.3.1.2 Labor Income and Public Revenues

The changes in labor income and the annual payments to the tribes, local governments and local public education is another area of much public interest expressed during scoping. **Table 3.18-33** presents impacts on those socioeconomic indicators.

[22] The totals for Proposed Action 2-Unit Operation include an allowance for 187 jobs, based on the assumption that 70 percent of the revenues are devoted to support general fund employment and programs, the remainder allocated to capital programs and trust accounts. This allocation mirrors expenditure patterns in the Navajo Nation's 2014 general fund budget.

Under Proposed Action 3-Unit Operation, workers in the primary segment of the study area would realize a collective total of $149.7 million in labor income annually; a total of more than $3.7 billion over the 25-year period associated with Proposed Action 3-Unit Operation. The annual total is equivalent of 1.6 percent of the total personal income of the 3-county region in 2013. With the 2-Unit Operation, projected annual household income of $110.8 million would be generated in the study area. Wages and salaries paid in conjunction with the Tribal jobs and induced jobs supported indirectly by the payments to be made by the NGS participants to the Navajo Nation could account for a substantial portion of the total. The lease and additional payments associated with Lease would amount to an indirect monetary transfer from the electrical consumers, including CAP's water customers, to the Navajo Nation and its members.

Extending the operating life of NGS would generate future retirement income for more households, as presently occurs as a result of past operations of the NGS. Much of that future income would accrue to workers hired to fill positions as current workers retire. Payments of those benefits would extend beyond 2044. Similarly, any new tribal jobs supported by payments from NGS would accrue income benefits beyond 2044. Although the value of those benefits is not estimated, they would be important given persistent high unemployment and poverty among the Navajo.

Table 3.18-33 NGS Labor Income and Public Revenue Impacts of the Proposed Action

Parameter	3-Unit Operation	2-Unit Operation
Labor Income		
Annual (direct, indirect, and induced) [constant $, no escalation] [1]	$ 149.8 million	$ 110.8 million
Annual labor income as a percent of 3-county regional personal income	1.6%	1.2%
Total 2020 to 2044	$ 3,745 million	$ 2,770 million
Access to comprehensive benefit programs	Access to benefits extended for current and a future generation of workers.	Similar benefits to the 3-Unit Operation, but approximately 1/3 fewer beneficiaries.
Long-term pension and retirement income	Substantial income to many current and future workers	Similar effects as for the 3-Unit Operation, but fewer beneficiaries
Payments to the Navajo Nation, Local Governments, and Education Support		
NGS payments to the Navajo Nation		
Annual	$ 43 million	$ 31.7 million
Total 2020 to 2044	$ 1,075 million	$ 793 million
Property taxes paid by NGS participants to Coconino County/ Public Education: [2]		
Annual	$ 11.2 million	$ 7.7 million
Aggregate Total 2020 to 2044	$ 280 million	$ 193 million
NGS Scholarships, Community Support, and employee donations to charitable organizations and campaigns	>$430,000 / year (NGS) + unknown amount from employees	> $430,000 / year (NGS) + unknown amount from employees

[1] These totals include estimates of the indirect and induced income derived using an IMPLAN model calibrated for northeastern Arizona.

[2] Includes in-lieu payments by SRP and the future effects on taxes from assumed investment in Selective Catalytic Reduction: $796 million for the Proposed Action 3-Unit Operation and $531 for the 2-Unit Operation.

Future revenues in excess of $1,355 million would accrue to the Navajo Nation, local governments and public education, principally in Coconino County, in conjunction with Proposed Action 3-Unit Operation.

On an annual basis, the $43 million in payments accruing to the Navajo Nation would represent an increase of nearly 15 percent in the tribe's annual general revenues as compared to its 2014 annual revenues. The future revenues would not be sensitive to fluctuations in interest rates and energy commodity prices and would escalate in response to general inflation. The stability of revenues and adjustments for inflation represent advantages to the tribe. The corresponding total payments for the 2-Unit Operation are $986 million.

Under provisions of the NGS 1969 Lease with the Navajo Nation, sales to NGS are not subject to sales taxes levied by the Navajo Nation. Future TPT taxes received by businesses on sales to employees and other households whose income is indirectly supported by NGS operations would generate tax revenues. Approximately 32 percent of the total TPT receipts are distributed to counties and municipalities in the state. Consequently, local governments would benefit from these receipts.

3.18.4.3.1.3 Demographics and Communities

Impacts on local labor markets, population, housing and private and public sectors of the local communities are presented in **Table 3.18-34**.

Table 3.18-34 NGS Demographic/Community Impacts of the Proposed Action

Parameter	3-Unit Operation	2-Unit Operation
Labor Market	Supports jobs and lower unemployment in the regional economy, especially in Page and among Navajo living in the LeChee and Kaibeto chapters and elsewhere in the northwestern portion of the Navaho Nation. Possible new job opportunities for Navajo, likely concentrated in Window Rock, Fort Defiance, and other communities that function as service centers for the Navajo Nation.	Supports jobs and lower unemployment in the region, with fewer jobs supported in the Page economy. Unemployment higher in Page than with the 3-Unit Operation Possible new job opportunities with the Navajo Nation tied to payments from NGS; similar to, but of a smaller scale than for 3-Unit Operation. Above gains would be offset by cutbacks at NGS and ripple effects in Page, Flagstaff and broader regional economy. Cutbacks at NGS likely achieved via attrition, retirements, voluntary separation, transfers, and application of union work rules.
Population	Temporary population influx during overhauls and selective catalytic reduction installation. Little long-term change in regional population directly related to NGS. Increased Navajo Nation employment could promote higher on-reservation population.	Minor population declines foreseeable in Page / LeChee area due to reductions in local jobs and local spending. Potential emigration dampened by tendency among retirees or those accepting voluntary separation to maintain local residence.
Housing	Little long-term change in housing need in Page. Demand for temporary accommodations would increase during selective catalytic reduction installation. Housing demand may increase in Window Rock and Fort Defiance, but added jobs and income promotes affordability among Navajo.	Lower housing demand in Page; housing prices and rents may decline and the number of vacancies could increase. Seasonal demand for temporary accommodations would be lower due to changes in NGS overhaul schedule, but increase during selective catalytic reduction installation.

Table 3.18-34 NGS Demographic/Community Impacts of the Proposed Action

Parameter	3-Unit Operation	2-Unit Operation
Effects on local retail and service sector	Businesses on Navajo Nation and in nearby off-reservation communities, including Gallup, benefit from increased consumer spending supported by higher lease and additional payments. Businesses in Page would benefit from temporary boosts during overhauls and selective catalytic reduction installation. Effects of selective catalytic reduction installation could compete/ overlap with seasonal tourism demands.	Effects tied to higher payments to Navajo Nation would be similar to, but on a smaller scale than those for 3-Unit Operation. Gains in income and spending on the eastern portion of the primary segment of the study area would occur, but there would be declines in Page, Flagstaff, and Tuba City and Moenkopi areas due to the ripple effects of cutbacks at NGS.
Effects on public facilities and services	Demands and utilization of public facilities and service would continue consistent with established affected environment patterns.	Utilization of most public facilities and service would continue, but potentially at reduced levels in Page compared to established affected environment patterns. There would be an increase in demand for public assistance and other social services in Page and Navajo Chapters near NGS. Downward pressure on housing prices in Page could affect property taxes.

3.18.4.3.1.4 Sociocultural Conditions

Implementation of Proposed Action 3-Unit Operation would perpetuate most prevailing sociocultural conditions associated with NGS in the primary segment of the study area. One change influence would be the installation of Selective Catalytic Reduction. That project would introduce employment and population influxes into the Page community, similar to those associated with overhauls, but of longer duration. The longer duration raises a potential conflict with the seasonal tourism demand for temporary accommodations. selective catalytic reduction installation also would generate additional tax revenues in Page, Flagstaff, and to the Navajo Nation. At the same time, selective catalytic reduction installation may offer extended employment opportunities to some workers who have temporary employment in conjunction with the overhauls. To the extent that this occurs, it would represent an important local economic benefit.

Other sociocultural changes would occur in conjunction with the higher lease and additional payments to the Navajo Nation. The Navajo Nation might expand services, providing more Navajo workers with jobs, depending on how the Nation chooses to allocate the funds. Additional jobs could allow more Navajo families to remain on or return to the Navajo Nation.

NGS and employee participation in civic, service and charitable organizations likely would continue, as would the annual economic infusion associated with NGS overhauls.

Navajo, Hopi, and NGOs who advocate for a transition away from coal-fired generation to renewable or lower-emissions sources would be dissatisfied with the continued operations of NGS at current levels, as would those individuals and organizations concerned about air quality, human and ecological health, and climate change-related effects of the facility.

Implementation of Proposed Action 2-Unit Operation would support 1,616 direct, indirect, and induced jobs in the primary segment of the study area, as compared to the 2,164 jobs supported by the Proposed Action 3-Unit Operation. The differences in job availability may prompt out-migration of some workers

and their families, and stresses on families as some workers then travel away for employment. New Navajo Nation jobs that could be added as a result of NGS Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1) and other payments could offset some of the differences in job availability that would be associated with Proposed Action 2-Unit Operation. The lower number of direct jobs at NGS and many of the indirect and induced jobs are likely to affect the labor force residing in Page, LeChee, or Kaibeto. Jobs added in response to higher NGS payments would more likely be located in Window Rock and elsewhere. Differences associated with the installation of selective catalytic reduction on two units would include fewer jobs and construction would occur several years later than under Proposed Action 3-Unit Operation.

Participation in the civic, service and charitable organizations by SRP and active employees would likely be lower under a Proposed Action 2-Unit Operation than under Proposed Action 3-Unit Operation, but also could receive boosts from newly retired individuals who retain local residency. Multigenerational, extended family Navajo and Hopi households who rely heavily on the incomes provided by a working household member affected by lay-offs under Proposed Action 2-Unit Operation would find the changes particularly burdensome.

From a social perspective, the shutdown on one unit with the 2-Unit Operation and installation of selective catalytic reduction on the remaining units at NGS may temper the dissatisfaction among some Navajo, Hopi and NGOs who advocate for a transition to renewable or lower-emissions sources, and are concerned about air quality, human and ecological health, and climate change-related effects of the facility.

3.18.4.3.2 Proposed Kayenta Mine Complex

Implementation of the Proposed Action would require a continued supply of coal through 2044. From a socioeconomic perspective, few changes in overall operations would occur at the proposed KMC under the Proposed Action. Rather, differences in socioeconomic effects would result indirectly in response to changes in future production rates to supply coal to NGS. Changes in the pace of mining would affect labor needs, investments in capital equipment, the amount and location of future disturbance and mining, and future royalty, bonus and tax payments made by PWCC that help fund a variety of administration functions and services provided by the tribes, local governmental entities and public education districts.

Future employment effects of continued operations with the future changes as proposed are presented in **Table 3.18-35**. **Tables 3.18-36, 3.18-37,** and **3.18-38** address Labor Income and Public Revenue, Demographic and Community, and Social effects, respectively.

3.18.4.3.2.1 Operations and Employment

Annual coal supply requirements under the Proposed Action 3-Unit Operation would be up to 8.1 million tons per year, with some year-to-year variation in response to actual production needs, i.e., coal requirements decline during major overhauls at NGS. Installation of the selective catalytic reduction may increase required coal tonnages slightly. No major changes in labor force requirements to sustain annual coal production are anticipated. No future changes in the coal supply agreement affecting royalty and bonus payments, or groundwater use at the mine are assumed. A substantial increase in water fees, retroactive to 2015, is pending approval.[23] It is assumed that the new rate would be in effect as part of any Proposed Action Alternative.

[23] The terms of the new rate have not been released publically, pending final approvals.

Continued O&M of the proposed KMC would support up to 1,648 long-term direct, indirect, and induced jobs in the regional economy. Over the 25-year period of extended operations, those jobs would represent up to 41,200 job-years of employment.

Annual coal supply requirements associated with the Proposed Action 2-Unit Operation would be 5.5 million tons per year. Ongoing O&M of the proposed KMC would support an estimated 1,129 jobs in the primary segment of the study area. Over the 25-year period of extended operations, those jobs would represent 28,225 job-years of employment in the primary segment of the study area, 12,975 job-years fewer than would be supported by Proposed Action Unit-3 Operation. Achieving the cutbacks in staffing at the mine from the levels anticipated at the end of 2019 would be achieved through attrition, retirements, voluntary separations and possibly lay-offs. Any lay-offs from among workers represented by the United Mine Workers of America Local 1924 would be implemented in compliance with union work rules. The majority of area residents affected by the loss of job opportunity would be Navajos. A number of Hopi might be affected by cutbacks in tribal staffing in response to reductions in tribal royalty, coal bonus and water fee revenues.

Table 3.18-35 Proposed KMC Operations and Employment Impacts of the Proposed Action

Parameter	3-Unit Operation 547 MW	2-Unit Operation 540 MW
Operational		
Annual Coal Production – NGS Total (average)	8.1 million tons	5.5 million tons
Total coal production 2020 to 2044	203 million tons	138 million tons
Difference in total production (tons and years at current production rate)	NA	65.0 million tons less ~ 8.0 years
Annual groundwater use (acre-feet per year)	Up to 1,200 acre-feet per year	Up to 1,200 acre-feet per year
Total groundwater use: 2020 to 2057 [1]	Up to 32,500 acre-feet	Up to 32,500 acre-feet
Employment		
PWCC direct jobs	440	299
On-site contractor jobs	79	53
Tribal and NTUA jobs	309	214
Indirect/induced jobs [2]	820	563
Total jobs	1,648	1,129
Aggregate job-years (2020 to 2044)	41,200	28,225
Difference in total job-years compared to Proposed Action 3-Unit Operation	NA	12,975 / 31.5% less than for the 3-Unit Operation

[1] 2057 would be expected bond release. The total includes 2,500 acre-feet for post mining use but does not include water to be pumped for residential and livestock use on the Black Mesa.

[2] Estimates of the indirect and induced jobs derived using an IMPLAN calibrated for northeastern Arizona.

NA = not applicable

3.18.4.3.2.2 Labor Income and Public Revenues

Table 3.18-36 presents effects on labor income and the annual payments to the tribes, local governments, and local public education under the Proposed Action.

Under Proposed Action 3-Unit Operation, workers and households in the primary segment of the study area would realize a collective total of up to $110.7 million per year in labor income; an aggregate total of

nearly $2.8 billion over the 25-year period. The annual sum is the equivalent of 1.1 percent of the total personal income of the 3-county region in 2013.

With a 2-Unit Operation, workers and households in the primary segment of the study area would realize collective labor income of up to $75.8 million annually; nearly $1.9 billion over the 25-year period. The annual total is equivalent to 0.8 percent of the total personal income of the 3-county region in 2013 and $873 million lower than under Proposed Action 3-Unit Operation.

As with NGS operations, extending the operating life of the proposed KMC to 2044 would provide current and retirement income for many households beyond the operating life of the plant. Those benefits take on added importance given the persistent high unemployment and poverty among the Navajo.

PWCC would make projected royalty, bonus, water fee and tax payments of more than $49 million annually under the Proposed Action 3-Unit Operation.[24] Future revenues accruing to the Navajo Nation, local governments and public education, principally in Navajo County, in conjunction with Proposed Action 3-Unit Operation are estimated in excess of $1.225 billion through 2044; payments to the Navajo Nation and Hopi Tribe would account for nearly $1.192 billion of the total. The comparable payments under Proposed Action 2-Unit Operation are estimated at $33.9 million annually and nearly $848 million through 2044.

Table 3.18-36 Proposed KMC Labor Income and Public Revenue of the Proposed Action

Parameter	3-Unit Operation	2-Unit Operation
Labor Income		
Annual [2015 USD]	$110.7 million	$75.8 million
Annual income - percent of 2013 3-county regional total	1.1%	0.8%
Aggregate Total 2020 to 2044	$ 2,768 million	$ 1,895 million
Difference compared to 3-Unit Operation	NA	$ 873 million less
Access to comprehensive fringe benefit programs	Access extended for current and a future generation of workers.	Similar to, but approximately 1/3 lower than for the 3-Unit Operation.
Long-term pension and retirement income	Substantial future income for many current and future workers.	Similar to, but approximately 1/3 lower than for the 3-Unit Operation.
Payments to the Tribes, Local Governments, and Education Support		
Annual PWCC lease, royalty and bonus payments [1, 2]	~$46.4 million	~$31.5 million
Annual water fees to the Navajo and Hopi (based on current rates) [3]	> $1.3 million	> $1.3 million
Annual property taxes paid by PWCC (average)	$1.33 million	$1.12 million
Aggregated combined PWCC payments (lease, royalty, bonus, water fees, and property taxes) 2020 to 2044	$1,225 million	$848 million
Difference compared to Proposed Action 3-	NA	$377.4 million lower / ~31%

[24] The projected annual payments are based on the current water fees paid by PWCC. A substantial increase in water rates, retroactive to 2015, is pending approval by the Hopi Tribal Council and the Secretary of the Interior. However, details of the new rate have not been released to the public.

Table 3.18-36 Proposed KMC Labor Income and Public Revenue of the Proposed Action

Parameter	3-Unit Operation	2-Unit Operation
Labor Income		
Unit Operation		
PWCC Scholarships, Community Support, and company and employee donations to charitable organization and campaigns	> $1.3 million – in 2013 Future amount unknown but would continue	> $1.3 million – in 2013 Future amount unknown but would continue
Federal Abandoned Mine Land and Black Lung Disability Programs		
Annual Total: 2020 to 2044	$7.0 million $175 million	$4.8 million $120 million

[1] Projections of future royalties and bonuses are based on the existing contracts, with no assumptions regarding changes during future "reopener" negotiations between the tribes and PWCC.

[2] Coal bonus payments are not made annually. The annual figure includes an average bonus per ton based on the projected tons of coal mined.

[3] An increase in water rates, retroactive to 2015, is pending approval by the Hopi Tribal Council and the Secretary of the Interior. Details of the new rate have not been released.

NA = not applicable.

Despite lower future royalty and bonus revenues under the Proposed Action 2-Unit Operation than the amounts received under the existing lease, the Navajo Nation would realize net gains in revenues under a 2-Unit Operation due to the higher NGS lease and additional payments under Lease Amendment No. 1. Implementation of a 2-Unit Operation would, however, substantially reduce revenues to the Hopi Tribe as compared to those associated with production for ongoing operations through 2019. Because mining related revenues account for most of the Hopi Tribe's general fund budget, reductions in such revenues may necessitate cutbacks in tribal employment and service levels that affect the entire tribe.

The sale of coal to NGS by PWCC is not subject to Navajo sales taxes. However, total personal income supported by the 2-Unit Operation would in turn support lower taxable sales by businesses to vendors and by consumers, than would occur with the 3-Unit Operation. Most of the effects on retail sales would accrue to businesses in Page, Kayenta, Tuba City, Flagstaff, Gallup, and Window Rock. Changes in sales for establishments in Albuquerque, Phoenix, Farmington and other communities also would occur.

Extending the operating life of NGS would generate labor income, including retirement benefits, for the current and future workers hired at the proposed KMC during the 25-year period and for tribal jobs supported by such payments.

3.18.4.3.2.3 Demographics and Communities

Table 3.18-37 addresses the Demographic and Community effects that would result in conjunction with operational changes at the proposed KMC.

Table 3.18-37 Proposed KMC Demographic/Community Impacts of the Proposed Action

Parameter	3-Unit Operation	2-Unit Operation
Labor Market	Local labor market conditions would be largely unaffected by continued operation and annual production of 8.1 million tons of coal. Support for tribal employment could be sustained at levels comparable to those associated with operations at the end of 2019.	Fewer job opportunities could result in higher local unemployment. Cutbacks in Hopi tribal staffing likely due to reductions in funding to support Hopi Tribal government operation Staffing cutbacks at the proposed KMC would be achieved through attrition,

Table 3.18-37 Proposed KMC Demographic/Community Impacts of the Proposed Action

Parameter	3-Unit Operation	2-Unit Operation
		voluntary separation, retirement, and application of United Mine Workers of America work rules. Workers with technical skills and training that are laid off would likely go off-reservation to seek work/income.
Population	Little, if any, net effect on regional population.	Fewer jobs could spur out-migration. Many affected households likely would remain on reservation while wage earners seek off reservation employment, returning as work schedules and finances allow. Potential emigration effects dampened by strong cultural ties to family and land.
Housing	Little, if any, net effect on regional housing need.	Homes in vicinity of the proposed KMC largely are owner occupied by families with long-term roots in the area. Few vacancies expected; continued occupancy by extended family would be likely. Existing housing shortages and challenges in obtaining homesite leases also could mitigate against increases in vacancies.
Effects on local retail and service sector	Consumer spending for retail and service establishments would continue at levels comparable to that associated with historical operations.	Businesses in Kayenta and other nearby communities experience reductions in sales tied to lower consumer spending. Declining business revenues in Moenkopi, Tuba City and elsewhere due to cutbacks in royalty and bonus payments.
Effects on public facilities and services	Demand and utilization of public facilities and services would be consistent with established patterns at the end of 2019. Community water pumping costs would increase due to N-Aquifer drawdown resulting from increased community pumping and continued mine use. Drawdown following cessation of mining would result from continued community pumping (see Section 3.7). Residential water service within the proposed KMC lease area may become available in conjunction with the first phase of the Many Mules water project. N-41 realignment and improvements would be completed.	Cutbacks in Hopi tribal staffing and services likely due to reduced revenues. Demands for and utilization of public services would be affected due to emigration anticipated in response to job losses. Demand for public assistance and other social services may increase due to higher unemployment and lower income. Effects on community water pumping costs similar to those for Proposed Action 3-Unit Operation. N-41 realignment and improvements would be completed. Reductions in NTUA revenues from the mine; rate hikes for other customers could result.

3.18.4.3.2.4 Sociocultural Conditions

As shown in **Table 3.18-38**, under the Proposed Action 3-Unit Operation, the Navajo Nation and Hopi Tribe could sustain levels of local employment associated with revenue derived from the Kayenta Mine at the end of 2019, maintaining relatively high paying jobs for primarily Navajo workers and allowing current workers and families to remain on their historic lands and support an extended family. PWCC lease and royalty payments would support services and employment across the Navajo Nation and Hopi Reservation, and PWCC-supplied water, coal and road maintenance and support for scholarships, events and charities would likely continue. Implementation of Proposed Action 2-Unit Operation could result in similar same effects, but at scaled back levels.

Proposed Action 3-Unit Operation and 2-Unit Operation would both provide opportunity for future PWCC employment for lease area residents, other Navajos and the Hopi. Given the relatively low work force turnover at the Kayenta Mine, few job openings are anticipated on an annual basis. This could change under Proposed Action 3-Unit Operation as current employees become eligible to retire. Hopi Tribe members would continue to face the challenge imposed by a lengthy commute between Hopi villages and the proposed KMC. Under Proposed Action 2-Unit Operation, future job opportunities would be more limited due to possible cutbacks in staffing levels.

Reductions in the direct workforce at the proposed KMC would primarily affect the Kayenta, Shonto, Tuba City, Forest Lake, and Piñon Chapters. Secondary effects would be likely in the Page, Flagstaff, and Kayenta communities. The lower level of employment at the proposed KMC under the Proposed Action 2-Unit Operation would contribute to out-migration of Navajo workers and families, and stresses on families as wage-earners travel away from home for employment. The loss of income could pose high economic burdens on extended families who rely on incomes provided by the mine.

The continuation of mining under Proposed Action may require relocation or lump sum monetary compensation (for residences and/or improvements) for up to eight households, depending on the actual location of mining (PWCC 2012, et seq.). Although relocation may result in improved housing and infrastructure conditions, it can move families away from their customary use areas. Up to six relocations would occur under the Proposed Action 2-Unit Operation.

Coal royalties due to lower coal production under the 2-Unit Operation would adversely impact Navajo and Hopi government services and employment. Because Kayenta Mine-related revenues constitute a high percentage of Hopi Tribe revenues, the reduction in the proposed KMC-related revenues would be more severe for the Hopi. Reductions in services would adversely affect the quality of life for many Navajo and Hopi across both reservations.

Table 3.18-38 Proposed KMC Sociocultural Impacts of the Proposed Action

Parameter	3-Unit Operation	2-Unit Operation
Economic importance of KMC for the Navajo Nation and Hopi Tribe	Continuation of historical employment levels would allow workers and their families to remain on their historic lands and support extended families. PWCC lease and royalty payments for the proposed KMC would be comparable to historical levels, supporting services and employment across the Navajo Nation and Hopi Reservation. PWCC-supplied water, firewood, and coal, road maintenance and support for scholarships, events and charities would occur, at levels comparable to those occurring during at the end of the baseline period.	Employment at KMC under would be lower than under the 3-Unit Operation. Local employment of fewer workers could prompt out-migration of some Navajo workers and families, or increase the numbers of wage earners that travel long-distances for employment. Because many wage earners support extended families, economic hardships would likely be greater than for a similar off-reservation loss of employment. PWCC-supplied coal, water, firewood and services, and corporate and employee support for scholarships, community events and charities would occur, but likely at lower levels than with the 3-Unit Operation. Hopi Tribe employment and services would likely decrease, potentially resulting in out-migration of some Hopis.

Table 3.18-38 Proposed KMC Sociocultural Impacts of the Proposed Action

Parameter	3-Unit Operation	2-Unit Operation
Lease area resident and Hopi employment	Lease area residents and Hopi would have opportunities for the proposed KMC employment similar to historical opportunities.	Fewer employment opportunities for lease area residents and Hopi due to work force reductions at the proposed KMC.
Air quality, human health and safety, ecological health, and water quantity and quality	Continued concerns about the proposed KMC-related effects on the identified resources, particularly for residents of the proposed KMC lease area. Continued concern about depletion and degradation of the N-Aquifer.	Concerns about the proposed KMC-related effects on the identified resources would be comparable to those with a 3-Unit Operation. Continued concern about depletion and degradation of the N-Aquifer.
Relocation	Up to eight households may be relocated or receive lump sum compensation for residences and improvements.	Two fewer households may be relocated than under the 3-Unit Operation because parcel N-10 would not be mined.
Withdrawal of grazing lands	Withdrawal of additional grazing lands could increase strains on the affected grazing permit holders and further impact traditional cultural activities and lifestyles. Compensation for loss of grazing would continue. Reclamation of disturbed lands would continue.	Withdrawal of grazing lands would be lower, resulting in lesser impacts on the affected grazing permit holders. Reclamation of disturbed lands would continue, similar to under Proposed Action 3-Unit Operation No change in policies for compensation of loss of grazing, but fewer acres involved.
Homesite leases	Navajo process for obtaining homesite leases would be unaffected.	Navajo process for obtaining homesite leases would be unaffected.
Road safety, maintenance and dust	Continued concerns regarding road safety, dust, and flooding at low crossings for residents within and near the lease area.	Potential reduction in road safety and dust concerns in and near the lease area due to lower traffic volumes. Concerns about flooding at low crossings would be similar to those for the 3-Unit Operation.
Cultural Resources	Some traditional Navajo and Hopi would likely be dissatisfied with the continuation of mining and its potential effects on TCPs, places, and landscapes having cultural and religious significance.	Dissatisfaction levels would likely be comparable to those under Proposed Action 3-Unit Operation.
Cultural Values	Continued dissatisfaction among Navajo and Hopi who believe that mining and related disturbance and environmental effects are incompatible with Native American traditional values.	Dissatisfaction levels would likely be comparable to those under Proposed Action 3-Unit Operation.
Equity	Perceived inequities among lease area residents regarding the provision of water to entities in central Arizona, facilitated by local mining, and the lack of water service locally, may diminish if and when the Many Mules Water Project begins supplying water to lease area residents.	No appreciable differences as compared to Proposed Action 3-Unit Operation.

Table 3.18-38 Proposed KMC Sociocultural Impacts of the Proposed Action

Parameter	3-Unit Operation	2-Unit Operation
Setting	Effects of surface mining on the physical and cultural setting and quality of life in and near the lease area would be highest under Proposed Action 3-Unit Operation. Proposed Action 3-Unit Operation would likely result in the most dissatisfaction among local residents who value the traditional setting over job opportunities and PWCC-supplied coal, water, firewood and services.	Effects of surface mining on the physical and cultural setting and quality of life in and near the lease area would be lower than under Proposed Action 3-Unit Operation, but would still likely result in dissatisfaction among local residents who value traditional settings over employment opportunities and PWCC-supplied coal, water, firewood and services.

3.18.4.3.3 Native American Traditional Values and Concerns

NGS and the Kayenta Mine have been operating for over 40 years; consequently there has been extensive discourse about the effects of these two facilities on traditional Navajo and Hopi values. This discourse has been reported in a variety of studies, articles, interest group websites, and other secondary sources. The historical effects of the two facilities provide useful insights into the manner in which the Proposed Action and alternatives would be perceived to affect traditional Navajo and Hopi values.

This assessment assumes that historic Navajo and Hopi opinions about the compatibility of the mining and burning of coal on tribal lands for electrical power generation also would apply to the Proposed Action and alternatives.

It should be noted that the primary purpose of this discussion is to ensure other perspectives besides the predominant Western viewpoint are recognized, rather than provide an “impact assessment” per se.

Following are issues raised by those holding traditional values. Concerns expressed that address contemporary issues but also may be rooted in traditional cultural values are discussed in the Sociocultural Conditions and Trends subsection above.

- Changes to the land and the impact on traditional uses of the land including wildlife and native plants used for cultural purposes and for food.
- Land reclamation: some commenters expressed preference for reclamation for grazing; others expressed concern for the introduction of non-native species for reclamation purposes and the resulting changes in plant and animal species in the lease areas.
- Strong tangible and intangible ties to the land; the importance of land in the traditional sense and the belief that native people should be allowed to remain on their ancestral lands. To the native people it is “Mother Earth.”
- Impacts to traditional ways including loss of aquatic resources, native vegetation and wildlife for ceremonial, medicinal and other traditional uses.
- The mine is intrusive to the tribal residents and outside interests are controlling use of their native lands.
- Lack of access to water by the local population.

3.18.4.3.3.1 Navajo Concerns

The most commonly voiced concern expressed by Navajo individuals and NGOs during scoping and the subsequent listening sessions involved the potential effects of NGS and KMC emissions and activities on

resident health. Regarding NGS, concerns were expressed for airborne emissions and coal combustion waste. Regarding the proposed KMC, concerns included blasting emissions, coal dust, and fugitive dust from both mining operations and traffic. A number of comments expressed concern that water use at the Kayenta Mine, combined with historic pumping of the Navajo Aquifer (N-Aquifer) to supply the former Black Mesa Mine and Black Mesa coal-slurry pipeline, has substantially depleted the aquifer, with associated adverse effects on springs, seeps, and wells in the Black Mesa area. A number of comments expressed concern for the relocation of residents and withdrawal of grazing lands, breaking traditional connections to the cultural practices and ceremonies linking traditional Navajo to their homes and birthplaces. Some residents expressed a preference for reclamation to accommodate grazing, a traditional cultural activity; others prefer returning disturbed land to their original vegetative state using nursery-grown native plants. Others are concerned about the potential for reestablishing plants used for ceremonial purposes. Comments regarding the proposed KMC also expressed concern for past treatment of sacred sites and family burials.

3.18.4.3.3.2 Hopi Concerns

The primary issues identified by Hopi tribal members include “concerns for air quality, water quality, and the indirect effects that air and water contamination might have on the ecosystem (i.e., animals and plants), and public health. Some Hopi tribal members also expressed serious concerns for the irreversible damage that mining causes to the natural environment, and the effect that these changes would have on community sustenance, traditional uses of the environment, and religious experiences associated with the land. Hopis are extremely concerned about the effect that past mining has had on their ancestral villages and burial sites, and they would like to see all ancestral sites protected. Disturbance of human remains by mining constitutes a significant impact on the spiritual wellbeing of the Hopi people. Finally, since the start of mining operations on Black Mesa, Hopis have persistently voiced concerns about the use of groundwater for mining. Some Hopi people are concerned about depletion to the aquifers, contamination of water, and the effect that groundwater pumping has on the overall health and well-being of the environment and the people” (Hopkins et al. 2016).

3.18.4.3.3.3 Navajo Generating Station

The proposed action would not result in any changes to the general physical environment related to the NGS and associated facilities from 2022 through 2044 plus decommissioning; however, it would continue the prior disturbance of the traditional setting, including that of the BM&LP Railroad that may be the basis for multiple cultural practices.

3.18.4.3.3.4 Proposed KMC

Under the Proposed Action, the Kayenta Mine permit area and former Black Mesa Mine would be combined into a single permit consisting of 62,930 acres; the combined area would be called the KMC. The Proposed Action would involve a continuation of mining, which would continue to alter the local environment. Lack of access, noise, dust and the concerns of pollution in areas of traditional significance would continue, and, to some extent, be expanded as new areas are mined.

Up to an additional 5,665 acres of tribal trust lands on the proposed KMC lease area would be mined under the Proposed Action. This disturbance would further alter the traditional setting within the KMC, which is the basis for multiple cultural practices. The disturbance would affect plants used for traditional purposes, and disturb ancestral sites and human remains. Up to eight additional households could require relocation or receive compensation for their homes and other improvements and up to six grazing areas would be withdrawn from active use.

3.18.4.3.4 Transmission Systems and Communication Sites

The STS and WTS transmission systems traverse land owned or managed by a combination of private, tribal, and governmental agencies. In addition, 19 existing radio communication sites support operations of the plant, railroad, and transmission systems. Most of the ROWs for these facilities are located in

rural, generally undeveloped areas. In some locations the facilities are readily visible, but public visibility and awareness of the facilities in other areas is limited by access and terrain. These transmission lines and communications facilities are not unique in their presence on the landscape. In some locations the facilities are collocated within or near other linear systems (e.g., other transmission lines, pipelines, highways, or railroads). No specific social concerns about transmission lines and communication sites were identified during scoping.

Ongoing employment and other economic impacts of transmission lines and communications facilities of the type associated with this project include periodic inspection and maintenance of the infrastructure and ROW. Private, state and tribal ROW leases often generate rental income and the utility-owned interests are subject to property taxes levied by local governments, school districts, and other taxing jurisdictions. Operation and maintenance would continue unaffected under the Proposed Action for the life of the project. The timing of decommissioning and final reclamation requirements for the WTS and STS ROWs ultimately would be determined by the authorities with responsibility for ROW issuance.

Table 3.18-39 summarizes key socioeconomic parameters and impacts associated with the transmission lines and communication sites that would be associated with the Proposed Action. There would be no appreciable differences in such socioeconomic impacts between the Proposed Action and conditions at the end of 2019.

Table 3.18-39 Socioeconomic Impacts of the Proposed Action Related to Transmission Systems Communications Sites

Parameter	Impacts
Operations	Existing lines, substations, and communication sites would continue to be utilized. Operations and maintenance would continue with little, if any, change. Overall utilization of these facilities by utilities and agencies due to reduction in NGS output under the 2-Unit Operation would have few, if any, socioeconomic effects because utilities would likely shift their dispatch and transmission procedures to optimize use of the available capacity.
Employment	An unknown number of jobs with utility companies, contract maintenance firms, local government, and local business currently associated with these systems. No discernible impacts on utility employment related to transmission line maintenance. No discernible changes in indirect and induced employment.
Construction	No new construction would be anticipated to occur after 2020. Conditions and operations would be essentially the same as under the historical operations, through 2019.
Labor Income and Public Revenues	No discernible changes in labor income associated with these systems would occur. Property taxes and ROW rental fees would continue on private, state and some tribal lands. Non-federal owners would begin paying ROW rents on federal lands. No substantive changes in demand on state and local facilities and services would occur.
Demographic / Community	No discernible changes in effects on population, housing, local retail and service establishments, or public facilities and services are anticipated.
Social	Current attitudes and concerns related to these facilities, if any, would likely continue.

3.18.4.3.5 Central Arizona Project

This subsection examines the prospective change in pumping energy costs for the CAP and the effects on water rates that would be associated with the Proposed Action operations. The analysis of future energy costs to CAP is based on future costs of NGS assuming continuation of the existing cost structure, and considering increases in operating costs over time. Incremental costs that would occur

post-2019, including the cost of selective catalytic reduction installation, are estimated and summed with the base case costs to derive future costs. Costs are reported for three time periods: 2020 to 2025, 2026 to 2029, and 2030 to 2044. Those periods generally correspond to the assumed timing of operational changes affecting future NGS production costs. **Technical Supplement 3.18-A** at the end of this section documents the derivation of future energy costs associated with the Proposed Action operations and the alternatives.

3.18.4.3.5.1 Future Costs for Energy

Future costs of energy generated by NGS would increase under either Proposed Action operation. Those costs would be passed through to Reclamation and to the other NGS participants. In turn, Reclamation's energy costs would pass through to CAP and purchasers of surplus energy.

Primary factors driving future cost increases would include additional lease payments to the Navajo Nation, and capital, financing costs and operating costs associated with installation of Selective Catalytic Reduction. **Technical Supplement 3.18-A** at the end of this section provides additional detail on the derivation of future energy costs and the effects on CAP water costs.

Lease Amendment No. 1 to the Indenture of Lease

This amendment provides for a substantial increase in annual payments to the Navajo Nation by the NGS co-tenants. Allocating the Amendment #1 lease costs across future energy production yields incremental costs per MW hours of $2.50 and $2.70 for the 3-Unit Operation and 2-Unit Operation, respectively, over current NGS costs.

Capital Cost of Selective Catalytic Reduction Installation and Operation

Installation and operation of selective catalytic reduction pollution control equipment would be the single largest factor driving future increases in NGS energy costs. Based on assumed installation and financing costs and an $0.80 per MW hours allowance for increased operating costs (NREL 2012a), results in a projected cost of $4.40 per MW hours for the Proposed Action 3-Unit Operation and $5.20 per MW hours for the 2-Unit Operation (**Table 3.18-40** and **Technical Supplement 3.18-A**).

Table 3.18-40 Incremental Costs of Reclamation Power from NGS Associated with Selective Catalytic Reduction Installation

Parameter	3-Unit Operation	2-Unit Operation
Installed Capital Cost – Average (millions)	$796	$531
Term of debt financing	20 years	15 years
Annual debt service payment at 5% interest (millions)	$63.4	$50.7
Incremental Cost / MW hours, incl. $0.80 additional operating	$4.40	$5.20

Reclamation's share of the selective catalytic reduction capital investment would exceed $190 million for the 3-Unit Operation and $130 million for the 2-Unit Operation, exclusive of financing costs. Cost recovery would occur through billings to CAWCD and sales of surplus energy.

Table 3.18-41 summarizes the total annual energy supplied to CAP by NGS and the federal share of energy generated by NGS that would be available to sell as surplus. In addition to the energy from NGS, CAP uses approximately 300,000 MW hours of energy per year purchased by CAWCD from Reclamation (Hoover Dam) and other sources.

Table 3.18-41 Allocation of Federal Power from NGS for CAP

Alternative	NGS Energy[1] (MW hours/year)		
	Supplied to CAP	Available for Surplus	Total Generated
Proposed Action 3-Unit	2,696,000	1,472,000	4,168,000
Proposed Action 2-Unit	2,696,000	1,421,000	4,117,000

[1] Annual energy quantities are for a typical year without adjustment for the effects of minor or major maintenance overhauls.

NA = not applicable.

3.18.4.3.5.2 Future Energy Costs for Reclamation

Reclamation's future energy costs from NGS (on a per MW hours basis and rounded to the nearest $0.10) which serve as the basis for the costs billed to the CAP, are shown in **Table 3.18-42**. Under either Proposed Action configuration, costs associated with selective catalytic reduction installation would raise energy costs by more than 9 percent, with the lease amendment costs raising costs by another 4 to 5 percent.

Table 3.18-42 Future Energy Rates for Federal Power from NGS

NGS Operation	Annual Energy Rates / MW hours for CAP		
	2020 to 2025	2026 to 2029	2030 to 2044
Proposed Action 3-Unit Operation	$47.20	$53.00	$54.40
Proposed Action 2-Unit Operation	$49.40	$50.80	$57.50

The cost increases, on a per MW hours basis, which would accrue to Reclamation and to the CAP in conjunction with Lease Amendment No. 1 and selective catalytic reduction installation, would be comparable to those borne by the other participant in NGS.

3.18.4.3.5.3 Annual Pumping Energy Costs

Based on the CAP's annual power consumption, the CAP's annual energy costs for the Proposed Action 3-Unit Operation would increase from an average of $127.3 million in the 2020 to 2025 period to $144.8 million in the 2030 to 2044 period (see **Table 3.18-43**). The comparable cost range for the 2-Unit Operation are $144.8 million to $164.5 million. Included in the above is a $14.3 million annual allowance for the cost of power from Hoover Dam and energy purchases from the market.[25] Annual energy costs during the first and last periods would be higher under the 2-Unit Operation than those for the 3-Unit Operation due to higher selective catalytic reduction debt service associated with the latter. Over the 25-year extended operational life of NGS, the total pumping energy cost for the CAP would exceed $3.5 billion under the 3-Unit configuration and $3.6 billion under the 2-Unit configuration.

[25] The $14.3 million represents CAWCD's average expenditures for such energy in recent years. The availability and annual outlays for such energy are assumed to be unaffected by the Proposed Action.

Table 3.18-43 Annual Energy Charges to CAP for NGS Power

NGS Operation	Total Annual Energy Charges			Aggregate Total 2020 to 2044
	2020 to 2025	2026 to 2029	2030 to 2044	
3-Unit Operation	$127,250,000	$141,540,000	$144,780,000	$3,501,000,000
2-Unit Operation	$132,640,000	$136,150,000	$152,320,000	$3,625,000,000

Projected annual energy costs, on a per acre-foot of water basis, would increase from $80 during the 2020 to 2025 period to $90 during the 2030 to 2044 period for the Proposed Action 3-Unit Operation and from $80 to $94 for the Proposed Action 2-Unit Operation (**Table 3.18-44**).

Table 3.18-44 CAP Annual Energy Charges per acre-foot

NGS Operation	Annual Energy Charges / Acre-Foot [1,2]			
	2020 to 2025	2026 to 2029	2030 to 2044	Net Change 2020 to 2044
Proposed Action 3-Unit Operation	$80	$88	$90	$10
Proposed Action 2-Unit Operation	$83	$85	$95	$12

[1] Based on 1.6 million acre-feet/year.

[2] Equivalent rate for 2016 is $76 / acre-feet (CAWCD 2015a).

The projected $80 per acre-foot energy cost in 2020 under the 3-Unit Operation would represent a 5 percent increase over the $76 per acre-foot rate for 2016. The $88 per-acre foot costs in 2026 through 2029 would represent a 16 percent increase as compared to 2016 costs. Relative to the total annual costs for the four major categories of customers, the $4 per acre-foot incremental costs between 2020 and 2025 [$80 - $76 = $4] would represent increases of 2 to 5 percent (**Table 3.18-45**). The $14 per acre-foot increment in 2030 to 2044 [$90 to $76] would represent an effective increase of between 8 percent and 18 percent above current rates. Any future increases in the fixed O&M of CAP's rates would compound the effects of higher pumping energy costs.

Table 3.18-45 Comparative Impact of Energy Charges for CAP Customers

Parameter	Total Annual Energy Charges			
	M&I Long-term Subcontract	M&I Non-subcontract and Recharge	Federal / Indian	Agricultural Settlement Pool
Firm 2016 Rate per acre-foot	$161	$184	$161	$76
$4 increase as a percent of 2016 firm rate	2%	2%	2%	5%
$18 increase as a percent of 2016 firm rate	9%	8%	9%	18%

For CAP customers, changes in energy costs would affect water costs, with the relative magnitude of change varying across the different categories of customers. Projected water costs under the Proposed Action 2-Unit Operation would be higher than under the 3-Unit Operation.

For M&I customers on long-term contracts, pumping energy costs represent approximately half of the total water rate. For many M&I customers, subsequent treatment, distribution, and system operation costs would further reduce the relative effect on final customers. Increases in water cost thus translate

into higher costs of doing business, a reduction in consumer disposable income for other purposes, and higher costs for the public sector (i.e., for irrigation, public recreation, and potable uses). Secondary effects of such impacts could include reductions in employment and income. Higher water costs would promote current efforts towards conservation and improved irrigation efficiency.

The largest relative impact would be for users in the Agricultural Settlement Pool which pay only energy charges. Agricultural use of water represents approximately 25- to-30 percent of the annual water deliveries by CAP. The impact of the higher rates also would be substantial on Indian and non-Indian agricultural interest that use water for irrigation. Because agricultural producers are not able to set the prices for their commodities, increases in production costs typically come from the “bottom line” (i.e., lower farm income). Increased production costs and lower income may result in farming operations being scaled back, changes in cropping patterns or the amount of land in production, or in extreme instances, could result in cessation of farming.

For CAP-affected Indian tribes receiving water through CAP and customers in the agricultural settlement pool, energy costs represent their total current water rate. Most water for these customers is likely used untreated for irrigation purposes although users may incur additional distribution and application costs. For these users, increases in water rates would raise production costs and lower farm income. For some CAP-affected Tribes, reductions in farm income could affect the availability of revenues to support tribal operations and service provision. Higher energy rates also could hamper CAP-affected Tribes’ plans to support future commercial and industrial development uses and population growth, and their ability to reestablish traditional irrigation-based agriculture on their reservations. Although higher water rates would not affect the capacity of the CAP to deliver water to the Tribes, higher costs may be viewed as effectively affecting their ability to access that water. Beyond a strictly economic issue, some Tribes may view these effects within the context of Reclamation’s obligations under various water settlements.

For individual Tribes and users, higher water costs could result in reductions in the quantity of water used, acreages under cultivation, changes in crops raised, and cutbacks in farm employment. As with M&I users, higher water costs also could promote conservation and efforts to improve irrigation efficiency. Higher rates for CAP water could prompt some current users to resume or increase groundwater pumping. Another foreseeable consequence of higher rates would be decisions by some private landowners to convert agricultural lands to other land uses. [26]

CAP water users would face potential further indirect consequences from increases in energy costs as a result of lower revenues that would accrue to the Lower Colorado River Basin Development Fund (see Section 3.18.3.3). Surplus energy sales of the federal share of NGS power serve an important role in CAP financing and in meeting federal obligations under various settlement agreements with Indian tribes in the area. In recent years, gross surplus sales revenue has averaged approximately $35 million annually. Net revenues have been much lower, contributing about one-fourth of CAPs annual repayment obligation. Such sales are largely contingent upon power from NGS being cost competitive with the cost of power from other sources and availability during periods of peak demand. Consequently, future cost increases for NGS power could erode the potential for and realizable revenues from future surplus energy sales As noted above, reductions or the loss of such revenues would pose a financial risk to CAP’s non-Federal water users that would bear a higher financial burden associated with debt repayment.

[26] An assessment of the extent and timing of these potential tertiary effects is beyond the scope of this NEPA analysis due to a lack of readily available information about the individual landowners, the numerous alternatives under consideration, and uncertainties about other factors that could be as or more influential in affecting future development conditions in the three-county CAP-affected region.

For M&I users, the effects of higher energy rates on the ultimate consumers are tempered somewhat by the fact that the water costs represent a relatively small share of the ultimate cost of potable water to the consumer. Water treatment, storage, distribution and system administration account for the majority of ultimate costs to the consumer.

A third major group of customers includes the Central Arizona Groundwater Recharge District and the Arizona Water Banking Authority. The increases in energy costs would result in a direct increase in the water acquisition costs for these two entities. Both entities are funded by a combination of public funds and user and water management fees. Increases in costs may require increases in fees, use of reserves, or other means to address the higher costs.

3.18.4.3.6 Project Impact Summary – All Project Components

Approving the extended operational life of the NGS and proposed KMC would have important and far-reaching socioeconomic consequences for northeastern Arizona, and in particular the Navajo Nation, Hopi Tribe and many individual members of the two tribes. The impacts of those approvals would extend to the CAP-affected tribes and other CAP customers by providing a continuous and reliable source of energy to operate the CAP system at predictable rates that also could support future sales of surplus energy yielding revenues to support the Development Fund. **Table 3.18-46** summarizes the critical socioeconomic effects associated with the Proposed Action operations.

Table 3.18-46 Impact Summary for the Proposed Action Operations

	NGS Configuration	
	3-Unit Operation	**2-Unit Operation**
Operations		
Federal Energy from NGS (TW hours/year)	4.17	4.12
Coal Used – NGS Total (million tons) Annual Aggregate 2020 to 2044	 8.1 203	 5.5 138
Employment		
Total Regional Jobs (direct, indirect, and induced) – Typical Year	3,812 jobs	2,745 jobs
Aggregate job-years – 2020 to 2044	95,303	68,617
Labor Income and Public Revenue		
Annual Labor Income (millions)	$260.4	$186.5
Aggregate Labor Income: 2020 to 2044 (millions)	$6,510	$4,663
Access to fringe benefit programs and long-term retirement income	Access to benefits and retirement income extended for current and a future generation of workers.	
Aggregate lease and other payments to the Navajo Nation, Hopi Tribe, local governments and public education: 2020 to 2044 (millions)	$2,554	$1,797
Net revenue effects to the Navajo Nation and Hopi Tribe as compared to end of 2019	Navajo Nation – much higher Hopi Tribe – unchanged	Navajo Nation – higher Hopi Tribe – much lower

Table 3.18-46 Impact Summary for the Proposed Action Operations

	NGS Configuration	
	3-Unit Operation	**2-Unit Operation**
Demographics/Community		
Air quality, human health and safety, ecological health, water quantity and quality, and elements of traditional lifestyles and social stability.	Provision of a substantial number of well-paying jobs would allow many Native American workers and their families to achieve or maintain a higher material standard of living, remain on their respective reservations, and support extended families. NGS and PWCC would provide substantial support for educational scholarships and community charitable causes in northeastern Arizona. Concerns about the effects of NGS emissions on air quality, visibility, climate change, and human and ecological health would persist. Navajo, Hopi, and NGOs who advocate for a transition away from coal-fired generation to renewable or lower-emissions sources would be dissatisfied with the continued operations of NGS. Concerns for health and ecological effects of KMC emissions, coal dust, fugitive dust, and coal fires and potential related effects on contaminating soil, water, and food sources would persist. Concern about potential depletion and degradation of the N-Aquifer associated with proposed KMC pumping and resultant effects on wells, springs and seeps would persist. PWCC-supplied water, firewood, coal, road maintenance and emergency medical services would continue to benefit residents of the proposed KMC area, and in the case of coal and water, nearby Navajo chapters and Hopi villages. Up to 8 additional household relocations could occur in the proposed KMC lease area under 3-Unit Operation and additional six grazing areas would be withdrawn from active use. Two fewer relocations would occur under 2-Unit Operation and fewer grazing lands would be withdrawn. Effects of surface mining on the physical and cultural setting and quality of life in and near the lease area would be higher with a 3-Unit Operation. Future operations would likely perpetuate dissatisfaction among local residents who value the traditional setting over job opportunities and support provided for tribal government and services and PWCC provided services. Most of the types of concerns outlined above would occur under either Proposed Action operation. Support for local economic and social stability would be stronger for the 3-Unit Operation than with the 2-Unit Operation.	
CAP Pumping Energy Charges		
Annual 2030 to 2044 (millions)	$144.8	$152.3
Aggregate 2020 to 2044 (millions)	$3,501	$3,625
Primary reasons for higher costs	Selective catalytic reduction installation costs, including financing, are the primary factor. Higher lease costs to the Navajo Nation, representing the first major increase since the NGS was built, also important.	

The summary assessment of impacts, as they relate to the specific issues defined in Section 3.18.4.2 above follow.

3.18.4.3.6.1 Regional Employment and Wages for the Navajo Nation and Hopi Tribe

Because of the many jobs and personal income that would be supported by the Proposed Action, the project related impacts on regional employment and wages would be major under either operation, particularly as related to the two tribes. Employment and income under the 3-Unit Operation would be higher than that expected at the end of 2019, while that under the 2-Unit Operation would be slightly lower than the levels expected at the end of 2019. The economic impacts would be particularly important because of the persistent unemployment and poverty in the region.

3.18.4.3.6.2 Demographic, Economic, Attitudes, and Social Organization Trends on Navajo and Hopi Populations

In addition to persistent high unemployment, limited job opportunities, and low personal income, traditional uses of the land and cultural ties to homesites and customary and traditional use areas among the Navajo and Hopi influence contemporary sociocultural conditions in the study area. Proposed Action-related income and access to fringe benefits, including retirement income, would support social stability for some Navajo and Hopi. At the same time, the continued operation of the NGS and the proposed KMC and related perceptions of environmental, health and cultural effects would result in dissatisfaction for some members of the two tribes and NGOs. These impacts would range from major to moderate.

3.18.4.3.6.3 Lease Fees, Royalties, Water Fees, and Other Payments to the Navajo Nation and Hopi Tribe

Project-related payments to the Navajo Nation and Hopi Tribe account for large portions of their respective general fund revenues to support governmental options, particularly for the Hopi. Future payments, including those to other local governments and to support public education, of more than $2.5 billion for the 3-Unit Operation and nearly $1.8 billion for the 2-Unit Operation would result. Given the magnitude of those revenues and few opportunities to replace those revenues with revenues from other sources, the fiscal impacts of operations under either Proposed Action would be major.

3.18.4.3.6.4 Social Fabric and Values that Provide Incentives for Younger Tribal Members to Remain on the Reservation

Future private and tribal employment opportunities and income effects associated with the Proposed Action and the economic support for households living on the reservations would provide incentives for younger tribal members to remain on the reservations. The impacts would be major because of the limited availability of foreseeable comparable opportunities and incomes from other employers.

3.18.4.3.6.5 Future Costs of Power Required for CAP Pumps and Economic Impacts due to Reductions in Surplus Revenues for the Development Fund

Pumping energy costs for the CAP would increase under either Proposed Action operation; by up to 18 percent (Proposed Action 3-Unit Operation) to 25 percent (Proposed Action 2-Unit Operation) as compared to the 2016 base rate of $76 per acre-foot of water delivered. The likely impacts of those increases would comprise a minor to moderate impact for users; moderate for the agricultural interests who pay only pumping energy costs and for the CAP-affected Tribes who used water for agricultural irrigation, minor for those M&I customers that subsequently treat, distribute and sell water to final consumers. Either Proposed Action would provide a continuous and reliable source of energy to operate the CAP system at predictable rates that supports the opportunities for future sales of surplus energy yielding revenues to support the Development Fund.

3.18.4.3.6.6 Native American Traditional Values

Air, water, land, traditional plants, cultural resources, homes and subsistence farming, gathering, and grazing activities that would be affected by NGS and the proposed KMC under the Proposed Action are considered important in the context of Navajo and Hopi traditional values. Navajo and Hopi who view

mining and burning of coal on tribal lands, and use of tribal water for mining, as incompatible with their respective traditional values have voiced opposition to the Proposed Action.

Others have voiced support for the Proposed Action, pointing to the economic, employment, and fiscal benefits that would be generated for the two tribes. It could be assumed that those voicing support believe that mining and burning of coal for electric power generation and use of tribal water for mining could be compatible with their traditional values.

3.18.4.3.7 Cumulative Impacts

3.18.4.3.7.1 Navajo Generating Station and Proposed Kayenta Mine Complex

The contributions of the NGS and proposed KMC to cumulative effects within the cumulative impact study area are described below.

The primary cumulative impact analysis area for socioeconomics includes the Navajo Nation, Hopi Reservation, and northern Coconino and Navajo counties, Arizona, with a focus on the Navajo chapters and portions of the Hopi Reservation surrounding NGS and proposed KMC and the nearby off-reservation communities in the two counties, particularly Page. The communities, residents, and tribal and local governments in this area share economic dependencies on tourism and travel, natural resources, the influences of federal expenditures, and a general setting that is remote from major metropolitan areas. Localized areas within the region vary considerably in terms of access to employment opportunities, basic retail trade and services, health care, and water and electricity.

Given the considerable distances between communities and limited size and availability of services within the interior of the region, cumulative socioeconomic effects can arise when effects of projects that are spatially distant from one another jointly impact the same community(ies). The potential for cumulative effects for spatially and even temporally separated projects is particularly true with respect to fiscal effects on tribal and local governments, which often involve multi-year budgeting and expenditure cycles. Consequently, cumulative fiscal effects could materialize over several years, even in instances of limited direct coincidence in timing of events or actions among different sources.

For socioeconomics, the residual and continuing effects of past and present actions are manifest in the settlement, land use, and development patterns that are evident on the landscape, in established political and tribal boundaries, types and location of major economic activities, and existing demographic and sociocultural conditions (see Section 3.18.3). Activities that were instrumental in establishing the existing cumulative environment for social and economic conditions in the region include the following:

- Construction and operation of the Glen Canyon Dam, Lake Powell National Recreation Area, and the highway crossing of Glen Canyon.
- Establishment of the community of Page to support construction of the Glen Canyon Dam, and provide services for recreational uses of Lake Powell.
- The growth of nearby communities that are home to many workers for NGS and Kayenta Mine (Page, LeChee, Kayenta, Shonto, Forest Lake, and Pinon).
- Construction and operation of seven electrical generating stations in the northeastern Arizona and northwestern New Mexico, along with coal mines to supply those generating stations in the 1970s.
- Completion of a new east entrance station and reconstruction and paving of Desert View Drive at Grand Canyon National Park, which increased visitor flow to/from/through Page and other national parks and monuments and cultural attractions in northeastern Arizona.
- Operation and the subsequent closure of the former Black Mesa coal mine and Black Mesa Pipeline's coal-slurry pipeline.

The residual effects of many of those activities and actions will continue to influence future socioeconomic conditions in the region.

As a part of the current assessment, three individual projects (Four Corners Power Plant and Navajo Mine [New Mexico], San Juan Generating Station and San Juan Mine [New Mexico], and Cholla Power Plant [Navajo County, Arizona] and other similar activities located in and near the primary segment of the study area (the Escalante, Coronado, and Springerville generating stations and El Segundo, Navajo, and Lee's Ranch mines in northeastern Arizona and northwestern New Mexico) were identified as having potential to result in cumulative socioeconomic effects with those associated with the Proposed Action. Although not all of these are located on the Navajo Nation, collectively these facilities contribute to the region's economic base and indirectly to the ongoing fiscal and economic stability of the Navajo Nation and northwestern Arizona.

The foreseeable socioeconomic impacts associated with the other facilities include temporary effects related to closure of some units and converting other facilities to natural gas. Long term, these changes will result in reductions in regional coal demand in northwestern New Mexico, lower employment in the electrical generation and mining industries, lower local tax revenues and the possibilities of population outmigration and lower housing demand.

The contrast in futures between economic contractions and associated socioeconomic effects for the other projects and the stability associated with the Proposed Action 3-Unit Operation are somewhat inconsistent with typical perspective of additive and concurrent socioeconomic effects associated with growth and new development. In this case, because the NGS and Kayenta Mine are already established and no major changes in operations are proposed, implementation of the Proposed Action 3-Unit Operation would contribute to economic and social stability in the western part of the Navajo Nation, and on the Hopi Reservation and northwestern Arizona. Moreover, the increased tribal revenues associated with the Proposed Action 3-Unit Operation would help offset the effects of employment cutbacks and reductions of revenues that occur from the sequential retirements of other generating stations and the associated coal mines. The Hopi Tribe would not experience similar effects because it has little fiscal and economic dependency on the other operations.

Under the Proposed Action 2-Unit Operation, the employment and social effects of taking one unit offline would decrease contributions to regional economic and social stability in comparison to that under the Proposed Action 3-Unit Operation. However, fiscal payments to the Navajo Nation would be higher than those being paid under the existing lease.

Regarding cumulative sociocultural conditions within the western part of the Navajo Nation and the Hopi Reservation, past sociocultural influences have included the Navajo livestock reduction programs of the 1930s and 1940s, the Bennett Freeze, which effectively prohibited new development, including extension of utilities, road improvements, and even maintenance and repairs of existing properties across the southwestern portion of Navajo-Hopi Partitioned lands, and the passage of the 1974 Navajo-Hopi Land Settlement Act, which resulted in relocation of thousands of Navajo and a small number of Hopi from the designated partitioned lands (see Section 3.18.3.1 for a discussion of general sociocultural trends on the Navajo Nation and Hopi Reservation). Within the Kayenta and former Black Mesa mine lease area, households have been relocated or received compensation for their residences and improvements since mining was initiated. Additionally, grazing lands have been withdrawn in active mining areas, and the grazing permittees compensated for withdrawn lands.

Directly and indirectly, NGS and the Kayenta and former Black Mesa mines have provided a source of employment and income for many Navajo and Hopi workers during their operations, which has improved the material standard of living for these workers and allowed them to remain on their respective reservations. The payments of these facilities to the Navajo Nation and Hopi Tribe have supported the provision of Tribal services and the development of Tribal infrastructure and facilities.

Development and operations of NGS and the Kayenta and former Black Mesa mine also have contributed to the change in the sociocultural setting that is occurring across the Navajo Nation and Hopi Reservation.

Residents residing in the vicinity of the Kayenta and former Black Mesa mine have coexisted with mining activities and traffic, and the cumulative change in the landscape and traditional setting on a daily basis for over 40 years. There is a history of concerns voiced by some residents and others about the mines' air quality, water quantity and quality, and health effects, the treatment of cultural properties, and the perceived incompatibility of coal mining with traditional values. At the same time some area residents and others have supported the mines for the employment and other amenities that they have provided. Based on comments received during meetings with area residents, support for mining and concern for the effects of mining exist within the same household and at times, the same commenter.

Reasonably foreseeable future actions contributing to cumulative effects include implementation of the Proposed Action, which under both 3-Unit Operation and 2-Unit Operation would result in a continuation of the above referenced effects on sociocultural conditions. The potential for prolonged drought effects also could further diminish the ability for Navajo and Hopi participation in gazing and farming activities, and contribute to continued off-reservation migration.

Conversely, implementation of the Proposed Action would support continued employment, and allow the holders of direct, indirect, and induced jobs supported by the two facilities to remain on their respective reservations. Payments by the two facilities to the two tribes also would support continuation of tribal services and the development of new infrastructure and facilities, depending on tribal use of those revenues. These latter effects would be higher under the 3-Unit Operation than the 2-Unit Operation.

Based on scoping comments, published articles, and interest group websites, coal mining and coal-fired power plants, including the Four Corners Power Plant and Navajo Mine, the proposed Desert Rock Power Plant, and the historic and present operations of NGS, the Kayenta Mine and the former Black Mesa Mine and Coal Slurry Pipeline have all been considered by some Navajo and Hopi to be incompatible with their respective traditional values. Other Navajo and Hopi have supported past and present operations, as evidenced by their approval of the leases over the past 40-year period. It is assumed that the support was associated with the economic, employment, and fiscal benefits that have been generated for the respective tribes. It also is likely that some Navajo and Hopi who have supported past and present mining and burning of coal for electric power generation and use of tribal water for mining believed that these activities could be compatible with their traditional values.

While no major reasonably foreseeable actions are slated for the Navajo chapters surrounding NGS, or the chapters and area of the Hopi Reservation surrounding the proposed KMC, the past, present and proposed future operations of those facilities through 2052 all contribute to the perceptions of their impacts on Navajo and Hopi traditional tribal values.

3.18.4.3.7.2 Transmission Systems and Communication Sites

These transmission lines and sites exist; therefore, the continuing effects are limited because no construction is proposed under the Proposed Action Alternative. Operation of both lines and the communications sites is foreseeable under all action alternatives. Therefore, no cumulative social and economic effects of consequence would be expected to arise in conjunction with these transmission lines and communication sites.

3.18.4.3.7.3 Central Arizona Project

CAP's service territory is expansive and largely urban in nature. The Phoenix metropolitan area has been among the fastest growing areas in the nation for more than 20 years. The availability of CAP water has provided an alternative to the use of groundwater for a large portion of that growth.[27] Growth is expected to continue (see Section 3.18.3.3 above), with substantial new development occurring in conjunction with that growth. While occurring in the same time frame and location as the CAP, few if any of those changes would trigger cumulative effects on CAP revenues and expenses. However, the potential for cumulative effects affecting CAP water rates does arise in connection with events that are totally beyond local control: future water flows in the Colorado River and the potential for shortages.

Decreases in water deliveries would occur under a declared shortage on the Colorado River, such that fixed O&M costs need to be recovered based on a lesser quantity of water deliveries. Preliminary assessment from CAWCD is that rates could increase by as much as $20 per acre-foot [25 percent] based on Stage I shortage conditions [reduction of 320,000 acre-feet withdrawn]. Stage II or Stage II shortage conditions would result in further increases in O&M rates, i.e., by as much as $38 per acre-foot, or 43 percent under a Stage III shortage (CAWCD 2015c,d).

Potential further indirect effects of water shortages include reductions in the availability of power generated at Hoover Dam. The extent to which Colorado River shortages affect Hoover power availability for CAP, and the cost implications of any changes in availability is uncertain. However, to the extent that power availability is curtailed, energy costs could increase as CAWCD secures replacement power from other sources.

The contributions of the Proposed Action to cumulative socioeconomic effects would be moderate to major because the incomes for residents and payments to the Navajo Nation are substantial and would provide a measure of revenue stability at a time when revenues from other sources may decline.

3.18.4.4 Natural Gas Partial Federal Replacement Alternative

3.18.4.4.1 Navajo Generating Station

Implementation of a PFR Alternative presupposes continued operation of the NGS, Kayenta Mine, and continued use of the transmission lines and communications sites. Furthermore, the PFR Alternatives would affect only the federal share of NGS power and energy. No other changes in ownership, allocations of energy and power, or other characteristics of the NGS and other facilities are assumed in the EIS. The socioeconomic effects of the PFR alternatives would be the combined effects attributable to Proposed Action 3-Unit Operation or Proposed Action 2-Unit Operation and the incremental changes in effects of the specific PFR alternative.

Implementation of the Natural Gas PFR assume NGS output would be curtailed by between 100 MW and 250 MW on an on-going basis; NGS would operate below its maximum design capacity on a long-term basis. The upper end of the range would be equivalent to 43 percent of the gross Federal share of NGS output. Purchased power would be dedicated to meet CAP energy needs. Between 0.88 TW hours and 2.19 TW hours of energy would be sourced from the grid through a power purchase agreement (**Table 2-9**). NGS generated power would supply the remaining CAP demand and the remainder would be available for sale as surplus to support the Development Fund. Projected annual energy production at NGS and the allocation of that energy between CAP needs and availability for sale as surplus, and the corresponding annual coal use are shown in **Table 3.18-47**. Sales of surplus energy would be contingent upon future market conditions and NGS surplus power being cost competitive.

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[27] The use of CAP water to reduce groundwater pumping in the three-county CAP service area was described in Reclamation's 1972 and 1982 EISs on the CAP.

Table 3.18-47 Annual Energy Output and Coal Use for the Natural Gas PFR Alternative

Configuration	Proposed Action	Natural Gas PFR 100 MW Replacement	Natural Gas PFR 250 MW Replacement
3-Unit Operation, 547 MW Federal Share			
Federal Energy from NGS (TW hours/year) [1]	4.17	3.29	1.98
Federal Energy Supplied to CAP (TW hours/year)	2.70	1.82	0.51
NGS Energy Available as Surplus (TW hours/year)	1.47	1.47	1.47
Annual Tons of Coal Used – NGS Total (million tons) Differences [percentage] [2]	8.1 NA	7.7 -5%	7.1 -12%
2-Unit Operation, 540 MW Federal Share			
Federal Energy From NGS (TW hours/year)	4.12	3.24	1.93
Federal Energy Supplied to CAP From NGS(TW hours/year)	2.70	1.82	0.51
NGS Energy Available as Surplus (TW hours/year)	1.42	1.42	1.42
Annual Tons of Coal Used – NGS Total (million tons) Differences [percentage] [2]	5.5 NA	5.1 -7%	4.5 -18%

[1] TW hours/year = terawatt-hours per year. 1 terawatt equals 1,000,000,000,000 watts.

[2] Differences in tons of coal are relative to the base tonnages for the corresponding Proposed Action 3-Unit Operation or 2-Unit Operation.

NA = not applicable.

Annual coal requirements for the Natural Gas PFR would be between 0.4 million and 1.0 million tons lower than those with the respective Proposed Action operations. Reductions in coal requirements for the Natural Gas PFR with the 2-Unit Operation would be in addition to the 2.6 million tons per year reduction associated with retirement of one unit with the 2-Unit Operation.

Fewer jobs and lower labor income, tax revenues and other economic effects in the primary segment of the study area would be associated with the Natural Gas PFR Alternative, as compared to corresponding Proposed Action operation. Implementation of this alternative presumes power purchases from existing generating sources located outside the region with resulting cutbacks in NGS staffing due to long-term curtailment of energy generation. Increases in lease and additional payments would still accrue to the Navajo Nation.

In general, the effects for a 3-Unit Operation with a 100-MW reduction would not differ substantially from those under Proposed Action 3-Unit Operation, for although it would represent a substitution of energy generated by natural gas for 18 percent of the federal share presently generated by coal, it represents 4.4 percent of NGS's total rated capacity. On the other hand, a 250-MW reduction under a 2-Unit Operation would represent a net reduction of 44 percent in the overall capacity and output of NGS as compared to operations at the end of 2019. The key socioeconomic effects associated with the Natural Gas PFR Alternative include the following:

- Net job losses in regional employment and increases in unemployment would occur under this alternative, the magnitude increasing with higher levels of replacement power.

- With the Natural Gas PFR 3-Unit alternatives, NGS related employment and income in the primary segment of the study area would be between 4 percent (100 MW) and 8 percent (250 MW) lower than for the Proposed Action 3-Unit Operation and total labor income in the region over the 25-year period would be between $180 million and $407 million lower.
- With the Natural Gas PFR 2-Unit alternatives, NGS related employment and income in the primary segment of the study area would be between 5 percent (100 MW) and 10 percent (250 MW) lower than for the Proposed Action 3-Unit Operation and total labor income in the region over the 25-year period would be between $135 million and $357 million lower. These differences would be in addition to those that would result from the closure of one unit.
- Total lease and additional payments to the Navajo Nation by NGS under Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1) for the 25-year period would be the same as under the corresponding Proposed Action operations - $1,075 million for the 3-Unit NGS option and $793 for the 2-Unit NGS option, provided the participants maintain NGS's current generator capacity ratings filed with the U.S. Energy Information Administration (EIA) – see the next item below.
- Under the Natural Gas PFR, the participants may have an option to lower the capacity ratings for NGS based on a consistent daily percentage reduction in output that would take into account the amount of energy procured by that CAP from other sources. Doing so could lower the additional payments made to the Navajo Nation under the lease amendment, resulting in potential cost savings and lowering the cost of NGS energy. The opportunities for such an action would increase at higher quantities of replacement and curtailment. No such adjustments are assumed for this assessment.
- Residents of LeChee, Kaibeto, Page, and Flagstaff, would be more likely to experience unemployment, with lesser effects occurring in the Tuba City and other communities.
- The potential for other socioeconomic effects, including lower housing demand and downward pressures on housing prices, would generally increase with higher levels of replacement power.
- Extending the operating life of the NGS under the Natural Gas PFR Alternative would allow more workers to accrue retirement benefits that would be realized beyond closure of the mine. The larger cutbacks for the Proposed Action 2-Unit Operation and 250 MW of replacement power would reduce such benefits.
- Higher levels of replacement power from natural gas, combined with retirement of one unit under Natural Gas PFR Alternative could ease public concern about environmental and health effects and contributions to climate change.
- The Natural Gas PFR Alternative could reduce NGS and employee participation in civic, community, and charitable initiatives.
- Higher NGS lease and other payments to the Navajo Nation would still be realized under this Alternative.
- The primary segment of the study area would not realize any economic or social effects directly associated with the purchase of power from the grid because the sources of such power are assumed to be outside the primary segment of the study area and already in existence.

Table 3.18-48 discloses the range of socioeconomics consequences associated with the Natural Gas PFR Alternative, focusing on those differences from those associated with the Proposed Action 3-Unit Operation.

Table 3.18-48 Socioeconomic Impacts of the Natural Gas PFR Alternative Related to NGS under the Natural Gas PFR Alternative

Parameter	NGS Configuration and Replacement Power			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Employment				
New Regional Jobs Tied to Alternative Power	0	0	0	0
Total Regional Jobs – Typical Year	2,077 87 fewer than Proposed 3-Unit Operation	1,999 165 fewer than Proposed 3-Unit Operation	1,535 81 fewer than Proposed 2-Unit Operation	1,453 163 fewer than Proposed 2-Unit Operation
Aggregate job-years (direct, indirect, and induced) – 2020 to 2044	51,935 4% less than Proposed Action 3-Unit Operation,	49,985 8% fewer than Proposed Action 3-Unit Operation	38,385 5% less than Proposed Action 2-Unit Operation	36,335 10% less than Proposed Action 2-Unit Operation
Labor Income and Public Revenue				
Annual Labor Income	$142.6 million	$133.5 million	$105.4 million	$96.5 million
Aggregate Labor Income: 2020 to 2044	$3,565 million	$3,338 million	$2,635 million	$2,413 million
Total NGS lease and other payments to the Navajo Nation: 2020 to 2044 [1]	$ 1,075 million Same as Proposed Action 3-Unit Operation.	$ 1,075 million	$ 793 million Same as Proposed Action 2-Unit Operation	$ 793 million
Aggregate property tax and in-lieu pymts: 2020 to 2044: Coconino County / Public education	$ 280 million Same as Proposed Action 3-Unit Operation	$ 280 million	$ 193 million Same as Proposed Action 2-Unit Operation	$ 193 million
Additional lease or tax income from PFR Alternative	None The source of power is assumed to be outside of the study area			
Demographic/Community				
Labor Market	Few differences from those under the corresponding Proposed Action alternatives at 100 MW of replacement power. Differences more substantial as replacement power increases. Jobs would contribute to lower unemployment in the region. Effects of 2-Unit Operation would be lower than those for the 3-Unit Operation and also would be lower as level of replacement power increases. Peak jobs would be approximately 1 percent of the combined 3-county employment in 2013, but much higher percentage of jobs held by Navajo and Hopi.			
Population	Little appreciable differences from the effects under the corresponding Proposed Action alternatives at 100 MW of replacement power. Fewer jobs under 2-Unit Operation could result in population declines in Page and some Navajo Chapters. Likelihood of population declines increases at higher quantities of replacement energy, particularly with 2-Unit Operation. Temporary influxes would occur in conjunction with overhauls and selective catalytic reduction installation.			
Housing	Few differences from those under the corresponding Proposed Action alternatives at 100 MW of replacement power.			

Table 3.18-48 Socioeconomic Impacts of the Natural Gas PFR Alternative Related to NGS under the Natural Gas PFR Alternative

Parameter	NGS Configuration and Replacement Power			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Effects on public facilities and services	Demands and utilization would continue consistent with historical operations through 2019, with declines in Page and nearby Navajo Chapters under 2-Unit 250-MW.			
Social				
Economic importance for the Navajo Nation and Hopi Tribe	Effects on Navajo Nation would be accentuated under this alternative as job opportunities for Navajo decline at higher levels of curtailment, compounding the effects associated with retiring one generating unit. The Hopi Tribe would not be directly affected by changes in NGS operations. Effects on employment and economic diversity would occur primarily in the LeChee and Kaibeto Chapters, in Page, and to a lesser extent in Flagstaff and Tuba City/Moenkopi areas.			
Social and economic importance for Coconino and Navajo counties and the City of Page	Social and economic effects on nearby off-reservation communities would be accentuated under this alternative due to larger reductions in jobs and income.			
Transition to renewable energy or natural gas	Navajo, Hopi, and NGOs advocating for a transition away from coal may be encouraged with this alternative, particularly as the amount of replacement power rises, but would remain dissatisfied with continued NGS operations. Dissatisfaction under 2-Unit 250-MW Option may be diminished because it would reduce coal as energy source for as much as 46 percent of the federal energy.			
NGS-related air quality, human health and safety, and ecological health concerns	Continued operations of 3 units would result in continued concerns about environmental and health effects of emissions, reduced somewhat by installation of selective catalytic reduction and partial replacement with natural gas. Concerns may be tempered by shutdown of one unit and substantial use of natural gas for replacement power.			

[1] Assumes the NGS participants choose to not adjust the rated capacity of the NGS generating units based on the long-term curtailment. Lowering the rated capacity could reduce the additional payments made to the Navajo Nation.

Substantive socioeconomic differences in the region associated with BM&LP Railroad with implementation of the Natural Gas PFR Alternative would be limited, as compared to those under the Proposed Action. Under this alternative the number of weekly train movements would range between 20.1 round-trips (3-Unit 100 MW) and 11.7 round-trips (2-Unit 250 MW), the latter an average of 1.7 round-trips per day compared to 3.0 trips under historical operation. The lower frequency associated with the Natural Gas PFR 250-MW 2-Unit Operation could result in elimination of 7 day/week operations. Implementation of this alternative would result between 6 and 57 fewer jobs and as much as $4.1 million less annual labor income in the primary segment of the study area. The differences in labor income during the 25-years of extended operations would result in lower retirement income beyond 2044.

3.18.4.4.2 Proposed Kayenta Mine Complex

- Reductions in annual coal production would reduce the company's labor force requirements and royalty and bonus payments made to the Navajo and Hopi tribes (see **Table 3.18-49**). Among all action alternatives, implementation of the Natural Gas PFR Alternative in combination with a 2-Unit configuration would result in the most pronounced changes in local socioeconomic conditions, with the exception of those resulting under No Action.

- Net reductions of as many as 709 jobs in the primary segment of the study area economy would occur. Reductions in employment would range from 5 percent to 42 percent as compared to the Proposed Action 3-Unit Operation.
- Implementation of Natural Gas PFR Alternative in conjunction with a 2-Unit Operation would support between $2.64 billion and $1.57 billion in labor income over the 25 years. However, that total would be as much as $1.2 billion less than under the Proposed Action.
- Extending the operating life of the mine would allow more workers to accrue retirement income benefits that would be realized beyond 2044.
- Over the 25-year period of extended operations, royalty, bonus and water payments would total between $649.1 million and $1.14 billion. Distribution of those revenues would be approximately 67 percent to the Navajo Nation and 33 percent to the Hopi Tribe.
- Over the life of the mine, PWCC payments into the federal Abandoned Mine Land and Black Lung Disability funds would be as much as $23 million less than under Proposed Action 3-Unit Operation.
- The Hopi Tribe would remain heavily reliant on those revenues to support tribal government and to provide essential services for its members living on the reservation.
- Navajo County and the local school district would receive lower property taxes paid by PWCC and from TPT proceeds as compared to Proposed Action 3-Unit Operation.
- Even with the lower levels of coal production and mining activity associated with this alternative under a 2-Unit NGS Option, concerns about air quality, human health and safety, ecological health, and water quality and quantity effects would likely continue.
- Groundwater concerns related to potential depletion of the N-Aquifer would be reduced, but likely persist.
- Residents within and near the lease area would likely continue to be concerned about equity under all PFR alternatives under a 2-Unit NGS Option.
- Under a 2-Unit 250-MW alternative, the surface mining effects on the physical and cultural setting and quality of life in and near the lease area would be substantially less than Proposed Action 3-Unit Operation. However dissatisfaction may persist among residents who value the traditional setting over employment opportunities and PWCC-provided coal, water, firewood and services.

Table 3.18-49 Socioeconomic Impacts of the Natural Gas PFR Alternative Related to the Proposed KMC

Parameter	NGS and Replacement Power Configuration			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Operational				
Annual Coal Production (million tons)	7.7	7.1	5.1	4.5
Employment (direct, indirect, and induced) – Typical Year	1,573 75 fewer than Proposed Action 3-Unit Operation	1,453 195 fewer than Proposed Action 3-Unit Operation	1,052 77 fewer than Proposed Action 2-Unit Operation	939 190 fewer than Proposed Action 2-Unit Operation
Aggregate job-years – 2020 to 2044	39,325	36,325	26,300	23,475

Table 3.18-49 Socioeconomic Impacts of the Natural Gas PFR Alternative Related to the Proposed KMC

Parameter	NGS and Replacement Power Configuration			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Labor Income / Public Revenue				
Annual Labor Income	$105.6 million	$97.6 million	$70.4 million	$62.7 million
Total Labor Income: 2020 to 2044	$2,639 million	$2,440 million	$1,760 million	$1,567 million
Total lease, royalty, bonus and water payments: 2020 to 2044	$1,137 million	$1,050 million	$764 million	$682 million
Total Property Taxes 2020 to 2044	$33 million	$33 million	$28 million	$28 million
Federal Abandoned Mine Land and Black Lung Disability funds 2020 to 2044	$167 million	$154 million	$111 million	$98 million

3.18.4.4.3 Transmission Systems and Communication Sites

When compared to the Proposed Action scenarios, implementation of a Natural Gas PFR Alternative would result in no substantive socioeconomic consequences related to the existing transmission lines and communication sites. The physical infrastructure is in place, no new construction is proposed, and operations and maintenance would continue for the life of the project. The timing of decommissioning and final reclamation requirements for the WTS and STS ROWs ultimately would be determined by the authorities with responsibility for ROW issuance.

3.18.4.4.4 Central Arizona Project

This subsection examines the prospective change in pumping energy costs for the CAP and the effects on water rates that would be associated with the Natural Gas PFR alternatives in a similar fashion as for the Proposed Action (Section 3.13.4.3, Central Arizona Project, and **Technical Supplement 3.18-A**). The analysis of future energy costs to CAP is a weighted average of: (1) future costs of NGS, (2) the incremental costs associated with curtailing NGS production, and (3) the cost of energy purchased from a Natural Gas generating source. The latter are based on NREL's annual baseline series of energy projections, analysis of energy pricing at the Mead hub, and long-term energy pricing projections from the EIA.

Table 3.18-50 presents the energy supply assumptions for this analysis, outlining the total annual power and energy supplied to CAP by NGS, acquired from alternative sources, and the federal share of power generated by NGS that would be available to sell as surplus. Not shown, but included in subsequent energy cost estimates, is 300,000 MW hours of energy assumed to be purchased by CAWCD from Reclamation (Hoover Dam) and other sources. A range of costs associated with future power purchases is presented including costs for construction of a new generation facility for comparative purposes only. Note that new construction was determined to not be economically viable (**Appendix 2A**).

Table 3.18-50 Annual Federal Power from NGS and Natural Gas PFR Alternative Supply for CAP

NGS / PFR Configuration	NGS Supplied to CAP (MW hours)	NGS Available for Surplus (MW hours)	Total NGS Generated (MW hours)	PFR Supplied Power to CAP (MW hours)
Proposed Action 3-Unit Operation	2,696,000	1,472,000	4,168,000	NA
3-Unit/Natural Gas 100 MW	1,819,000	1,472,000	3,290,000	877,000
3-Unit/Natural Gas 250 MW	505,000	1,472,000	1,975,000	2,192,500
Proposed Action 2-Unit Operation	2,696,000	1,421,000	4,117,000	NA
2-Unit/Natural Gas 100 MW	1,819,000	1,421,000	3,240,000	877,000
2-Unit/Natural Gas 250 MW	505,000	1,421,000	1,926,000	2,192,500

Note: CAP is assumed to use an additional 300,000 MW hours of energy per year from other sources.

3.18.4.4.4.1 Future Costs for Energy

Future costs of NGS energy for the Natural Gas PFR are based on the same underlying assumptions outlined under the Proposed Action. However, the incremental costs associated with Lease Amendment No. 1 and selective catalytic reduction are reallocated based on lower annual NGS output; in effect raising the cost of Reclamation energy.[28] The effect on Reclamation's cost of NGS energy would be in direct proportion to the amount of energy sourced from a non-NGS sources. Additionally, Reclamation's costs would be affected by curtailment. Costs for the other participants would likely be unaffected.

The operating agreements for NGS allow a participant to request that its share of power output be curtailed, i.e., not produced. When curtailment occurs, variable operating costs are reduced. However, certain fixed costs would still be incurred and must be covered by the remaining production. Given the projected levels of curtailment for the Natural Gas PFR, such charges are estimated at between $12,278,000 and $30,695,000 per year (**Table 3.18-51**). The incremental costs increase as the amount of replacement energy and hence, the amount of curtailment increases. Thus, the incremental costs associated with Natural Gas PFR 250 MW under the 2-Unit Operation would be substantially higher than those for 100 MW with the 3-Unit Operation.

Table 3.18-51 Incremental Costs to Reclamation due to NGS Curtailment under the Natural Gas PFR Alternative

NGS / PFR Configuration	Annual Curtailment Charges	Annual Curtailment Cost / MW hours
3-Unit/Natural Gas 100 MW	$12,278,000	$3.70
3-Unit/Natural Gas 250 MW	$30,695,000	$15.50
2-Unit/Natural Gas 100 MW	$12,278,000	$3.80
2-Unit/Natural Gas 250 MW	$30,695,000	$15.90

[28] It is assumed for this assessment that reductions in future emissions under the Natural Gas PFR alternative would not affect the timing of selective catalytic reduction installation as compared to the Proposed Action.

3.18.4.4.4.2 Future Energy Costs for CAP

Reclamation's future energy costs under the Natural Gas PFR alternatives, rounded to the nearest $0.10, are shown in **Table 3.18-52**. As shown, energy rates under Natural Gas PFR alternatives could be lower or higher than those under the Proposed Action, depending on the future prices of natural gas. Energy costs could be as much as $4.80 per MW hours lower (2-Unit Operation and 250 MW in 2030 to 2044) or as much as $14.50 per MW hours higher (3-Unit Operation and 250 MW in 2030 to 2044). In other words, the natural gas pricing range projected by NREL indicates a exposure risk to future rates that would be substantially higher than the rates under the Proposed Action than the potential savings associated with lower gas costs.

Table 3.18-52 Future Energy Charges per MW hour under the Natural Gas PFR Alternative

	CAP Annual Energy Charges / MW hours		
NGS / PFR Configuration	**2020 to 2025**	**2026 to 2029**	**2030 to 2044**
Proposed Action 3-Unit Operation	$47.20	$53.00	$54.40
3-Unit/Natural Gas 100 MW Power purchases (range)	$47.80 - $48.50	$53.20 - $54.70	$55.40 - $57.90
3-Unit/Natural Gas 250 MW Power purchases (range)	$45.10 - $57.60	$49.50 - $62.50	$52.80 - $68.90
Proposed Action 2-Unit Operation	$49.40	$50.80	$57.50
2-Unit/Natural Gas 100 MW Power purchases (range)	$49.40 - $54.40	$51.20 - $56.40	$57.70 - $64.20
2-Unit/Natural Gas 250 MW Power purchases (range)	$45.00 - $57.50	$47.50 - $60.50	$52.70 - $68.70

3.18.4.4.4.3 Annual Pumping Energy Costs

Annual energy costs for the Natural Gas PFR Alternative with a 3-Unit Operation would range from $122.4 million to $180.1 million and between $122.1 million and $179.6 million if implemented as part of a 2-Unit Operation (**Table 3.18-53**). The lower and upper ends of those ranges are driven by the low and high range of assumed natural gas prices.

Table 3.18-53 Annual Energy Charges to CAP under the Natural Gas PFR Alternative

	Total Annual Energy Charges [1]			Aggregate Total 2020 to 2044
NGS / PFR Configuration	**2020 to 2025**	**2026 to 2029**	**2030 to 2044**	
Proposed Action 3-Unit Operation	$127,250,000	$141,540,000	$144,780,000	$3,501,000,000
3-Unit/Natural Gas 100 MW Power purchases (range)	$128,870,000 to $130,490,000	$141,810,000 to $145,580,000	$147,200,000 to $153,400,000	$3,548,000,000 to $3,666,000,000
3-Unit/Natural Gas 250 MW Power purchases (`range)	$122,400,000 to $152,590,000	$132,910,000 to $164,460,000	$141,000,000 to $180,090,000	$3,381,000,000 to $4,275,000,000

Table 3.18-53 Annual Energy Charges to CAP under the Natural Gas PFR Alternative

NGS / PFR Configuration	Total Annual Energy Charges [1]			Aggregate Total 2020 to 2044
	2020 to 2025	2026 to 2029	2030 to 2044	
Proposed Action 2-Unit Operation	$132,640,000	$136,150,000	$152,320,000	$3,625,000,000
2-Unit/Natural Gas 100 MW Power purchases (range)	$132,640,000 to $144,780,000	$126,960,000 to $149,630,000	$152,860,000 to $168,500,000	$3,637,000,000 to $3,995,000,000
2-Unit/Natural Gas 250 MW Power purchases (range)	$122,130,000 to $152,320,000	$128,060,000 to $159,600,000	$140,730,000 to $179,550,000	$3,356,000,000 to $4,246,000,000

[1] The annual charges include $14.3 million for the purchases of energy from Hoover and other non-NGS sources. The costs and availability of such power is assumed to be the same under all action alternatives.

The annual energy charges to CAP for the 2030 to 2044 time period, for the Natural Gas PFR alternatives are shown in **Figure 3.18-10**.

Over the 25-year extended operating life of the NGS the aggregate energy costs to the CAP under the Natural Gas PFR alternative would be between $120 million lower and $774 million higher than for the Proposed Action 3-Unit Operation, again reflecting the potential effects of natural gas prices. The differences in aggregate energy costs if implemented with a 2-Unit Operation would be between $269 million lower and $621 million higher, contingent on future natural gas prices.

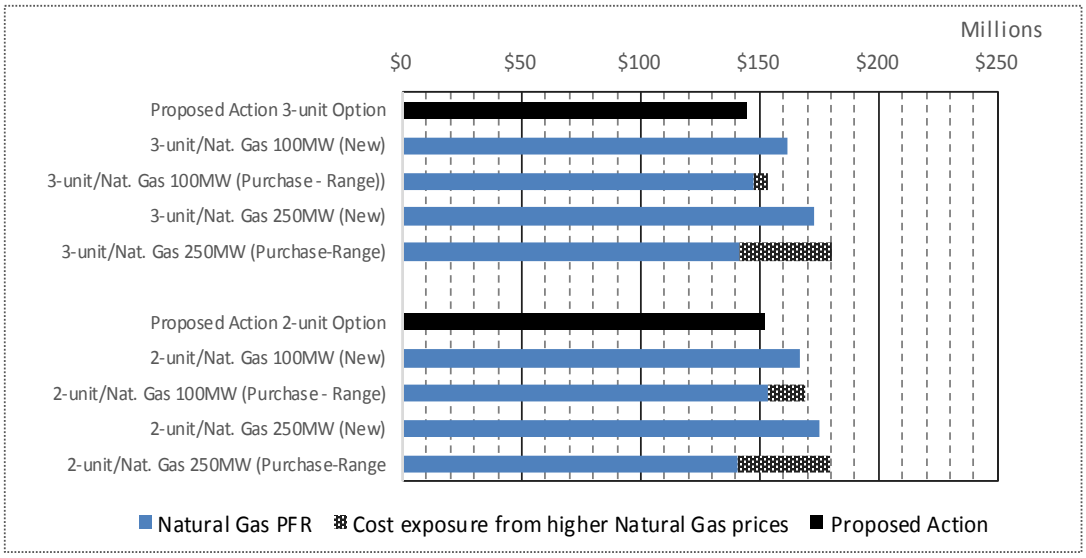

Figure 3.18-10 Annual CAP Energy Costs under the Natural Gas PFR Alternative, 2030 to 2044

Projected annual energy costs under the Natural Gas PFR Alternative, on a per acre-foot of water pumped basis, range between a low of $77 during the 2020 to 2025 period, to as high as $113 during the 2030 to 2044 period (**Table 3.18-54**). Energy costs assuming purchases from existing plant could be lower than the Proposed Action if natural gas prices remain low, but would exceed those of the Proposed Action if natural gas prices rise. The differences reflect the effects of curtailing NGS output on a 24-hour basis and the potential impacts of higher natural gas prices.

Table 3.18-54 CAP Annual Energy Charges per acre-foot under the Natural Gas PFR Alternative

NGS / PFR Configuration	Annual Energy Charges / Acre-Foot [1,2]			
	2020 to 2025	2026 to 2029	2030 to 2044	Net Change 2020 to 2044 (across the row)
Proposed Action 3-Unit Operation	$80	$88	$90	$10
3-Unit/Natural Gas 100 MW Power purchases (range)	$81 to $82	$89 to $91	$92 to $96	Up to $15
3-Unit/Natural Gas 250 MW Power purchases (range)	$77 to $95	$83 to $105	$88 to $113	Up to $36
Proposed Action 2-Unit Operation	$83	$85	$95	$12
2-Unit/Natural Gas 100 MW Power purchases (range)	$83 to $91	$86 to $94	$96 to $105	Up to $32
2-Unit/Natural Gas 250 MW Power purchases (range)	$76 to $95	$80 to $100	$88 to $112	Up to $36

[1] Based on 1,600,000 acre-feet per year.

[2] Equivalent current rate is approximately $76 / acre-feet (CAWCD 2015a).

The relative impact of the per acre-foot energy costs differences varies over time and between the major customer groups, based on the configuration of NGS and assumed level of replacement energy. For example, during the 2020 to 2025 period, the incremental cost of pumping energy under a 2-Unit configuration with the use of 250 MW of replacement power, ranges from -$7 to $11 per acre foot. In relative terms that range of increase would represent increases of between 9 percent lower and 14 percent higher (**Table 3.18-55**).

Table 3.18-55 Comparative Impact of Energy Charges for CAP Customers, 2020 to 2025

	Total Annual Energy Charges			
	M&I Long-term Subcontract	M&I Non-subcontract and Recharge	Federal	Agricultural Settlement Pool
Firm 2016 Rate per Acre-Foot	$161	$184	$161	$76
$7 decrease as a percent of 2016 firm rate	-4%	-4%	-4%	-9%
$11 increase as a percent of 2016 firm rate	7%	6%	7%	14%

As under the Proposed Action, customers in the Agricultural Settlement Pool and tribal agricultural producers that use water for irrigation would be most heavily affected in relative terms because increases in production costs typically come from the “bottom line” (i.e., lower farm income). Agricultural

use of water represents approximately 25 to 30 percent of the annual water deliveries by CAP. Higher production costs and lower income may result in farming operations being scaled back, changes in cropping patterns or the amount of land in production, or in some instances, could result in cessation of farming. Other potential effects described above for the Proposed Action, for instance, reductions in employment, and additional groundwater pumping, also could result with higher under the Natural Gas PFR alternatives. Any future increases in CAP's fixed O&M rates would compound the effects of higher pumping energy costs for customers other than those in the Agricultural Settlement Pool.

As with the Proposed Action, higher energy rates could hamper CAP-affected tribes plans to support future agricultural and development uses and population growth, and their ability to reestablish traditional irrigation-based agriculture on their reservations. CAP-affected tribes also would have fewer revenues to fund tribal services. These effects would be higher than those described for the Proposed Action under the Natural Gas PFR Alternative.

The energy rates (**Table 3.18-55**) costs associated with the Natural Gas PFR Alternative could affect the economic feasibility of surplus energy sales, both in terms of the likelihood and value of such energy sales. The incremental costs and thus, the risk to surplus sales, change in response to the levels of replacement energy and curtailment and changes in natural gas prices. Continued low natural gas prices could offer lower rates and result in savings to CAP. Conversely, higher natural gas prices would raise Reclamation's energy costs, further undermining the likelihood for surplus energy sales and surplus revenues. Conceivably, the loss of surplus revenue sales and impacts of curtailment costs associated with higher levels of replacement energy could raise costs to the point that would render Reclamation's energy costs economically unjustifiable for CAP.

Reductions or the total elimination of such revenues due to the high cost of energy represents a financial risk to CAP's customers as lower surplus reduce revenues into the Development Fund. Compensating for such reductions would require adjustments by CAP to fund debt service. Other resources available to CAWCD for debt service include the capital charges assessed to M&I customers, reserves, and ad valorem/property taxes. CAWCD currently imposes the maximum permissible rate for the latter.

Higher energy costs would require correspondingly reductions in consumer, business, and government expenditures for other goods and services, some of which would occur within the region, but others would affect non-local expenditures. The reductions would be long-term, increasing following selective catalytic reduction installation. Beyond those indirect economic impacts attributable to the lower consumer expenditures, further secondary impacts would occur if the outlays for replacement energy leave Arizona.

3.18.4.4.5 Project Impact Summary – All Project Components

Approving an extended operational life of the NGS and proposed KMC, in conjunction with the partial replacement of the federal share of NGS energy with purchased energy generated by lower-emitting source(s) fired by natural gas, would have far-reaching socioeconomic consequences for northeastern Arizona, and in particular the Navajo Nation, Hopi Tribe and many individual members of the two tribes. The impacts of this Natural Gas PFR, assuming replacement of between 100 MW and 250 MW of energy from NGS, would extend to the CAP-affected tribes and other CAP customers, affecting the future cost of pumping energy and the prospects for future sales of surplus energy yielding revenues to support the Development Fund. **Table 3.18-56** summarizes the critical socioeconomic effects associated with the Natural Gas PFR alternatives.

Table 3.18-56 Socioeconomic Impact Summary for the Natural Gas PFR Alternative

	NGS Configuration And Replacement Power			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Operations				
Federal Energy from NGS (TW hours/year)	3.29	1.98	3.24	1.93
Coal Used (million tons) Annual Aggregate 2020 to 2044	 7.7 193	 7.1 178	 5.1 128	 4.5 138
Employment				
New Regional Jobs Tied to Alternative Power	0	0	0	0
Total Regional Jobs – Typical Year	3,650	3,452	2,587	2,392
Aggregate total job-years – 2020 to 2044	91,250 4% less than Proposed Action 3-Unit	86,300 9% less than Proposed Action 3-Unit	64,675 6% less than Proposed Action 2-Unit	59,800 10% less than Proposed Action 2-Unit
Labor Income and Public Revenue				
Annual Labor Income	$248.2 million	$231.1 million	$175.8 million	$159.2 million
Aggregate Labor Income: 2020 to 2044	$6,205 million	$5,779 million	$4,394 million	$3,979 million
Access to fringe benefit programs and long-term retirement income	Access to benefits and retirement income extended for current and a future generation of workers. Fewer workers would benefit than under the respective Proposed Action operation; the differences increasing with higher levels of replacement.			
Aggregate lease and other payments to the Navajo Nation, Hopi Tribe, local governments and public education: 2020 to 2044	$2,499 million	$2,416 million	$1,742 million	$1,659 million
Net revenue effects to the Navajo Nation and Hopi Tribe as compared to end of 2019	Navajo Nation – much higher Hopi – somewhat lower	Navajo Nation – much higher Hopi - lower	Navajo Nation – higher Hopi – much lower	Navajo Nation – higher Hopi – much lower
Demographic/Community				
Air quality, human health and safety, ecological health, water quantity and quality, and elements of traditional lifestyles and social stability.	Public concerns under the Natural Gas PFR Alternative would be similar to those identified for the Proposed Action operations. The extent to which public concerns would be sensitive to changes in outputs associated with the Natural Gas PFR Alternative, particularly levels of mining, is unknown. Effects on economic and community stability, NGS and PWCC support for educational and community charitable causes would be similar to, but proportionally less compared to the respective Proposed Action operation. Implementation of this alternative, with higher levels of replacement energy, may result in some emigration from the region because of lower employment. These effects would translate to effects on local housing and community services. Concerns about the effects of NGS emissions and KMC emissions, dust and related effects would persist, but may be tempered somewhat at higher rates of replacement energy.			

Table 3.18-56 Socioeconomic Impact Summary for the Natural Gas PFR Alternative

	NGS Configuration And Replacement Power			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
	Navajo, Hopi, and NGOs advocating for a transition from coal-fired generation to lower-emissions sources would be dissatisfied with the continued operations of NGS. Concerns for potential effects on groundwater and surface water would be the same as under the Proposed Action. PWCC community support programs that benefit residents of the proposed KMC area, and nearby Navajo chapters and Hopi villages would continue. Lower coal requirements may result in fewer future household relocations and withdrawal of grazing lands in the proposed KMC lease area, particularly under the 2-Unit Operation and high levels of replacement energy. Effects of surface mining on the physical and cultural setting and quality of life in and near the lease area would be somewhat lower than under the corresponding Proposed Action operations. Future KMC operations would perpetuate dissatisfaction among local residents who value the traditional setting over job opportunities, mine-related revenues which support tribal government and services, and PWCC-provided services. Support of local economic and community stability would be stronger under the 3-Unit Operation than under the 2-Unit Operation and stronger at lower levels of replacement energy.			
CAP Energy Charges				
Annual 2030 to 2044 (millions)	$147.2 to $153.4	$141.0 to $180.1	$152.9 to $168.5	$140.7 to $179.6
Aggregate Total 2020 to 2044 (millions)	$3,458 to $3,666	$3,381 to $4,275	$3,637 to $3,995	$3,356 to $4,246
Primary reasons for cost differences	Curtailment costs are a primary factor, followed by project natural gas prices, selective catalytic reduction installation and higher lease costs to the Navajo Nation.			

3.18.4.4.6 Summary of Impacts

3.18.4.4.6.1 Regional Employment and Wages for the Navajo Nation and Hopi Tribe

Displacement of energy from NGS under the Natural Gas PFR would support fewer jobs in the region. Nonetheless, the project related impacts on regional employment and wages would be major under either operation. Support for Hopi Tribal government under the 2-Unit Operation and 250 MW of replacement energy would be much lower than that at the end of 2019, and might necessitate cutbacks in employment, programs and services. These impacts would be important because of the persistent unemployment and poverty in the region.

3.18.4.4.6.2 Demographic, Economic, Attitudes, and Social Organization Trends on Navajo and Hopi Populations

Generally, such impacts under the Natural Gas PFR would be similar to those described for the Proposed Action operations. The primary difference would be the potential for some emigration from the region due to lower employment/higher unemployment, particularly under the 2-Unit Operation with higher levels of replacement energy. Emigration could have indirect effects on housing availability and prices and community services. Nonetheless, the incomes and access to fringe benefits, including retirement income, would support community stability among the Navajo and Hopi. Continued operation

of the NGS and the proposed KMC would lead to concerns and dissatisfaction among some individual members of the two tribes and some NGOs. These impacts would range from major to moderate.

3.18.4.4.6.3 Lease Fees, Royalties, Water Fees, and Other Payments to the Navajo Nation and Hopi Tribe

Project-related payments to the Navajo Nation and Hopi Tribe account for large portions of their respective general fund revenues to support governmental options, particularly for the Hopi Tribe. Future revenues under the Natural Gas PFR would be higher for the Navajo Nation than those at the end of 2019, but for the Hopi Tribe, future revenues would be lower, particularly under the 2-Unit Operation with 250 MW of replacement energy. Given the magnitude of those revenues and few opportunities to replace reduced revenues with revenues from other sources, the fiscal impacts of implementation of the Natural Gas PFR operation would be major.

3.18.4.4.6.4 Social Fabric and Values that Provide Incentives for Younger Tribal Members to Remain on the Reservation

These impacts would be essentially the same as for the Proposed Action operations; major because of the foreseeable limited availability of foreseeable comparable opportunities and incomes from other employers.

3.18.4.4.6.5 Future Costs of Power Required for CAP Pumps and Economic Impacts Related to Reductions in Surplus Revenues for the Development Fund

Pumping energy costs for the CAP under the Natural Gas PFR Alternative could be as much as 8 percent lower or as much as 22 percent higher than those under the Proposed Action depending on future natural gas prices. The unavoidable costs associated with selective catalytic reduction installation, Lease Amendment No. 1, basic operating costs and costs associated with curtailment would create upward pressure on rates. Those pressures could be offset by low natural gas prices, or exacerbated by rising natural gas prices. In the event of higher energy costs, this alternative could adversely affect revenues from future surplus energy sales to support to the Development Fund, making it economically unjustifiable for CAWCD to purchase energy and power from NGS.

3.18.4.4.7 Cumulative Impacts

The contributions of the NGS and proposed KMC to cumulative effects within the cumulative impact study area, under the Natural Gas PFR would be similar to those described above for the Proposed Action. The primary difference would be that revenues to the Navajo Nation that would provide revenue stability would be lower under this alternative. Nonetheless, the contributions to cumulative effects would be moderate to major.

3.18.4.5 Renewable Partial Federal Replacement Alternative

3.18.4.5.1 Navajo Generating Station

Implementation of the Renewable PFR Alternative assumes NGS output would be curtailed to reduce the federal share of NGS energy by between 100 MW and 250 MW of generating capacity over a 14-hour period, that duration generally corresponding to the period of high commercial and residential demand and the availability of renewable generation capacity in the southwest. A corresponding amount of energy would be supplied by power purchased from non-NGS sources, with a stipulation that the generating source(s) be renewable technology. Generation from two or more sources, possibly involving different technologies, would be required to supply the necessary level of power for the defined duration. For this assessment, it is assumed that the source(s) would already exist. Between 0.51 TW hours and 1.28 TW hours of power and energy would be sourced annually from renewable sources; equivalent to between 58.3 MW hours and 145.8 MW hours per hour over the course of the year.

Energy deliveries from the renewable sources would be monitored over time and curtailment at NGS scheduled to achieve the necessary reduction in NGS production and associated reductions in coal combustion. The curtailment would not necessarily be concurrent with the scheduled delivery of energy from the renewable sources to the CAP, however reductions in the amount of power produced at NGS would occur over a yet-to-be determined period of time, i.e., monthly, quarterly or yearly, to total that supplied by renewable sources. Allowing for non-concurrent curtailment provides flexibility to optimize operations of NGS and also to maximize the potential value of surplus energy sales, while still assuring achievement of the established levels of emission reductions.

Under the Renewable PFR Alternative, replacement energy sourced from the grid would not fully meet the CAP's power needs. NGS generated power would fill the unmet demand, the remainder available for sale to support the Development Fund. Such sales would be contingent upon market conditions and NGS surplus power being cost competitive.

Projected annual energy production at NGS, the allocation of that power between CAP and its availability as surplus, and corresponding annual coal use are shown in **Table 3.18-57**.

Table 3.18-57 Annual Energy Output and Coal Use for the Renewable PFR Alternative

NGS Configuration	Proposed Action	Renewable PFR 100 MW Replacement	Renewable PFR 250 MW Replacement
3-Unit Operation, 547-MW Federal Share			
Federal Energy From NGS (TW hours/year) [1]	4.17	3.66	2.89
Federal Energy Supplied to CAP (TW hours/year)	2.70	2.19	1.42
NGS Energy Available as Surplus (TW hours/year)	1.47	1.47	1.47
Annual Tons of Coal Used – NGS Total (million tons) Differences [percentage] [2]	8.1 NA	7.9 - 2%	7.5 - 7%
2-Unit Operation, 540-MW Federal Share			
Federal Energy From NGS (TW hours/year)	4.12	3.61	2.84
Federal Energy Supplied to CAP (TW hours/year)	2.70	2.19	1.42
NGS Energy Available as Surplus (TW hours/year)	1.42	1.42	1.42
Annual Tons of Coal Used – NGS Total (million tons) Differences [percentage] [2]	5.5 NA	5.3 - 4%	4.9 - 11%

[1] TW hours/year = terawatt-hours per year. 1 terawatt equals 1,000,000,000,000 watts.

[2] Differences in tons of coal are relative to the base tonnages for the corresponding 3-Unit Operation or 2-Unit Operation Proposed Action.

NA = not applicable.

Implementation of the Renewable PFR Alternative would reduce annual coal consumption by 0.2 to 0.6 million tons; an amount equivalent to approximately 10 to 30 percent of the coal required for production of the federal share of power from NGS. The coal consumption reduction is proportional to the increase in renewable capacity; For the Proposed Action 2-Unit Operation, the Renewable PFR Alternative reductions would be in addition to those associated with shutting down one unit at NGS.

The implications associated with this alternative related to operational changes at NGS, the BM&LP Railroad, and the proposed KMC are described below. Compared to the Proposed Action, differences in employment, labor income, royalty and bonus income, and rail operations, generally would be proportional to the combined reductions from retirement of one generating unit and associated cutbacks

in the amount of federal power and energy supplied by NGS with proportional effects on tonnages of coal mined.

There would be no new jobs, labor income, tax revenues or other economic effects in the primary segment of the study area associated with the Renewable PFR Alternative because these alternatives are assumed to involve power purchases from existing generating sources. To the contrary, long-term curtailment of power and energy generation at NGS could result in cutbacks in NGS staffing and reductions in other operating expenditures. The impetus for such cutbacks would be lower under this alternative than under the Natural Gas PFR Alternative. The socioeconomic effects associated with changes tied to NGS for the Renewable PFR Alternative 3-Unit Operation and 2-Unit Operation configurations are presented in **Table 3.18-58**.

The key differences are the combined effects of retiring one unit and higher levels of curtailment on local employment, income, and the resulting possibility of population outmigration in the Page, Arizona area. On a net basis for the primary segment of the study area, the effects in the Page, Arizona area could be offset by gains in Navajo Nation tribal employment supported by the higher lease and additional payments that also would accrue under this Alternative.

Table 3.18-58 Socioeconomic Impacts of the Renewable PFR Alternative Related to NGS

Parameter	NGS Configuration and Replacement Power			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Employment				
New Regional Jobs Tied to Alternative Power	0	0	0	0
Total Regional Jobs (direct, indirect, and induced): Typical Year	2,096 68 fewer than Proposed Action 3-Unit Operation	2,054 110 fewer than Proposed Action 3-Unit Operation	1,559 57 fewer than Proposed Action 2-Unit Operation	1,509 107 fewer than Proposed Action 2-Unit Operation
Aggregate job-years: 2020 to 2044	52,410	51,360	38,985	37,25
Labor Income and Public Revenue				
Annual Labor Income	$144.3 million	$139.6 million	$107.9 million	$102.6 million
Aggregate Labor Income: 2020 to 2044	$3,608 million	$3,490 million	$2,698 million	$2,565 million
Total NGS lease and other payments to the Navajo Nation: 2020 to 2044	$ 1,075 million Same as Proposed Action 3-Unit Operation	$ 1,075 million	$ 793 million Same as Proposed Action 2-Unit Operation	$ 793 million
Total property tax and in-lieu payments: 2020 to 2044: Coconino County / Public Education	$ 254.2 million Same as Proposed Action 3-Unit Operation	$ 254.2 million	$ 157.2 million Same as Proposed Action 2-Unit Operation	$ 157.2 million
Additional lease or tax income from PFR Alternative	None. The source of power is assumed to be outside of the study area			
Demographic/Community	No appreciable differences as compared to the corresponding proposed alternative			

Table 3.18-58 Socioeconomic Impacts of the Renewable PFR Alternative Related to NGS

Parameter	NGS Configuration and Replacement Power			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Social				
Economic importance for the Navajo Nation and Hopi Tribe	Effects on Navajo Nation would be accentuated under this alternative as job opportunities for Navajo decline at higher levels of curtailment, compounding the effects associated with retiring one generating unit. The Hopi Tribe would not be directly affected by changes in NGS operations. Effects on employment and economic diversity would occur primarily in the Le Chee and Kaibeto Chapters, in Page, and to a lesser extent in Flagstaff and Tuba City/Moenkopi areas.			
Social and economic importance for Coconino and Navajo counties and the City of Page	Social and economic effects on nearby off-reservation communities would be similar to those under the corresponding Proposed Action operations due to comparability in employment, income and tribal revenues under these alternatives.			
Transition to renewable energy or natural gas	Navajo, Hopi, and NGOs advocating for a transition away from coal would remain dissatisfied with continued NGS operations, but may be encouraged with this alternative, particularly as the amount of replacement power rises. Dissatisfaction under 2-Unit Operation with 250-MW reduction may be diminished because it would reduce coal as energy source for as much as 31% of the federal energy.			
NGS-related air quality, human health and safety, and ecological health concerns	Continued operations of 3 units would result in continued concerns about environmental and health effects of emissions, reduced somewhat by installation of selective catalytic reduction and partial replacement with a renewable source. Concerns may be tempered by shutdown of one unit and substantial use of a renewable source for replacement power.			

The Renewable PFR Alternative would result in few discernible socioeconomic consequences related to the BM&LP Railroad in comparison to the Proposed Action. Changes that would occur from a socioeconomic perspective, would be tied to changes in the average weekly number of train trips. Weekly train movements would average between 20.5 round trips and 12.6 round-trips. Implementation of the Renewable PFR Alternative and the curtailment of production at NGS would result in between 4 and 53 fewer rail-related jobs and up to $3.7 million less in annual labor income in the primary segment of the study area. Individuals living in close proximity to the BM&LP ROW would be aware of the reductions in movements, but the general public would have little awareness of the changes in train movement frequency.

3.18.4.5.2 Proposed Kayenta Mine Complex

Approval and implementation of the Renewable PFR Alternative would result in NGS output being curtailed by between 100 MW and 250 MW according to an established schedule. Under the 2-Unit Operation, those reductions in output would be in addition to those stemming from the retirement of one 750-MW generating unit. Reductions in energy generation would reduce coal requirements from the proposed KMC, and consequently the company's labor needs and annual royalty and bonus payments made to the tribes.

Annual coal production under the Renewable PFR Alternative would decline from the 8.1 million tons required to support operation of a 3-Unit Operation under the Proposed Action, to between 7.9 million tons (100 MW) and 7.5 million tons (250 MW). Implementing this PFR Alternative in conjunction with a

2-Unit Operation changes the average annual coal requirement to between 5.3 million tons (100 MW) and 4.9 million tons (250 MW).

Other important socioeconomic impacts that would be tied to the changes in proposed KMC operations under the Renewable PFR Alternative include the following (**Table 3.18-59**):

- As many as 114 fewer jobs in the regional economy as compared to the corresponding Proposed Action operations due to job cutbacks at the mine, losses of secondary jobs supported by those jobs and purchases by PWCC and its vendors, and possible cutbacks in tribal employment tied to reductions in royalty and bonus payments.
- When compared to the corresponding Proposed Action operations, the aggregate employment associated with the proposed KMC, accumulated over 25 years, would be approximately 5,600 fewer job-years under the Natural Gas PFR 3-Unit Operations, with a difference of approximately 4,500 fewer job-years for the Natural Gas PFR 2-Unit Operation.
- Implementation of Renewable PFR Alternative would support between $2.70 billion and $1.70 billion in labor income over the 25 years. There is no reasonably foreseeable new or proposed industrial project or activity in the region that would generate comparable income in primary segment of the study area.
- Extending the operating life of the NGS plant would allow more workers to accrue retirement income benefits that would be realized beyond 2044.
- Annual royalty, bonus and water use payments accruing to the Navajo Nation and Hopi Tribe would be adjusted to reflect production. Over the 25-year period of extended operations such payment would total between $1.19 billion and $772 million. Distribution of those revenues would be approximately 67 percent to the Navajo Nation and 33 percent to the Hopi Tribe.
- The Hopi Tribe would remain heavily reliant on those revenues to support tribal government and to provide essential services for its members living on the reservation.
- Navajo County and the local school district would continue receiving portions of the property taxes paid by PWCC and from TPT proceeds derived from taxable sales in the region, but such receipts would decline in magnitude as compared to the Proposed Action.

Table 3.18-59 Socioeconomic Impacts of the Renewable PFR Alternative Related to the Proposed KMC

Parameter	NGS Configuration and Replacement Power			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Operational				
Annual Coal Production (million tons)	7.9	7.5	5.3	4.9
Employment (direct, indirect, and induced) – Typical Year	1,603 45 fewer than Proposed Action 3-Unit Operation	1,534 114 fewer than Proposed Action 3-Unit Operation	1,084 45 fewer than Proposed Action 2-Unit Operation	1,017 112 fewer than Proposed Action 2-Unit Operation
Aggregate job-years: 2020 to 2044	40,075	38,350	27,100	25,425

Table 3.18-59 Socioeconomic Impacts of the Renewable PFR Alternative Related to the Proposed KMC

Parameter	NGS Configuration and Replacement Power			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Labor Income and Public Revenue				
Annual Labor Income	$107.8 million	$103.0 million	$72.5 million	$68.1 million
Total Labor Income: 2020 to 2044	$2,695 million	$2,576 million	$1,813 million	$1,703 million
Total lease, royalty, bonus and water payments: 2020 to 2044	$1,160 million	$1,111 million	$787 million	$739 million
Total Property Taxes 2020 to 2044	$33 million	$33 million	$28 million	$28 million
Federal Abandoned Mine Land and Black Lung Disability funds 2020 to 2044	$170 million	$163 million	$114 million	$107 million

3.18.4.5.3 Transmission Systems and Communication Sites

When compared to the Proposed Action scenarios, the socioeconomic consequences of the Renewable PFR alternatives would be the same as those under the Proposed Action. The physical infrastructure is in place, no new construction is proposed, and operations and maintenance would continue for the life of the project. The timing of decommissioning and final reclamation requirements for the WTS and STS ROWs ultimately would be determined by the authorities with responsibility for ROW issuance.

3.18.4.5.4 Central Arizona Project

This subsection examines the prospective change in pumping energy costs for the CAP and the effects on water rates that would be associated with the Renewable PFR alternatives in a similar fashion as for the Proposed Action (see Section 3.13.4.3, Central Arizona Project and **Technical Supplement 3.18-A**). The analysis of future energy costs to CAP is a weighted average of: (1) future costs of NGS, (2) the incremental costs associated with curtailing NGS production, and (3) the cost of energy purchased from a Renewable generating source.

Table 3.18-60 presents the energy supply assumptions for the Renewable PFR alternatives. Not shown, but accounted for in subsequent energy cost estimates, is 300,000 MW hours/year of energy assumed to be purchased by CAWCD from Reclamation (Hoover Dam) and other sources.

Table 3.18-60 Annual Federal Power from NGS and Renewable PFR Alternative Supply for CAP

Configuration	NGS Supplied to CAP (MW hours/Year)	NGS Available for Surplus (MW hours/Year)	Total NGS Generated (MW hours/Year)	PFR Supplied Power to CAP (MW hours/Year)
Proposed Action 3-Unit Operation	2,696,000	1,472,000	4,168,000	-
3-Unit/Renewable 100 MW	2,185,000	1,472,000	3,657,000	511,000
3-Unit/Renewable 250 MW	1,418,000	1,472,000	2,890,000	1,278,000

Table 3.18-60 Annual Federal Power from NGS and Renewable PFR Alternative Supply for CAP

Configuration	NGS Supplied to CAP (MW hours/Year)	NGS Available for Surplus (MW hours/Year)	Total NGS Generated (MW hours/Year)	PFR Supplied Power to CAP (MW hours/Year)
Proposed Action 2-Unit Operation	2,696,000	1,421,000	4,117,000	-
2-Unit/Renewable 100 MW	2,185,000	1,421,000	3,606,000	511,000
2-Unit/Renewable 250 MW	1,418,000	1,421,000	2,839,000	1,278,000

Note: CAP is assumed to use an additional 300,000 MW hours of energy per year from other sources.

3.18.4.5.4.1 Future Costs for Energy

Future costs of NGS energy for the Renewable PFR are based on the underlying assumptions outlined under the Proposed Action with the incremental costs associated with Lease Amendment No. 1 and selective catalytic reduction adjusted to allocate those costs based on lower annual NGS output.[29] Reclamation's cost of NGS energy also would be affected by curtailment and the cost of "firming," essentially backup capacity to provide the necessary degree of electrical system reliability. Energy costs for the other participants would likely be unaffected by curtailment or regulation.

Charges Associated with Curtailment

Estimated charges for the levels of curtailment associated with the Renewable PFR, are estimated at between $7,154,000 and $17,892,000 per year, equivalent to between $2.00 and $6.30 a "per MW hours generated" basis (see **Table 3.18-61**). Those charges would be lower than the corresponding costs under the Natural Gas PFR, reflecting the lower quantity of replacement energy provided under the Renewable PFR Alternative.

Table 3.18-61 Incremental Costs to Reclamation due to NGS Curtailment under the Renewable PFR Alternative

NGS / PFR Configuration	Annual Curtailment Charges	Annual Cost per MW hours
3-Unit/Renewable 100 MW	$7,154,000	$2.00
3-Unit/Renewable 250 MW	$17,892,000	$6.20
2-Unit/Renewable 100 MW	$7,154,000	$2.00
2-Unit/Renewable 250 MW	$17,892,000	$6.30

Costs for "Firming" of Renewable Generation

Operation of the CAP requires a high degree of electrical system reliability. As a consequence, use of solar or wind-power would require "firming"[30] as needed." For this assessment, such energy needs are estimated at 6 percent of the annual output provided by renewable sources (NREL 2016). It is assumed

[29] It is assumed that reductions in future emissions under the Renewable PFR alternative would not affect the timing of selective catalytic reduction installation as compared to the Proposed Action.

[30] Firming refers to a secondary source of energy to compensate for the normal variability and irregularity of renewable energy generation (e.g., if part of a solar array is shaded by cloud cover) in order to assure delivery of a specific quantity of energy during a defined period of time. Firming power is typically provided by natural gas fired combined cycle generators.

that the energy would be supplied by a natural gas facility at the same $63.00 per MW hours assumed for replacement energy.

3.18.4.5.4.2 Future Energy Costs for CAP

The CAP's future energy costs under the Renewable PFR alternatives, rounded to the nearest $0.10, are shown in **Table 3.18-62**. As shown, the PFR alternatives would all result in higher costs of energy for CAP, with the differences increasing in magnitude as the level of replacement climbs.

Table 3.18-62 Future Energy Charges per MW hour under the Renewable PFR Alternative

NGS / PFR Configuration	CAP Annual Energy Charges / MW hours		
	2020 to 2025	2026 to 2029	2030 to 2044
Proposed Action 3-Unit Operation	$47.20	$53.00	$54.40
3-Unit/Renewable 100 MW	$52.60	$57.80	$58.60
3-Unit/Renewable 250 MW	$59.80	$63.80	$63.60
Proposed Action 2-Unit Operation	$49.40	$50.80	$57.50
2-Unit/Renewable 100 MW	$54.40	$55.50	$61.20
2-Unit/Renewable 250 MW	$61.10	$61.80	$65.60

3.18.4.5.4.3 Annual Pumping Energy Costs

Annual energy costs under the Renewable PFR Alternative with a 3-Unit Operation would range from $140.4 million to $167.2 million and between $144.7 million and $172.0 million if implemented as part of a 2-Unit Operation (**Table 3.18-63**). The comparative annual energy charges to CAP for the 2030 to 2044 time period, for the Renewable PFR alternatives and the Proposed Action 3-Unit Operation and 2-Unit Operation, are shown in **Figure 3.18-11**.

Table 3.18-63 Annual Energy Charges to CAP under the Renewable PFR Alternative

NGS / PFR Configuration	Total Annual Energy Charges [1]			Aggregate Total 2020 to 2044
	2020 to 2025	2026 to 2029	2030 to 2044	
Proposed Action 3-Unit	$127,250,000	$141,540,000	$144,780,000	$3,501,000,000
3-Unit/Renewable 100 MW	$140,410,000	$153,080,000	$154,960,000	$3,779,000,000
3-Unit/Renewable 250 MW	$157,990,000	$167,690,000	$167,150,000	$4,126,000,000
Proposed Action2-Unit	$132,640,000	$136,150,000	$152,320,000	$3,625,000,000
2-Unit/Renewable 100 MW	$144,720,000	$147,420,000	$161,160,000	$3,875,000,000
2-Unit/Renewable 250 MW	$161,220,000	$162,840,000	$172,000,000	$4,199,000,000

[1] The annual charges include $14.3 million for the purchases of energy from Hoover and other non-NGS sources. The costs and availability of such power is assumed to be the same under all action alternatives

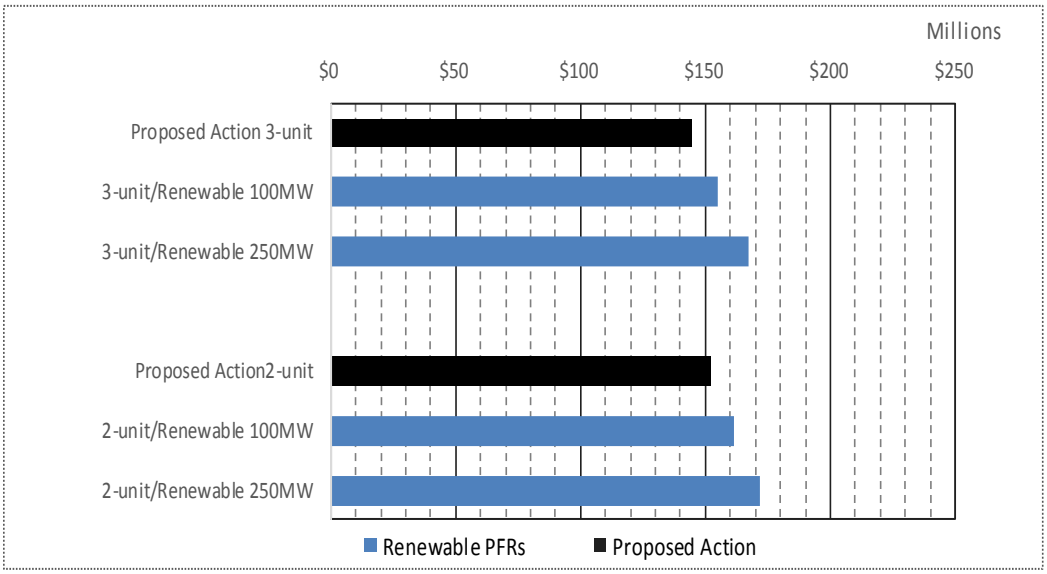

Figure 3.18-11 Annual CAP Energy Costs for the Renewable PFR Alternative, 2030 to 2044

Over the 25-year extended operating life of the NGS the aggregate energy costs to the CAP under the Renewable PFR Alternative would be between $278 million (8 percent) and $625 million (18 percent) higher than for the Proposed Action 3-Unit Operation. The differences in aggregate energy costs if implemented with a 2-Unit Operation would be between $250 million and $574 million.

Projected annual energy costs under the Renewable PFR Alternative, on a per acre-foot of water pumped basis, range from $88 to $101 during the 2020 to 2025 period, $92 to $105 during the 2026 to 2029 period, and $97 to $108 during the 2030 to 2044 period (**Table 3.18-64**). In all instances, projected costs increase as the level of replacement energy increases and would exceed those for the corresponding Proposed Action operation.

Table 3.18-64 CAP Annual Energy Charges per acre-foot under the Renewable PFR Alternative

Configuration	Annual Energy Charges / Acre-Foot [1,2]			
	2020 to 2025	2026 to 2029	2030 to 2044	Net Change 2020 to 2044 (across the row)
Proposed Action 3-Unit Operation	$80	$88	$90	$10
3-Unit/Renewable 100 MW	$88	$96	$97	$9
3-Unit/Renewable 250 MW	$99	$105	$104	$5
Proposed Action 2-Unit Operation	$83	$85	$95	$12
2-Unit/Renewable 100 MW	$90	$92	$101	$11
2-Unit/Renewable 250 MW	$101	$102	$108	$7

[1] Based on 1.6 million acre-feet per year.

[2] Equivalent current rate is approximately $76 / acre-feet (CAWCD 2015a).

The relative impact of the per acre-foot energy costs differences varies over time and between the various groups customers, based on the configuration of NGS and the amount of replacement energy. For example, during the 2020 to 2025 period, the incremental cost of pumping energy under a 2-Unit Operation with the purchase of 250 MW of replacement power, ranges between $7 and $19 per acre foot. In relative terms that range of increase would represent increases of between 4 and 25 percent across the various customers (**Table 3.18-65**). Note that the costs under the Renewable PFR Alternative would be higher than the lower costs under the Natural Gas PFR Alternative (**Table 3.18-51**) but lower than those under the Natural Gas PFR Alternative if natural gas prices were to climb substantially.

Table 3.18-65 Comparative Impact of Energy Charges for CAP Customers, 2020 to 2025, Renewable PFR

Parameter	Total Annual Energy Charges			
	M&I Long-term Subcontract	M&I Non-subcontract and Recharge	Federal	Agricultural Settlement Pool
Firm 2016 Rate per acre-foot	$161	$184	$161	$76
$11 increase as a percent of 2016 firm rate	4%	4%	4%	9%
$24 increase as a percent of 2016 firm rate	12%	10%	12%	25%

As would be true for the Proposed Action and Natural Gas PFR Alternative, customers in the Agricultural Settlement Pool and tribal and other non-tribal agricultural producers using water for irrigation would be most heavily affected.

The energy rate projections (**Tables 3.18-65**) suggest that effects of curtailment on costs associated with the Renewable PFR Alternative could affect future surplus energy sales, with the incremental costs increasing as a function of the levels of replacement energy. Reductions or the total elimination of such revenues due to the high cost of energy represents a financial risk to CAP's customers. Lower sales of surplus would reduce revenues into the Development Fund. Compensating for those reduction venues would require adjustments by CAP to fund debt service. In addition to surplus, other resources available for debt service include the capital charges assessed to M&I customers, reserves, and ad valorem/property taxes. CAWCD currently imposes the maximum permissible rate for the latter.

Higher energy costs for CAWCD would result in corresponding reductions in consumer, business and government expenditures for other goods and services, with associated effects on employment, income and taxes. Some of these indirect effects would occur within the study area; others would occur outside of the study area.

As with the Proposed Action, higher energy rates could hamper CAP-affected tribes' plans to support future agricultural and development uses and population growth, and their ability to reestablish traditional irrigation-based agriculture on their reservations. CAP-affected tribes also would have fewer revenues to fund tribal services. These effects would be higher than those described for the Proposed Action under the Renewable PFR Alternative.

3.18.4.5.5 Project Impact Summary – All Project Components

Approving an extended operational life of the NGS and proposed KMC, in conjunction with the partial replacement of the federal share of energy NGS with energy generated by renewable source(s), would have far-reaching socioeconomic consequences for northeastern Arizona, and in particular the Navajo Nation, Hopi Tribe and many individual members of the two tribes. The impacts of the Renewable PFR, assuming replacement of energy to that which is equivalent to that derived from 100 MW to 250 MW of NGS for a 14-hour period on a 7-day per week basis, would extend to the CAP-affected tribes and other

CAP customers, affecting the future cost of pumping energy and the prospects for future sales of surplus energy yielding revenues to support the Development Fund. **Table 3.18-66** summarizes the critical socioeconomic effects associated with the Renewable PFR Alternative.

Table 3.18-66 Socioeconomic Impact Summary for the Renewable PFR Alternative

Parameter	NGS Configuration and Replacement Power			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Operational				
Federal Energy from NGS (TW hours/year)	3.66	2.89	3.61	2.84
Coal Used (million tons) Annual Aggregate 2020 to 2044	 7.9 198	 7.7 188	 5.3 133	 4.9 123
Employment				
New Regional Jobs Tied to Alternative Power	0	0	0	0
Total Regional Jobs – Typical Year	3,699	3,588	2,643	2,526
Aggregate job-years (direct indirect, and induced) – 2020 to 2044	92,475 3% fewer than Proposed Action 3-Unit Operation	89,700 6% fewer than Proposed Action 3-Unit Operation	66,075 3% fewer than Proposed Action 2-Unit Operation	63,150 6% fewer than Proposed Action 2-Unit Operation
Labor Income and Public Revenue				
Annual Labor Income	$252.1 million	$242.6 million	$180.5 million	$170.7 million
Aggregate Labor Income: 2020 to 2044	$6,433 million	$6,310 million	$4,581 million	$4,461 million
Access to fringe benefit programs and long-term retirement income	Access to benefits and retirement income extended for current and a future generation of workers. Fewer workers would benefit than under the respective Proposed Actions; the differences increasing with higher levels of replacement.			
Aggregate lease and other payments to the Navajo Nation, Hopi Tribe, local governments and public education: 2020 to 2044	$2,532 million	$2,118 million	$1,800 million	$1,803 million
Net revenue effects to the Navajo Nation and Hopi Tribe as compared to end of 2019	Navajo Nation – much higher Hopi – slightly lower	Navajo Nation – much higher Hopi – somewhat lower	Navajo Nation – higher Hopi – much lower	Navajo Nation – higher Hopi – much lower
Demographic/Community				
Air quality, human health and safety, ecological health, water quantity and quality, and elements of traditional lifestyles and community stability.	Public concerns under the Renewable PFR Alternative would be similar to those identified for the Proposed Action operations. The extent to which public concerns would be sensitive to changes in outputs associated with the Renewable PFR Alternative, particularly levels of mining, is unknown. Effects on economic and community stability, NGS and PWCC support for educational and community charitable causes would be similar to, but scaled back slightly as compared to the respective Proposed Action operation. Implementation of this alternative, with higher levels of replacement energy, may			

Table 3.18-66 Socioeconomic Impact Summary for the Renewable PFR Alternative

Parameter	NGS Configuration and Replacement Power			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
	result in some emigration from the region because of lower employment. These effects would translate to effects on local housing and community services. Concerns about the effects of NGS emissions and KMC emissions, dust and related effects would persist, but may be tempered somewhat under the 2-Unit Operation with higher rates of replacement energy. Navajo, Hopi, and NGOs advocating for a transition from coal-fired generation to lower-emissions sources would be dissatisfied with the continued operations of NGS. Concerns for potential effects on ground and surface water, including depletion and degradation of the N-Aquifer, would be the same as under the Proposed Action. PWCC community support programs that benefit residents of the proposed KMC area, and nearby Navajo chapters and Hopi villages would continue. Lower coal requirements may result in fewer future household relocations and withdrawal of grazing lands in the proposed KMC lease area, particularly under the 2-Unit Operation with high levels of replacement energy. Effects of surface mining on the physical and cultural setting and quality of life in and near the lease area would be somewhat lower than under the corresponding Proposed Action operations. Future KMC operations would perpetuate dissatisfaction among local residents who value the traditional setting over job opportunities, mine-related revenues which support tribal government and services, and PWCC-provided services. Support of local economic and community stability would be stronger under the 3-Unit Operation than under the 2-Unit Operation and at lower levels of replacement energy.			
CAP Energy Charges				
Annual 2030 to 2044 (millions)	$155.0	$167.2	$161.2	$172.0
Aggregate Total 2020 to 2044 (millions)	$3,779	$4,126	$3,875	$4,199
Primary reasons for higher costs	Curtailment and selective catalytic reduction costs are the primary factors, followed by higher lease costs to the Navajo Nation.			

The summary assessment of impacts, as they relate to the specific issues defined in Section 3.18.4.2 above follow.

3.18.4.5.5.1 Regional Employment and Wages for the Navajo Nation and Hopi Tribe

The project-related impacts on regional employment and wages under the Renewable PFR Alternative with 100 MW of curtailment would be essentially the same as those under the Proposed Action 3-Unit Operation. Employment and income under the under the 2-Unit Operation would be lower than the levels expected at the end of 2019. Nonetheless, the project-related impacts on regional employment and wages would be major under either operation. Support for Hopi tribal government under the 2-Unit Operation and 250 MW of replacement energy would be much lower than that at the end of 2019, and might necessitate cutbacks in employment, programs and services. The economic impacts would be

major under either operation and important because of the persistent unemployment and poverty in the region.

3.18.4.5.5.2 Demographic, Economic, Attitudes, and Social Organization Trends on Navajo and Hopi Population

Such impacts under the Renewable PFR Alternative would be essentially the same as those described for the Proposed Action operations, and would range from moderate to major.

3.18.4.5.5.3 Lease Fees, Royalties, Water Fees, and Other Payments to the Navajo Nation and Hopi Tribe

Project-related payments to the Navajo Nation and Hopi Tribe account for large portions of their respective general fund revenues to support governmental options, particularly for the Hopi. For the Navajo Nation future revenues under the Renewable PFR would be higher than those at the end of 2019. Future revenues for the Hopi would be lower, particularly under the 2-Unit Operation with 250 MW of replacement energy. Consequently, fiscal impacts of operations under either Proposed Action would be major.

3.18.4.5.5.4 Social Fabric and Values that Provide Incentives for Younger Tribal Members to Remain in their Communities

These impacts would be essentially the same as for the Proposed Action operations; major because of the limited availability of foreseeable comparable opportunities and incomes from other employers.

3.18.4.5.5.5 Future Costs of Power Required for CAP Pumps and Economic Impacts Related to Reductions in Surplus Revenues for the Development Fund

Pumping energy costs for the CAP would increase under either Renewable PFR operation, with energy costs potentially much higher with 250 MW of replacement energy and higher future gas prices. Total pumping energy costs over the 2020 to 2044 time period would increase by between 7 percent (3-Unit Operation with 100 MW PFR) and 18 percent (2-Unit Operation with 250 MW PFR) as compared to those under the Proposed Action. The unavoidable costs associated with selective catalytic reduction installation, Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1), and basic operating costs would account for a portion of the increase, but costs associated with curtailment and firming would account for the majority of the increases, particularly as the amount of energy provided by the Renewable PFR rises. The likely impacts of those increases would comprise a minor to major impact for users. The higher energy costs under this alternative could adversely affect the economic feasibility of future sales of surplus energy yielding revenues to support to the Development Fund and make it economically unjustifiable for CAWCD to purchase energy and power from NGS.

3.18.4.5.6 Cumulative Impacts

The contributions of the NGS and proposed KMC to cumulative effects within the cumulative impact study area, under the Renewable PFR would be similar to those described above for the Proposed Action. The primary difference would be that revenues to the Navajo Nation that would provide revenue stability would be lower under this alternative. Nonetheless, the contributions to cumulative effects would be moderate to major.

3.18.4.6 Tribal Partial Federal Replacement Alternative

3.18.4.6.1 Navajo Generating Station

Implementation of the Tribal PFR Alternative would involve the purchase of power and energy from photovoltaic solar facility(ies) located on the lands of one or more affected tribes. Energy from the photovoltaic solar facility(ies) would be dedicated to meet a portion of CAP demands during daylight

hours (e.g., 12 hours a day), a duration which generally corresponds the period of time that a 100-MW photovoltaic solar facility would be able to reliably meet the 25-MW minimum curtailment requirement for NGS and also deliver 100 MW to 250 MW to the CAP during the midday. The net result would be between 0.33 TW hours and 0.84 TW hours of energy would be sourced from the tribal facility annually with the replacement solar power providing an average of between 38 MW and 94.9 MW hours per hour over the course of a 24-hour period.

Energy deliveries from the photovoltaic system would be monitored over time and curtailment at NGS scheduled to achieve the necessary reduction in NGS production and associated reductions in coal combustion. The curtailment would not necessarily be concurrent with the photovoltaic solar system production; reductions in the amount of power produced at NGS would occur over a yet-to-be determined period of time, i.e., monthly, quarterly or yearly, to total that supplied by the photovoltaic solar facility. Allowing for non-concurrent curtailment provides flexibility to optimize operations of NGS and also maximize the potential value of surplus energy sales, while still assuring achievement of the established levels of emission reductions. Implementation of this PFR alternative would require the solar project to provide firming[31] and the purchased power would be dedicated to supplying a portion of CAP's energy needs.

Under this arrangement, NGS would effectively be run at less than its rated capacity on a long-term basis. The annual projections of energy produced at NGS, the allocation of that power to meet CAP needs, the availability as surplus, and the corresponding projections of annual coal use are shown in **Table 3.18-67**.

Implementation of the Tribal PFR Alternative would reduce annual coal consumption by 0.4 to 0.2 million tons, an amount equivalent to approximately 10 to 20 percent of the coal required for production of the federal share of power from NGS. The coal consumption reduction is proportional to the increase in solar project capacity. For the Proposed Action 2-Unit Operation, the Tribal PFR Alternative reductions would be in addition to those associated with shutting down one unit at NGS.

Table 3.18-67 Annual Energy and Coal Use for the Tribal PFR Alternative

NGS Configuration	Proposed Action	Tribal PFR 100 MW Replacement (Capacity)	Tribal PFR 250 MW Replacement (Capacity)
3-Unit Operation, 547 MW Federal Share			
Federal Energy From NGS (TW hours/year) [1]	4.17	3.84	3.33
Federal Energy Supplied to CAP (TW hours/year)	2.70	2.37	1.86
NGS Energy Available as Surplus (TW hours/year)	1.47	1.47	1.47
Annual Tons of Coal Used – NGS Total (million tons) Differences [percentage] [2]	8.1 NA	7.9 - 2%	7.7 - 5%
2-Unit Operation, 540 MW Federal Share			
Federal Energy From NGS (TW hours/year)	4.12	3.78	3.28
Federal Energy Supplied to CAP (TW	2.70	2.36	1.86

[31] "firming" refers to a secondary source of power to compensate for the normal variability and irregularity of energy generation from a solar facility, i.e., if part of the array is shaded. Renewable sources cannot serve as a "firming" source because they do not offer the necessary reliability and responsiveness.

Table 3.18-67 Annual Energy and Coal Use for the Tribal PFR Alternative

NGS Configuration	Proposed Action	Tribal PFR 100 MW Replacement (Capacity)	Tribal PFR 250 MW Replacement (Capacity)
hours/year)			
NGS Energy Available as Surplus (TW hours/year)	1.42	1.42	1.42
Annual Tons of Coal Used – NGS Total (million tons) Differences [percentage] [2]	5.5 NA	5.3 - 3%	5.1 - 7%

[1] TW hours/year = terawatt-hours per year. 1 terawatt equals 1,000,000,000,000 watts.

[2] Differences in tons of coal are relative to the base tonnages for the corresponding Proposed Action 3-Unit Operation or 2-Unit Operation.

NA = not applicable.

Implementation of the Tribal PFR Alternative would involve construction and operation of a new photovoltaic solar facility on lands of an affected tribe and result in temporary and long-term socioeconomic effects for the affected tribe. The effects include construction and operation jobs, sales revenues for convenience retail and hospitality industry businesses, demand for temporary lodging accommodations including motels, hotels, and recreational vehicles/campgrounds, and increased demand on local facilities and services, particularly law enforcement, emergency medical and other first responders. These effects would be concentrated in the community(ies) near the project location, whether it (they) be on or off-reservation. Some effects would accrue in the community in which the tribal administrative and service agencies are based, if that community is not included in the immediate vicinity of the project location. The temporary effects would last the duration of construction activity; approximately 1.5 years for a facility capable of consistently delivering 100 MW of power to the grid and 2.5 to 3 years for the larger 250-MW facility (**Table 3.18-68**).[32] Construction of the project would support between 533 and 633 temporary jobs and between 9 and 13 long-term jobs.

Construction cost of the photovoltaic solar project ranges are projected at between $300 million (100 MW) and $750 million (250 MW). It is assumed that the project would be located on tribal lands under a long-term lease such that lease costs would be recovered through the revenue derived from energy sales.

The tribe on whose land the new photovoltaic solar facility would be located, would stand to realize lease and/or royalty income from the facility, if the project is owned and operated by an outside developer or a return on capital if the tribe develops the project itself. For this assessment, annual returns of $10,000 per MW are assumed. Consequently the net revenues would range between $1.4 million and $3.5 million. Those returns would accrue to support tribal or chapter services. If located on either the Navajo Nation or Hopi Reservation, revenues from the project would offset some of the reductions in coal royalties. If located on a CAP tribe reservation, such revenues could support tribal operations, or provide revenues to meet future CAP water costs.

[32] Based on typical photovoltaic solar productivity in northeastern Arizona over the course of a year, delivery of between 100 MW to 250 MW into the grid for transmission to the CAP during the midday would require a system with a nominal capacity of 135 MW to 350 MW. The differences between the 100 MW to 250 MW and the 135 MW to 350 MW specifications account for the effects of seasonal variation, inverter efficiency when converting power produced by the solar array to the form required for the grid, and capacity to meet NGS operational requirements for curtailment (see **Appendix 2A** for additional details).

Table 3.18-68 Economic Characteristics Associated with a New Photovoltaic Solar Facility

Parameter	Tribal Photovoltaic Solar Facility	
	100 MW [2]	250 MW [2]
Construction cost (millions)	~$300	~$750
Duration of construction	1.5 year	2.5 to 3 years
Number of Workers		
Construction	335	400
Indirect and Induced	198	236
Total	533	636
Operations - Total	9	13
Annual Labor Income: operations (millions)	$1.0	$1.4
Annual Lease, Royalty or Property Income (millions) [1]	$1.4	$3.5
Annual Energy Produced (MWh)	333,000	831,000

[1] Assumes lease, royalty or property income of $10,000 per MW of installed capacity.

[2] Delivery of between 100 MW to 250 MW into the grid for transmission to the CAP during the midday would require a system with a nominal capacity of 135 MW to 350 MW.

The key socioeconomic outcomes with respect to the Tribal PFR Alternative include the following (**Table 3.18-69**):

- The Tribal PFR Alternative would result in a combination of temporary construction and long-term operating jobs in conjunction with the photovoltaic solar project. These jobs could add to the gains from increases in tribal and associated indirect and induced jobs funded through the higher lease and additional payments under Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1).
- The net differences in employment, accumulated over 25 years, would be approximately 2 percent lower under the Tribal PFR Alternative than that for the corresponding Proposed Action operation.
- Implementation of the Tribal PFR Alternative would support substantial labor income in the region, more than $140 million annually with a 3-Unit Operation and more than $93 million annually with a 2-Unit Operation. Both amounts are slightly lower than the corresponding amounts under the Proposed Action.
- Total lease and additional payments of nearly $1.1 billion would accrue to the Navajo Nation between 2020 and 2044 in conjunction with a 3-Unit Operation of NGS. That total represents a 1,300 percent increase above the revenues provided by the current lease.
- Effects on regional labor markets, population, housing, and public facilities and services would be limited under all of these PFR alternatives, due to the limited magnitude of job reductions and the labor availability among the Navajo to fill many if not most of the new positions.
- Extending the operating life of the NGS plant would allow more workers to accrue retirement income benefits that would be realized beyond 2044.

Table 3.18-69 Socioeconomic Impacts of the Tribal PFR Alternative Related to NGS

	NGS Configuration and Replacement Power (Nominal Capacity)			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Employment				
Jobs Related to Alt. Power (direct, indirect, and induced) Construction Operating	533 for 1 year 9	636 for 2 years 13	533 for 1 year 9	636 for 2 years 13
Total Regional Jobs (direct, indirect, and induced) – Typical Year	2,125 39 fewer than Proposed 3-Unit Operation	2,113 51 fewer than Proposed 3-Unit Operation	1,586 30 fewer than Proposed 2-Unit Operation	1,568 48 fewer than Proposed 2-Unit Operation
Aggregate job-years – 2020 to 2044	53,135	52,835	35,054	39,210
Labor Income and Public Revenue				
Annual Labor Income	$146.0 million	$143.8 million	$96.1 million	$93.8 million
Aggregate Labor Income: 2020 to 2044	$3,650 million	$3,595 million	$2,740 million	$2,678 million
Total NGS lease and other payments to the Navajo Nation: 2020 to 2044	$ 1,075 million Same as Proposed Action 3-Unit Operation	$ 1,075 million	$ 793 million Same as Proposed Action 2-Unit Operation	$ 793 million
Aggregate property tax and in-lieu payments: 2020 to 2044: Coconino County / Public Education	$ 254.2 million Same as Proposed Action 3-Unit Operation	$ 254.2 million	$ 157.2 million Same as Proposed Action 2-Unit Operation	$ 157.2 million
New lease, royalty or property income from photovoltaic: Annual Total 2020 to 2044	Assumed operational in 2021 $1.4 million $35 million	Assumed operational in 2022 $3.2 million $87.5 million	Assumed operational in 2021 $1.4 million $35 million	Assumed operational in 2022 $3.5 million $87.5 million
Demographic/Community	No appreciable differences as compared to the corresponding proposed alternative			
Social				
Economic importance for the Navajo Nation and Hopi Tribe	Effects on Navajo Nation would be accentuated under this alternative as job opportunities for Navajo decline at higher levels of curtailment, compounding the effects associated with retiring one generating unit. The Hopi Tribe would not be directly affected by changes in NGS operations. Effects on employment and economic diversity would occur primarily in the Le Chee and Kaibeto Chapters, in Page, and to a lesser extent in Flagstaff and Tuba City/Moenkopi areas.			

Table 3.18-69 Socioeconomic Impacts of the Tribal PFR Alternative Related to NGS

	NGS Configuration and Replacement Power (Nominal Capacity)			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Social and economic importance for Coconino and Navajo counties and the City of Page	Social and economic effects on nearby off-reservation communities would be similar to those under the corresponding Proposed Action operations due to comparability in employment, income and tribal revenues under these alternatives.			
Transition to renewable energys	Navajo, Hopi, and NGOs advocating for a transition away from coal would remain dissatisfied with continued NGS operations, but may be encouraged with this alternative, particularly as the amount of replacement power rises. Dissatisfaction under 2-Unit 250-MW Operation may be diminished because it would reduce coal as an energy source for as much as 31 percent of the federal energy.			
NGS-related air quality, human health and safety, and ecological health concerns	Continued operations of 3 units would result in continued concerns about environmental and health effects of emissions, reduced somewhat by installation of selective catalytic reduction and partial replacement with a renewable source. Concerns may be tempered by shutdown of one unit and substantial use of a renewable source for replacement power.			

Sociocultural effects associated with operations at NGS under the Tribal PFR Alternative would be similar to those associated with Proposed Action. Changes would stem from the slightly lower NGS employment and from the purchase of energy generated from a tribal renewable source(s) to replace a portion of the federal share of energy generated by NGS. The Tribal PFR Alternative would represent a reduction in total NGS-related employment (direct, indirect, and induced) of approximately 2 to 3 percent as compared to the corresponding Proposed Action operations. These changes include the long-term jobs that would be provided by a 250-MW solar facility, although its location within the primary segment of the study area is uncertain. Reductions in NGS employment would primarily affect the Page, LeChee and Kaibeto communities, and result in moderate reductions in 1) the number of NGS employees available for participation in local government and civic organizations, 2) economic diversity, and 3) a potential reduction in NGS and employee participation in civic, community, and charitable initiatives. As with Proposed Action 3-Unit Operation and Proposed Action 2-Unit Operation, higher NGS lease and other payments could result in an expansion of services and higher employment in Window Rock and elsewhere on the Navajo Nation, if the Nation's allocation of the additional revenue is similar to the current allocation.

The differences that would occur from the Tribal PFR Alternative in conjunction with a Proposed Action 2-Unit Operation are presented in **Table 3.18-46**. In general the effects mirror those for the Proposed Action 3-Unit Operation, but with a few more jobs lost due to curtailment and the resulting possibility of population outmigration in the Page area. On a net basis for the primary segment of the study area, the effects in the Page area could be offset by gains in Navajo Nation tribal employment supported by the higher lease and additional payments that also would accrue under this alternative.

Implementation of the Tribal PFR Alternative would have few discernible socioeconomic consequences related to the BM&LP Railroad in comparison to those effects associated with the Proposed Action. Changes in socioeconomic effects would arise primarily in response to differences in the volume (tonnage) of coal to be transported, which would translate to fewer train movements per day or week. Under this alternative the average number of weekly train movements would be between 12.6 round-trips and 20.5 round-trips. Implementation of this PFR Alternative would result in reductions of between 3 and 46 fewer jobs and a reduction of up to $3.4 million in annual labor income in the

primary segment of the study area. No readily discernible fiscal effects to the Navajo Nation, Hopi Tribe, or local governments directly associated with the BM&LP Railroad would result. Individuals living in close proximity to the BM&LP ROW would be aware of the reductions in movements, but the general public would have little awareness of the changes in train movement frequency.

3.18.4.6.2 Proposed Kayenta Mine Complex

Approval and implementation of the Tribal PFR Alternative would result in NGS output being curtailed by between 100 MW and 250 MW on a consistent basis for a pre-established number of hours daily, based on the available output from a new photovoltaic solar project. Under the 2-Unit Operation, those reductions in output would be in addition to those stemming for the retirement of one 750-MW generating unit. Reductions in the quantity of energy generated at NGS would reduce the quantity of coal required from PWCC's proposed KMC, and consequently the company's labor force requirements and annual royalty and bonus payments made to the Navajo and Hopi tribes (**Table 3.18-70**).

Annual coal production under the Tribal PFR Alternative would decline from the 8.1 million tons required to support operation of a Proposed Action 3-Unit Operation at full production, to between 7.9 million tons (100 MW) and 7.7 million tons (250 MW). Implementing the Tribal PFR Alternative in conjunction with a Proposed Action 2-Unit Operation reduces the average annual coal requirement to between 5.3 million tons (100 MW) and 5.1 million tons (250 MW). The latter is equivalent to a 35 percent reduction from the 8.1 million tons required under a full-production 3-Unit Operation. Of the total 3.0 million ton reduction, approximately 0.4 million tons represents the reduction associated with the Tribal PFR Alternative and the remaining 2.6 million tons equals the interests of the other NGS participants associated with retiring one unit.

Other important socioeconomic impacts that would be tied to the changes in the proposed KMC operations under the Tribal PFR Alternative include the following:

- Net reductions of between 30 and 82 jobs in the regional economy as compared to the employment supported by the Proposed Action 3-Unit Operation.
- The net job years, accumulated over 25 years, would be between 1,875 and 17,725 job-years lower as compared to the Proposed Action 3-Unit Operation.
- Implementation of the Tribal PFR Alternative in conjunction with a 3-Unit Operation would support between $2.64 billion and $1.57 billion in labor income over the 25 years.
- Extending the operating life of the mine would allow more workers to accrue retirement income benefits that would be realized beyond 2044.
- Annual lease, royalty, bonus and water sales payments accruing to the Navajo Nation and Hopi Tribe would be adjusted for production. Over the 25-year period of extended operations such payment would total between $1.20 billion and $791 million. Distribution of those revenues would be approximately 67 percent to the Navajo Nation and 33 percent to the Hopi Tribe.
- The Hopi Tribe would remain heavily reliant on those revenues to support tribal government and to provide essential services for its members living on the reservation.
- Navajo County and the local school district would continue receiving portions of the property taxes paid by PWCC and from tax proceeds derived from taxable sales in the region, but such receipts would decline in magnitude.
- Although the combined effects of retiring one unit at NGS and reductions in mining due to replacement power could reduce groundwater pumping, concern regarding the potential depletion of the N-Aquifer would likely continue

Surface mining effects on the physical and cultural setting and quality of life in and near the lease area would be less, but still result in dissatisfaction among residents who value the traditional setting over employment opportunities and PWCC-supplied coal, water, firewood and services.

Table 3.18-70 Socioeconomic Impacts of the Tribal PFR Alternative Related to the Proposed KMC

Parameter	NGS and Replacement Power Configuration (Nominal Capacity)			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Operatios				
Annual Coal Production (million tons)	7.9	7.7	5.3	5.1
Employment (direct, indirect, and induced) – Typical Year	1,618 30 fewer than Proposed 3-Unit Operation	1,566 82 fewer than Proposed 3-Unit Operation	1,095 134 fewer than Proposed 2-Unit Operation	1,052 177 fewer than Proposed 2-Unit Operation
Aggregate job-years: 2020 to 2044	40,450	39,150	27,375	26,300
Labor Income and Public Revenue				
Total Labor Income: 2020 to 2044	$2,718 million	$2,630 million	$1,832 million	$1,759 million
Total lease, royalty, bonus and water payments: 2020 to 2044	$1,169 million	$1,135 million	$797 million	$763 million
Total Property Taxes 2020 to 2044	$33 million	$33 million	$28 million	$28 million
Federal Abandoned Mine Land and Black Lung Disability funds 2020 to 2044	$172 million	$167 million	$116 million	$110 million

3.18.4.6.3 Transmission Systems and Communication Sites

Operation of the WTS and STS would continue for the life of the project. The timing of decommissioning and final reclamation requirements for the WTS and STS ROWs ultimately would be determined by the authorities with responsibility for ROW issuance.

Implementation of the Tribal PFR Alternative could result in the construction and operation of a new gen-tie line to serve as an interconnection between the solar generating project and the transmission system. Construction and operation of the gen-tie line as part of a solar project, would have limited temporary effects for construction employment, as well as spurring sales for local businesses and taxes for local jurisdictions. Long-term effects of the gen-tie line operation would include employment associated with maintenance and additional lease revenues and/or property taxes. Based on the value of improvements and typical ROW requirements, the magnitude of those effects would be limited. The effects would be the same under either a 3-Unit Operation or 2-Unit Operation, varying slightly based on location and length between the project and the point of interconnection. The same communities that would be affected by construction of the new photovoltaic solar project would likely be affected by any socioeconomic changes related to gen-tie line construction; those communities are unknown at this time.

3.18.4.6.4 Central Arizona Project

This subsection examines the prospective change in pumping energy costs for the CAP and the effects on water rates that would be associated with the Tribal PFR alternatives. The analysis of future energy

costs to CAP is a weighted average of: (1) future costs of NGS under the Proposed Action, (2) the incremental costs associated with curtailing NGS production, and (3) the cost of energy purchased from a new solar project developed on lands of the Navajo, Hopi or CAP-affected tribe.

Table 3.18-71 presents the energy supply assumptions for the Tribal PFR Alternative, outlining the annual power and energy supplied to CAP by NGS, acquired from alternative source(s), and the federal share of power generated by NGS that would be available for sale as surplus. Not shown, but accounted for in subsequent energy cost estimates, is 300,000 MW hours of energy assumed to be purchased by CAWCD from Reclamation (Hoover Dam) and other sources.

Table 3.18-71 Annual Federal Power from NGS and Tribal PFR Alternative for CAP

Alternative	NGS Supplied to CAP (MW hours/year)	NGS Available for Surplus (MW hours/year)	Total NGS Generated (MW hours/year)	PFR Supplied Power to CAP (MW hours/year)
Proposed Action 3-Unit Operation	2,696,000	1,472,000	4,168,000	-
3-Unit/Tribal 100 MW	2,362,000	1,472,000	3,834,000	333,000
3-Unit/Tribal 250 MW	1,864,000	1,470,000	3,334,000	831,000
Proposed Action 2-Unit Operation	2,696,000	1,421,000	4,117,000	-
2-Unit/Tribal 100 MW	2,362,000	1,421,000	3,783,000	333,000
2-Unit/Tribal 250 MW	1,862,000	1,421,000	3,283,000	831,000

Note: CAP is assumed to use an additional 300,000 MW hours of energy per year from other sources.

3.18.4.6.4.1 Future Costs for Energy

Future costs of NGS energy for the Tribal PFR Alternative are based on the underlying assumptions outlined under the Proposed Action with the incremental costs associated with Lease Amendment No. 1 and selective catalytic reduction adjusted to allocate those costs based on lower annual NGS output.[33] Reclamation's cost of NGS energy also would be affected by curtailment and the cost of firming. Energy costs for the other NGS co-tenants would likely be unaffected by either curtailment or firming.

<u>Charges Associated with Curtailment</u>

Estimated charges for the levels of curtailment associated with the Tribal PFR Alternative, would be between $1.30 and $3.80 on a “per MW hours generated” basis (see **Table 3.18-72**). Those charges would be the lowest among the PFR alternatives, reflecting the lower quantity of replacement energy to be purchased.

Table 3.18-72 Incremental Costs to Reclamation due to NGS Curtailment under the Tribal PFR Alternative

	Annual Charges for Curtailment	Annual Cost per MW hours
3-Unit/Tribal 100 MW	$4,662,000	$1.20
3-Unit/Tribal 250 MW	$11,634,000	$3.50

[33] It is assumed that reductions in future emissions under the Tribal PFR Alternative would not affect the timing of selective catalytic reduction installation as compared to the Proposed Action.

Table 3.18-72 Incremental Costs to Reclamation due to NGS Curtailment under the Tribal PFR Alternative

	Annual Charges for Curtailment	Annual Cost per MW hours
2-Unit/Tribal 100 MW	$4,662,000	$1.20
2-Unit/Tribal 250 MW	$11,634,000	$3.50

Costs for Regulation of Renewable Generation

Power supplied by a tribal solar facility would require firming. For this assessment, such energy needs are estimated at 6 percent of the annual output provided by renewable sources (NREL 2016). It is assumed that the energy would be supplied by a natural gas facility at the same $63.00 per MW hours assumed for replacement energy.

3.18.4.6.4.2 Future Energy Costs for CAP

The CAP's future energy costs under the Tribal Renewable PFR Alternative, rounded to the nearest $0.10, are shown in **Table 3.18-73**. As shown, the PFR alternatives would all result in higher energy costs, with the differences increasing in magnitude as the level of replacement climbs.

Table 3.18-73 Estimated Future Energy Charges per MW hour for the Tribal PFR Alternative

Alternative	CAP Annual Energy Charges / MW hours		
	2020 to 2025	2026 to 2029	2030 to 2044
Proposed Action 3-Unit	$47.20	$53.00	$54.40
3-Unit/Tribal 100 MW	$50.50	$55.90	$57.10
3-Unit/Tribal 250 MW	$55.10	$59.90	$60.90
Proposed Action 2-Unit	$49.40	$50.80	$57.50
2-Unit/Tribal 100 MW	$52.50	$53.70	$60.00
2-Unit/Tribal 250 MW	$56.60	$57.60	$63.10

3.18.4.6.4.3 Annual Pumping Energy Costs

Annual energy costs for the Tribal PFR Alternative with a 3-Unit Operation would range from $135.3 million to as high as $160.6 million and between $132.6 million and $165.9 million if implemented as part of a 2-Unit Operation (**Table 3.18-74**).

Table 3.18-74 Annual Energy Charges to CAP under the Tribal PFR Alternative

Alternative	Total Annual Energy Charges			Aggregate Total 2020 to 2044
	2020 to 2025	2026 to 2029	2030 to 2044	
Proposed Action 3-Unit	$127,250,000	$141,540,000	$144,780,000	$3,501,000,000
3-Unit/Tribal 100 MW	$135,290,000	$148,490,000	$151,460,000	$3,678,000,000
3-Unit/Tribal 250 MW	$146,610,000	$158,200,000	$160,620,000	$3,922,000,000
Proposed Action 2-Unit	$132,640,000	$136,150,000	$152,320,000	$3,625,000,000
2-Unit/Tribal 100 MW	$140,140,000	$143,100,000	$158,470,000	$3,790,000,000
2-Unit/Tribal 250 MW	$150,000,000	$152,420,000	$165,890,000	$3,998,000,000

The annual energy charges to CAP for the 2030 to 2044 time period, for the Tribal PFR alternatives, are shown in **Figure 3.18-12**.

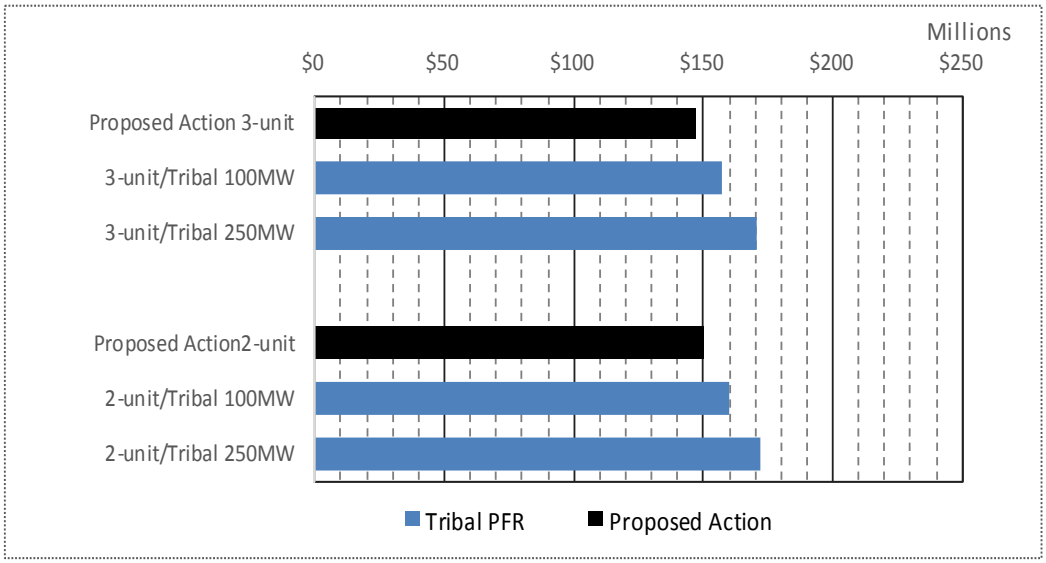

Figure 3.18-12 Annual CAP Energy Costs under the Tribal PFR Alternative, 2030 to 2044

Over the 25-year extended operating life of the NGS the aggregate energy costs to the CAP under the Tribal PFR Alternative would be between $177 million (5 percent) and $421 million (12 percent) higher than for the Proposed Action 3-Unit Operation. The differences in aggregate energy costs if implemented with a 2-Unit Operation would be between $165 million and $373 million.

Projected annual energy costs under the Tribal PFR Alternative, on a per acre-foot of water pumped basis, range from $85 to $94 during the 2020 to 2025 period, $92 to $96 during the 2026 to 2029 period, and $95 to $106 during the 2030 to 2044 period (**Table 3.18-75**). In all instances, projected costs increase as the level of replacement energy increases and would exceed those for the corresponding Proposed Action operation.

Table 3.18-75 CAP Annual Energy Charges per acre-foot under the Tribal PFR Alternative

Configuration	Annual Energy Charges / Acre-Foot [1,2]			
	2020 to 2025	2026 to 2029	2030 to 2044	Net Change 2020 to 2044 (across the row)
Proposed Action 3-Unit Operation	$80	$88	$90	$10
3-Unit/Tribal 100 MW	$85	$93	$95	$10
3-Unit/Tribal 250 MW	$94	$96	$106	$12
Proposed Action 2-Unit Operation	$83	$85	$95	$12
2-Unit/Tribal 100 MW	$90	$92	$101	$11
2-Unit/Tribal 250 MW	$94	$95	$104	$10

[1] Based on 1,600,000 acre-feet per year.

[2] Equivalent current rate is approximately $76 / acre-feet (CAWCD 2015a).

The relative impact of the per acre-foot energy costs differences varies over time and between the various groups of customers, based on the configuration of NGS and the amount of replacement energy. For example, during the 2020 to 2025 period, the incremental cost of pumping energy under a 2-Unit Operation with the purchase of 250 MW of replacement power, ranges between $7 and $11 per acre-foot. In relative terms that range of increase would represent increases of between 4 and 14 percent across the various customers (see **Table 3.18-76**). Note that the costs under the Tribal PFR Alternative would be higher than the lower costs under the Natural Gas PFR Alternative (**Table 3.18-51**) but lower than those under the Natural Gas PFR Alternative if natural gas prices were to climb substantially.

Table 3.18-76 Comparative Impact of Energy Charges for CAP Customers, 2020 to 2025, Tribal PFR Alternative

Parameter	Total Annual Energy Charges			
	M&I Long-term Subcontract	M&I Non-subcontract and Recharge	Federal	Agricultural Settlement Pool
Firm 2016 Rate per acre-foot	$161	$184	$161	$76
$7 increase as a percent of 2016 firm rate	4%	4%	4%	9%
$17 increase as a percent of 2016 firm rate	7%	6%	7%	14%

As would be true for the Proposed Action and the other PFR alternatives, customers in the Agricultural Settlement Pool and tribal and other non-tribal agricultural producers using CAP water for irrigation would be most heavily affected.

The energy rate projections shown in **Tables 3.18-76** suggest that effects of curtailment on costs associated with the Tribal PFR Alternative could contribute to lower future surplus energy sales and revenues, with the incremental costs increasing as a function of the levels of replacement energy. Reductions or the total elimination of such revenues due to the high cost of energy represents a financial risk to CAP's customers. Lower sales of surplus would reduce revenues into the Development Fund. Compensating for those reduction venues would require adjustments by CAP to fund debt service. In addition to surplus, resources available to CAWCD for debt service include the capital charges assessed to M&I customers, reserves, and ad valorem/property taxes. CAWCD currently imposes the maximum permissible rate for the latter.

Higher energy costs for CAWCD would result in correspondingly reductions in consumer, business and government expenditures for other goods and services, with associated effects on employment, income and taxes. Some of these indirect effects would occur within the study area, but occur outside of the study area.

As with the Proposed Action, higher energy rates could hamper CAP-affected tribes' plans to support future agricultural and development uses and population growth, and their ability to reestablish traditional irrigation-based agriculture on their reservations. CAP-affected tribes also would have fewer revenues to fund tribal services. These effects would be higher than those described for the Proposed Action under the Tribal PFR Alternative.

3.18.4.6.5 Project Impact Summary – All Project Components

Approving an extended operational life of the NGS and proposed KMC, in conjunction with the partial replacement of the federal share of energy NGS with energy generated by photovoltaic solar technology located on Navajo, Hopi or CAP-affected tribal land, would have far-reaching socioeconomic consequences for northeastern Arizona, and in particular the Navajo Nation, Hopi Tribe and many

individual members of the two tribes. The impacts of the Tribal PFR Alternative, assuming replacement of energy from NGS equivalent to that derived from 100 MW to 250 MW of solar capacity over a 12-hour window on a 7-day per week basis, would extend to the CAP-affected tribes and other CAP customers, affecting the future cost of pumping energy and the prospects for future sales of surplus energy yielding revenues to support the Development Fund. **Table 3.18-77** summarizes the critical socioeconomic effects associated with the Tribal PFR Alternative.

Table 3.18-77 Summary of Socioeconomic Impacts for the Tribal PFR Alternative

Parameter	NGS Configuration And Replacement Power (Nominal Capacity)			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Operations				
Federal Energy from NGS (TW hours/year)	3.86	3.38	3.76	3.22
Coal Used (million tons) Annual Aggregate 2020 to 2044	7.9 198	7.7 193	5.3 133	5.1 128
Employment				
New Regional Jobs Tied to Alternative Power Construction Operating	533 for 1 year 9	636 for 2 years 13	533 for 1 year 9	636 for 2 years 13
Total Regional Jobs – Typical Year	3,743	3,679	2,681	2,620
Aggregate job-years: 2020 to 2044	93,575	91,975	67,025	65,500
Labor Income and Public Revenue				
Annual Labor Income (millions)	$256	$250	$184	$179
Aggregate Labor Income: 2020 to 2044 (millions)	$6,490	$6,441	$4,630	$4,594
Access to fringe benefit programs and long-term retirement income	Access to benefits and retirement income extended for current and a future generation of workers. Fewer workers would benefit than under the respective Proposed Actions; the differences increasing with higher levels of replacement.			
Total lease and other payments to the Navajo Nation: 2020 to 2044	$2,532 million	$2,118 million	$1,800 million	$1,803 million
Net revenue effects to the Navajo Nation and Hopi Tribe as compared to end of 2019	Navajo Nation – much higher Hopi – slightly lower	Navajo Nation – much higher Hopi – somewhat lower	Navajo Nation – higher Hopi – much lower	Navajo Nation – higher Hopi – much lower

Table 3.18-77 Summary of Socioeconomic Impacts for the Tribal PFR Alternative

Parameter	NGS Configuration And Replacement Power (Nominal Capacity)			
	3-Unit Operation		2-Unit Operation	
	100-MW	250-MW	100-MW	250-MW
Demographic/Community				
Air quality, human health and safety, ecological health, water quantity and quality, and elements of traditional lifestyles and community stability.	Public concerns under the Tribal PFR Alternative would be similar to those identified for the Proposed Action operations. The extent to which public concerns would be sensitive to changes in outputs associated with the Renewable PFR Alternative, particularly levels of mining, is unknown. Effects on economic and community stability, NGS and PWCC support for educational and community charitable causes would be similar to, but scaled back slightly as compared to the respective Proposed Action operation. Implementation of this alternative, with higher levels of replacement energy, may result in some emigration from the region because of lower employment. These effects would translate to effects on local housing and community services. If a new solar facility were to be built on the Navajo Nation or Hopi Reservation, the short-term and long-term jobs, personal income and income to the tribe could offset some emigration pressures. Concerns about the effects of NGS emissions and KMC emissions, dust and related effects would persist. Navajo, Hopi, and NGOs advocating for a transition from coal-fired generation to lower-emissions sources would be dissatisfied with the continued operations of NGS, but dissatisfaction may be tempered somewhat under the 2-Unit Operation with higher rates of renewable replacement energy, located on tribal lands. Concerns for potential effects on ground and surface water, including depletion and degradation of the N-Aquifer, would be the same as under the Proposed Action. PWCC community support programs that benefit residents of the proposed KMC area, and nearby Navajo chapters and Hopi villages would continue. Lower coal requirements may result in fewer future household relocations and withdrawal of grazing lands in the proposed KMC lease area, particularly under the 2-Unit Operation and high levels of replacement energy. Effects of surface mining on the physical and cultural setting and quality of life in and near the lease area would be somewhat lower than under the corresponding Proposed Action operations. Future KMC operations would perpetuate dissatisfaction among local residents who value the traditional setting over job opportunities, mine-related revenues which support tribal government and services, and PWCC provided services. Support of local economic and community stability would be stronger under the 3-Unit Operation than under the 2-Unit Operation and lower levels of replacement energy.			
CAP Energy Charges:				
Annual: 2030 to 2044 (millions)	$151.5	$160.6	$152.3	$165.9
Aggregate 2020 to 2044 (millions)	$3,678	$3,922	$3,625	$3,998
Primary reasons for higher costs	Curtailment and selective catalytic reduction costs are the primary factors, followed by higher lease costs to the Navajo Nation.			

The summary assessment of impacts, as they relate to the specific issues defined in Section 3.18.4.1 above follow.

3.18.4.6.5.1 Regional Employment and Wages for the Navajo Nation and Hopi Tribe

The project-related impacts on regional employment and wages under the Tribal PFR Alternative would be essentially the same as those under the Proposed Action. Employment and income under the under the 2-Unit Operation would be lower than the levels expected at the end of 2019. Revenue support for Hopi tribal government under the 2-Unit Operation and 250 MW of replacement energy would be much lower than that at the end of 2019, and might necessitate cutbacks in employment, programs and services. The economic impacts would be major under either operation and important because of the persistent unemployment and poverty in the region. Construction of a new solar facility on Navajo Nation or Hopi Reservation would provide new long-term minor to moderate economic stimulus.

3.18.4.6.5.2 Demographic, Economic, Attitudes, and Social Organization Trends on Navajo and Hopi Populations

Such impacts under the Tribal PFR Alternative would be essentially the same as those described for the Proposed Action operations, and range from moderate to major.

3.18.4.6.5.3 Lease Fees, Royalties, Water Fees, and Other Payments to the Navajo Nation and Hopi Tribe

For the Navajo Nation future revenues under the Tribal PFR would be higher than those at the end of 2019, but lower than those associated with the Proposed Action. Future revenues for the Hopi would be lower, particularly under the 2-Unit Operation with 250 MW of replacement energy. Consequently, fiscal impacts of operations under the Tribal PFR Alternative would be major.

3.18.4.6.5.4 Social Fabric and Values that Provide Incentives for Younger Tribal Members to Remain in their Communities

These impacts would be essentially the same as for the respective Proposed Action operations; major because of the foreseeable limited availability of foreseeable comparable opportunities and incomes from other employers.

3.18.4.6.5.5 Future Costs of Power Required for CAP Pumps and Economic Impacts due to Reductions in Surplus Revenues for the Development Fund

Pumping energy costs for the CAP would increase under either Tribal PFR operation, with energy costs potentially much higher with 250 MW of replacement energy and higher future gas prices. Total pumping energy costs over the 2020 to 2044 time period would increase by between 5 percent (3-Unit Operation with 100 MW PFR) and 16 percent (2-Unit Operation with 250 MW PFR) as compared to those under the Proposed Action. The unavoidable costs associated with selective catalytic reduction installation, Lease Amendment No. 1, and basic operating costs would account for a portion of the increase, but costs associated with curtailment and firming would account for the majority of the increases, particularly as the amount of energy provided by the Tribal PFR Alternative rises. The likely impacts of those increases would comprise a minor to major impact for users. The higher energy costs under this alternative could adversely affect the economic feasibility of future sales of surplus energy yielding revenues to support to the Development Fund and economically unjustifiable for CAWCD to purchase energy and power from NGS.

3.18.4.6.6 Cumulative Impacts

The contributions of the NGS and proposed KMC to cumulative effects within the cumulative impact study area, under the Tribal PFR Alternative would be similar to those described above for the Proposed Action. The primary differences would be that revenues to the Navajo Nation that would provide revenue stability would be lower under this alternative and the potential for short and long-term fiscal effects associated with a new photovoltaic solar facility. Nonetheless, the contributions to cumulative effects would be moderate to major.

3.18.4.7 No Action

3.18.4.7.1 Navajo Generating Station and Proposed Kayenta Mine Complex

Because the NGS and the Kayenta Mine are economically interrelated in terms of impacts to employees, and revenues to the Navajo Nation and Hopi Tribe, the consequences of the No Action Alternative implementation are addressed for both components together.

Decisions to withhold approval of the actions that would allow the NGS, proposed KMC, and BM&LP Railroad facilities to operate beyond 2019 would result in actions on the part of the NGS participants and PWCC to take the NGS off-line and complete decommissioning and reclamation required under the existing leases and permits, by the end of 2019. Some of those actions, and the associated socioeconomic effects, would occur prior to the final shutdown. For example, coal mining would cease before the NGS plant ceased operation to facilitate depletion of storage stockpiles at the plant and mine. Overhauls scheduled for 2017, 2018, and 2019 could be modified or cancelled. The effects associated with the post-shutdown activities are not addressed specifically in this assessment as similar activities and effects would occur in the future assuming implementation of the Proposed Action or action alternatives, and are assumed to be of similar type and scale.

Socioeconomic impacts in the primary segment of the study area that would result in conjunction with the No Action Alternative would be major, widespread, and long-lasting. These impacts would directly and indirectly affect the Navajo and Hopi tribal governments, households, businesses and local government agencies and services. Because the NGS and Kayenta Mine are among the largest private sector employers in northeastern Arizona, the effects would extend to Coconino, Navajo and Apache counties and throughout the state. The subsequent loss of existing jobs and income and reductions in revenues paid to the tribes would result in major effects, given persistently high unemployment and poverty among on-reservation Navajo and Hopi, and the importance of the revenues paid to the tribal governments in supporting tribal employment and the provision of services on a reservation-wide basis. The importance of the jobs, income and revenues is underscored by the lack of any identified or reasonably foreseeable new industrial or commercial development that offers prospects to offset the losses.

3.18.4.7.1.1 Local Economic Impacts Associated with Closures

Retiring the NGS at the end of 2019 would precipitate major socioeconomic impacts in the primary segment of the study area which would be regarded as negative by many residents, other local stakeholder interests, and local and tribal governments. The permanent loss of up to 3,090 jobs in the primary segment of the study area would follow in the wake of the shutdown; this would be equivalent to 2.0 percent of the total employment of the entire 3-county region in 2013. Regional labor income would decline by an estimated $261 million per year – see **Table 3.18-78**. The effective losses in jobs and income would be even higher if the prospective gains foregone associated with Lease Amendment No. 1 are considered.

The Navajo Nation and Hopi Tribe are the single largest employers on their respective reservations. They, along with local governments and public education providers, would see combined reductions in net revenues of more than $58.5 million per year; equivalent to more than 23 percent of the combined annual general fund revenues of the two tribes. Foregone revenues to the Navajo under Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1)would be the equivalent of another 18 percent loss in general fund revenues. The losses would be particularly severe for the Hopi Tribe for which mining-related revenues account for more than 80 percent of its general fund that supports the tribe's executive, legislative and judicial functions and various services provided to its members. Both Tribes would continue to receive various federal grants and contract funds, and operate their respective enterprise activities, but those grants and contract funds are generally dedicated to sustaining the enterprises and providing specific programs, e.g., housing, and consequently, are unavailable to meet general government expenses.

Local economic and social implications of the effects of No Action would be most heavily felt in Page, Kayenta, the Navajo chapters that are home to many of NGS and Kayenta Mine workers, Window Rock, Fort Defiance, Kykotsmovi, Tuba City and Moenkopi. Job and income losses would occur in the Flagstaff, Gallup, and other off-reservation communities; however, the relative effects of those losses would be less severe.

Local businesses in Page would suffer the loss of revenues tied to the annual overhauls at NGS. Because those overhauls are scheduled to coincide with the off-season for Page tourism, convenience retail, lodging and eating and drinking establishments would be more heavily affected than other sectors of the economy.

Table 3.18-78 Operations and Employment Impacts of the No Action Related to NGS and the Kayenta Mine

Parameter	No Action
Operations	
Annual NGS Power Production	Generation at NGS ceases Electrical generation in the primary segment of the study area decreases by 17.3 TW hours/year
Annual Coal Production	Coal mining likely ceases due to a lack of other customers
Reduction in total production (tons and years at current production rate)	Approximately 203 million tons of additional coal reserves would remain unproduced
Annual groundwater use (acre-feet / year)	Up to 1,200 acre-feet per year less groundwater used
Total groundwater use – 2020 – 2057	Up to 30,000 acre-feet less groundwater used
Water withdrawals from Lake Powell	NGS-related withdrawals would cease
NGS and Kayenta Mine Related Employment	
NGS direct, incl. BM&LP and contractors, annually	-521
PWCC direct, incl. contractors, annually	-519
Overhaul contractors (annual equivalent)	-124
Tribal jobs, annually	-562
Total Indirect/induced jobs, annually	-2,048
Total jobs	-3,212
Job-years lost over 25-year period Current jobs Gains from additional revenues foregone Total losses	 -80,300 - 11,300 -91,600
Labor Income and payments to the tribes and local governments	
Annual labor income	$261 million per year less $6,531 million less over 25 years [1]
Access to fringe benefit programs	Reduced opportunities for current and future workers to realize benefits. Limited alternative employment options with comparable benefits
Long-term pension and retirement income	Substantial reductions in future income for many current and a future generation of workers, extending beyond 2044.

Table 3.18-78 Operations and Employment Impacts of the No Action Related to NGS and the Kayenta Mine

Parameter	No Action
NGS and PWCC lease, royalty, bonus and water payments to the tribes and local governments	$58.5 million/year under current lease and up to $43 million/year in foregone lease and additional payments
Scholarships and community contributions	$700,000 per year less
Reduction in NTUA revenues from electricity sales	Approximately $10 million / year less. Would likely necessitate rate increases for other residential and commercial customers.
Federal Abandoned Mine Lands and Black Lung Funds 2020 to 2044	PWCC payments into these funds would cease -$175 million

[1] Includes $685 million in income foregone that would have accrued under the terms of Lease Amendment No. 1.

Unemployment would rise substantially in the affected areas of the two reservations and in Page; however, the local experience following the closure of the former Black Mesa Mine and Black Mesa pipeline was that many employees with lengthy tenure chose early retirement and did not seek new jobs.

Foregone future sales would cause some businesses to lay off staff, cut back hours for workers, adjust hours of operation, or make other adjustments. Some business closures could occur, particularly in Page and among businesses that may already be weak. Business closures would be apparent by an increase in commercial vacancies. Loss of business from annual overhauls would eliminate the seasonal economic stimulus historically experienced by many local lodging accommodations, fast food, and gas and convenience stores during the off-season for tourism.

Coconino and Navajo counties and the local school districts would see erosion of their tax base and reductions in property tax revenues. Taxing jurisdictions in Coconino County would see the largest reduction, more than $6 million per year. Page would experience erosion of its property tax base and revenues due to declining residential and commercial market values. Future TPT/sales tax receipts due to declining consumer spending and expenditures by NGS participants, PWCC and their vendors would accrue to the Navajo Nation and to local governments in Page, Flagstaff, Gallup, and other off-reservation counties of Coconino, Navajo, and Apache counties.

Sociocultural impacts of the No Action Alternative would be major and long-term. **Tables 3.18-79** and **3.18-80** summarize the primary demographic and sociocultural effects of No Action. The impacts include dislocation and emigration and stresses on families and extended kinship networks as families either move or wage earners relocate in search of employment, leaving their family on the reservation. Because many Navajo and Hopi wage earners support extended, multigenerational families, the closures would likely affect a substantially larger population than a similar off-reservation event in other parts of the nation. Consequently, the closures would result in a decrease in the material standard of living for many Navajo, Hopi, their families, and extended families. The reductions in income would be amplified by the strong cultural and family ties among the Navajo and Hopi, along with a comparative lack of education, training, and work experience, and more limited financial and other resources, that limit their ability and willingness to respond to economic dislocation as is common in many off-reservation situations through emigration. No Action-related population declines would be expected in Page and some Navajo Chapters and Hopi villages. Reductions in NGS and Kayenta Mine related tribal revenues would reduce Navajo Nation governmental services and limit Hopi Tribal services, affecting the quality of life for members of both tribes.

Table 3.18-79 Demographic/Community Impacts of the No Action Related to NGS and the Kayenta Mine

Parameter	Impacts
Labor Market	Local unemployment would increase, potentially dramatically. Effects would be most pronounced in Page and the LeChee, Shonto, Kaibeto, Forest Lake, Kayenta chapters. Some displaced NGS and Kayenta Mine employees with lengthy tenure and vested retirement benefits would choose to retire and maintain their present on or off-reservation residence. Others may relocate for economic reasons, either elsewhere on the reservation or off-reservation, depending on where they find work SRP and PWCC might offer transfers to other facilities to some employees. Additional Navajo and Hopi would become unemployed in response to cutbacks necessitated by reductions in funding. Migration is a common mechanism for labor market adjustment. Some out-migration would be expected to occur, but strong cultural and family ties, and other factors, may temper household migration but encourage long distance commuting for employment (i.e., workers employed out-of-town, sending money back and returning periodically).
Population	Population declines of magnitudes discernible to local residents and community and chapter officials would likely occur in the LeChee, Shonto, Kaibeto, and Forest Lake chapters, and in Page. Secondary population effects would occur over a wider area, including Tuba City, Kayenta, the Flagstaff area and Window Rock, but would be less likely to be discernible. Flagstaff may be a destination for some households who leave Page, the Navajo Nation or Hopi Reservation. A scarcity of available housing and lack of job opportunities on the Navajo Nation contributes to on-reservation relocation challenges. Among those not eligible, or who are financially unable, to retire, many affected families may maintain a local residence, with one or more workers commuting to work on a weekly, or less frequent basis, transferring money back and returning periodically. The costs of commuting and maintaining multiple residences would lower the standard of living for these households.
Effects on local retail and service sector	Businesses in Page, Kayenta, other communities on the Navajo Nation and the Hopi reservation, Page, Flagstaff and elsewhere would see reductions in business revenues due to lower consumer spending and purchases by the proponents, contractors and vendors. Reductions in sales would cause some businesses to lay-off staff or cut back hours for workers (indirect and induced), adjust hours of operation, or make other adjustments. Some business closures could occur, particularly among businesses that may already be weak.
Housing	Greater need for housing assistance would be expected due to loss of income. Housing availability in Page would likely increase as more rentals become available and the number of homes available for sale rises. Home prices and rental rates would soften as supply increases and demand declines.
Community facilities and services	Cutbacks in Navajo and Hopi tribal staffing and services could be expected due to the loss of plant and mine-related revenues. Service cutbacks could affect services across the entire Navajo Nation, but be more strongly felt on the Hopi Reservation. Public facilities and services in Page, Flagstaff and the remainder of Coconino County and Navajo County would see reductions in funding, triggering service level adjustments. Demands for some services would decline due to declining populations. Demands on social services, unemployment, work force training, and other similar services could increase. Reductions in NGS and Kayenta Mine-related revenues could result in budget shortfalls for these services.

Table 3.18-80 Selected Sociocultural Impacts of No Action Related to NGS and the Kayenta Mine

Parameter	Impacts
Economic importance for the Navajo Nation and Hopi Tribe	Most of the workers directly affected by the NGS and Kayenta Mine shutdowns would be Navajo. Loss of NGS and Kayenta Mine-related jobs would lower the material standard of living for those Navajo and Hopi workers unable to find replacement jobs at relatively comparable salaries and benefits, and without major increases in commuting costs. Relocation of wage earners would result in stresses on families. The loss of NGS and Kayenta Mine-related revenues would substantially affect the funding available to the Navajo Nation to deliver services and maintain tribal employment. The loss of Kayenta Mine-related revenues, which comprise over 80 percent of the Hopi Tribe's general fund revenues, would result in severe cutbacks in tribal services and jobs. Loss of services would affect residents throughout the Navajo Nation and Hopi Reservation. Because many Navajo and Hopi wage earners support an extended family, economic effects of closure would be widespread and severe. There is no presently identified or foreseeable commercial or industrial project in the region, including development of renewable energy, with the potential to offset the loss of employment, income and public sector revenues associated with the NGS and Kayenta Mine for northeastern Arizona.
Social and economic importance of NGS for Coconino and Navajo counties and the City of Page	Closure of NGS would adversely affect economic diversity in Page. The loss of the annual NGS overhauls would eliminate a major source of off-season (relative to tourism) commerce for lodging, dining and other retail and service businesses. Closure of NGS also would eliminate NGS corporate and employee support for and participation in civic, service and charitable initiatives.
Transition to renewable energy or natural gas	Because the sources of post-closure replacement power for NGS non-federal partners is not known, transition to renewable energy is not linked to closure.
Air quality, human health and safety, and ecological health concerns	Environmental and health concerns voiced by residents related to NGS and Kayenta Mine would be substantially reduced upon closure and likely cease at the conclusion of reclamation. Concerns about previous health effects could persist. Concerns expressed by residents about potential depletion and degradation of the N-Aquifer would diminish and may cease if long-term effects on the aquifer do not materialize. See Section 3.8 for the assessment of impacts on water resources.
Relocation	Relocations of residents to accommodate mining would cease.
Withdrawal of grazing lands	Withdrawal of grazing lands to accommodate mining would cease.
Homesite leases	The effect of closure on the ability of residents in and near the PWCC lease area to obtain homesite leases is uncertain.
Road safety, maintenance and dust	Road safety and dust issues related to mine operations in and near the PWCC lease would be reduced substantially. Concerns would shift to difficulty in post-closure road maintenance and winter time plowing absent PWCC's efforts and participation.

Table 3.18-80 Selected Sociocultural Impacts of No Action Related to NGS and the Kayenta Mine

Parameter	Impacts
Cultural Resources	Mining-related disturbance of TCPs, places, and landscapes that have cultural and religious significance would cease. Concerns about residual effects on cultural resources and the disposition of previously removed artifacts and burial sites would likely persist.
Cultural Values	Navajo and Hopi who believe that mining is incompatible with traditional culture and beliefs would likely be satisfied with closure of the Kayenta Mine.
Equity	Concern regarding perceived inequities associated with mining and electrical generation to benefit others while those living within and near the lease area experience adverse effects of mining and lack of water service, might decrease, or emerge as concern about residual inequities from past activities and a sense that best opportunities to address those inequities passed with the closure of the mine.
Setting	No additional disturbance of the physical and cultural setting would occur.
	Residents within and near the PWCC lease area who value the traditional setting over employment opportunities and PWCC-supplied coal, water, firewood and services would likely be satisfied upon closure and successful reclamation.

Unless the Navajo Nation negotiated with the NGS Participants to acquire the assets, a decision to implement the No Action Alternative would result in actions to remove and reclaim the BM&LP Railroad ROW. Rails, elements of the catenary system, and rolling stock could be sold as scrap or to another railroad. At-grade crossings, warning signs and other safety devices would be removed. Motorist delays at public at-grade crossings would be eliminated, as would concern for safety at at-grade crossing. ROW fencing would be removed, eliminating the current barrier to herd movements for affected grazing allotments.

3.18.4.7.2 Transmission Systems and Communication Sites

The NGS transmission system is an established part of the western U.S. transmission grid and supports reliability and delivery of power throughout the region, well beyond the power generated by the NGS. Therefore, under the No Action Alternative it is likely that that one, several, or all of the land owners/managers of the transmission line rights-of-way and communication site leases would renew some portion of the facilities to keep the power grid performing as expected.

In the event it is determined that some or all of the transmission systems and communication site ROWs are not renewed, a lengthy study and permitting process would need to occur before any decommissioning is initiated due to the essential and integral nature of these facilities with the western electric grid. As noted in Section 2.3.3, up to 4,826 acres within and alongside the transmission system corridors could be temporarily disturbed if the entirety of the transmission systems and communication sites were decommissioned and removed.

Major new transmission system construction would not be anticipated in conjunction with the No Action. Some upgrades could be required to provide additional transmission capacity in some locations, depending on the source of replacement power in relationship to changes in the future utilization of the WTS and STS in a post-closure environment.

Should capacity upgrades be required, they would likely involve temporary and localized economic and social effects associated with construction of such systems. Such effects can generally be characterized by a relatively small workforce, involving mostly non-local, unaccompanied workers, in a situation where most of the work occurs along a linear corridor located outside of communities. The focus of construction

activity shifts location along the corridor over time, reducing or eliminating the effects on some communities, while introducing effects in other locations. The primary socioeconomic effects for affected communities would include temporary lodging demand and revenues and increases in convenience retail and eating and drinking sales and sales taxes. The temporary influx of workers and construction activity can result in increases in traffic and localized congestion, with temporary demands on law enforcement and emergency medical/first responder capabilities. Major adverse social effects on community cohesiveness and lifestyle would be unlikely in conjunction with transmission line upgrades.

In summary, no social and economic effects of consequence would be expected to arise in conjunction with these transmission lines and communication sites.

3.18.4.7.3 Central Arizona Project

A decision to withhold federal approval of those actions necessary to allow operation of NGS and the proposed KMC to continue would necessitate actions on the part of CAWCD to secure an alternative source(s) of 2.7 TW hours of electrical power and energy to operate the CAP system.[34] Replacement energy supply and delivery agreement(s) would need to be in-place and operational not later than December 22, 2019, when NGS is taken off-line. The replacement agreement could involve a short-term purchase agreement to acquire from existing generating sources and a long-term agreement based on power from new source(s), including renewable sources. NREL's analysis indicates projected long-term rates for new construction at approximately $63 per MW hours. Such rates translate to pumping energy costs of $106 per acre-foot. When combined with the long-term uncertainties associated with natural gas rates, and the loss of surplus energy sales that would result, construction of a new facility is seen as economically unsupported.

Based on NREL's analysis, the low-cost short-term option would likely be energy supplied by existing natural gas – combined cycle sources. Depending on market conditions and future prices of natural gas, energy could be available at lower cost than from NGS under the Proposed Action, but it also could be considerably more costly. Based on NREL's analysis, pumping energy costs under No Action could be between 23 percent less costly and 21 percent more costly compared to energy pumping costs under the Proposed Actions. Due to the uncertainty regarding natural gas prices, future energy rates under No Action may be more variable over time than under the Proposed Action. **Table 3.18-81** presents the comparative energy pumping rates and energy costs for the No Action Alternative and the Proposed Action.

Table 3.18-81 Energy Costs Per MW hours – Proposed Action and No Action Alternatives

	2020	2026	2030
Energy Pumping Rates per Acre-Foot			
Proposed Action (3-Unit / 2-Unit)	$80 / $83	$88 / $85	$90 / $95
No Action (new Natural Gas plant)	$106	$106	$106
No Action (power purchase – range)	$61 to $88	$66 to $93	$73 to $106
Annual Pumping Energy Charges for CAP			
Proposed Action	$127,250,000 / $132,640,000	$141,540,000 / $136,150,000	$144,780,000 / $152,320,000
No Action (new Natural Gas plant)	$169,850,000	$169,850,000	$169,850,000

[34] For purposes of this assessment, it is assumed that energy from Hoover Dam would continue to be available to CAWCD at the same cost as it would be assuming the Proposed Action or PFR Alternatives.

Table 3.18-81 Energy Costs Per MW hours – Proposed Action and No Action Alternatives

	2020	2026	2030
No Action (power purchase – range)	$101,640,000 to $139,110,000	$112,690,000 to $156,100,000	$124,290,000 to $175,510,000
Potential for Surplus Energy Sales to support the Development Fund			
Proposed Action	Yes	Yes	Yes
No Action	No	No	No

Surplus energy sales and revenues to support the Development Fund would cease under No Action, regardless of whether pumping energy costs were higher or lower than those under the Proposed Action. Compensating for those reductions venues would require adjustments by CAP to fund debt service. Other resources available for debt service include the capital charges assessed to M&I customers, reserves, ad valorem/property taxes, or adjustments in other budgeted expenditures. CAWCD currently imposes the maximum permissible rate for the latter. The loss of surplus revenue sales could increase pumping energy rates on the order of $10 to $15 per acre-foot. No Action also would result in the loss of contributions to NGS plant reclamation and retirement costs, and retiree health care. Although beyond the scope of this NEPA analysis, the closure of NGS would have other consequences for SRP, Arizona Public Service Company and Tucson Electric Power Company customers who also receive power generated by NGS.

3.18.4.7.4 No Action Impact Summary – All Project Components

Under the No Action Alternative, NGS decommissioning activities would begin in 2018 with effective shutdown of the plant occurring by the end of 2019. The Kayenta Mine would cease operations by the end of 2019 under the No Action Alternative. Mine closure and reclamation procedures would take place pursuant to the existing Kayenta Mine mining permit, and would take approximately 10 to 15 years to complete.

Navajo and Hopi who view mining and burning of coal on tribal lands, and use of tribal water for mining as incompatible with their respective traditional values would likely support the No Action Alternative, in part because mining and coal-fired electric power generation activities would cease and reclamation would occur 25 years sooner than under all action alternatives.

Navajo and Hopi who believe that mining and burning of coal for electric power generation and use of tribal water for mining could be compatible with their respective traditional values would likely oppose this alternative because of the foregone tribal economic, employment and fiscal benefits.

In the absence of the Proposed Action, major socioeconomic effects would occur throughout the study area.

Under the No Action there would be a high likelihood for concurrent effects on Navajo Nation and Hopi Tribe fiscal resources resulting from shutdown activities at NGS and the proposed KMC occurring in the shadow of similar shutdowns of units at FCPP and San Juan Generating Station and reductions in coal production at the respective supply mines. Although separated in distance and timing, the sequential nature of these changes, all precipitated by air quality compliance actions in conjunction with low natural gas prices, would result in negative socioeconomic effects on the Navajo Nation and Coconino and Navajo counties.

Coconino County could experience reductions in TPT revenues due to the residual effects of the shutdown of one unit at the Cholla generating station and effects arising from modification or cancellation

of overhauls at NGS in 2017 and 2018. The extent of fiscal effects is uncertain but unlikely to major considering the overall fiscal resources available.

Navajo County could experience adverse fiscal effects due to the residual impacts of the shutdown of one unit at the Cholla generating station and effects arising from the closure of the Kayenta Mine. Apache County could experience fiscal impacts, primarily changes in revenues, arising from the effects on the Navajo Nation fiscal conditions that arise from in conjunction with actions at the NGS, Kayenta Mine, and other generating stations and mines in the region.

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Technical Supplement 3.18-A

Analysis of the Proposed Action and Partial Federal Replacement Alternatives on Water Rates for the Central Arizona Project

Introduction

This technical supplement describes the analysis of the effects on long-term energy costs and water rates for the Central Arizona Water Conservation District's (CAWCD) Central Arizona Project (CAP) that would be associated with the Proposed Action and action alternatives considered in this EIS. CAP's total future annual energy costs would be comprised of three components: cost of NGS energy, energy cost of the alternatives, and energy costs for power obtained from other sources.

The focus of the analysis is on fiscal effects to CAP customers, both those with and without long-term contracts, and those Indian tribes that currently receive deliveries from the CAP. Subsequent effects on end-users of the water and any effects on future economic and community development in the CAP service area due to changes in energy prices are uncertain and beyond the scope of this EIS.

The analysis of future water rates associated with the three partial federal replacement (PFR) alternatives is not indicative of any agreement on the part of CAWCD to accept or participate in the implementation of a PFR should that alternative be approved as part of a Record of Decision for this NEPA action.

The future cost of energy generated by NGS would increase under the Proposed Action, with additional increases projected under all of the action alternatives. Future increases in NGS energy costs would be passed through to Reclamation and the customers of the other NGS participants. In turn, Reclamation's energy costs would pass through to CAWCD. Higher energy costs would translate to increases in water costs for CAWCD's customers, with the relative magnitude of change varying across the different categories of class of customers. For municipal and industrial (M&I) customers on long-term contracts, pumping energy costs represent approximately half of the total rate. For many M&I customers, taking into account the subsequent treatment, distribution, and system operation costs would reduce the relative cost effect on final customers, although the absolute change would be the same. Increases in water cost translate into higher costs of doing business, a reduction in consumer disposable income for other purposes, and higher costs for the public sector (i.e., for irrigation, public recreation and other potable uses).

For Indian tribes and customers in the agricultural settlement pool,[35] energy costs represent their total current rate. Most of the water for these customers is used raw (i.e., untreated) for irrigation. For these users, increases in water rates would translate to higher costs of production and downward pressure on farm income.

CAP water users face a possible further indirect consequence from future increases in energy costs, those associated with the effects on the Lower Colorado River Basin Development Fund. Annual revenues from sale of surplus power, along with property taxes and reserves, are available for application to CAP's debt repayment obligation to the Federal government, up to that year's repayment obligation. Thus, reductions in revenues from surplus energy sales pose a risk for CAP's M&I customers who could face higher capital charges to fund debt service.

[35] The agricultural settlement pool refers to a group of agricultural customers who agreed to relinquish water rights in exchange for water deliveries via the CAP; those deliveries would be billed at the cost to CAWCD of pumping energy only. The pool currently is 400,000 acre-feet per year, decreasing to 300,000 acre-feet per year in 2017, 225,000 acre-feet per year in 2024, and 0 in 2031 (CAP 2015).

The remainder of this technical appendix summarizes the analysis and results of the reasonably foreseeable changes in NGS costs related to the extension of operation through 2044.

Assumptions

- Costs associated with installation and operation of selective catalytic reduction at NGS would be allocated among the participants based on their respective shares of future generating capacity.
- Reclamation's energy costs associated with its participation in NGS would be borne by CAWCD and other purchasers of the power.
- CAP's overall electrical transmission costs would be unaffected by the alternatives.
- The analysis does not include potential costs associated with acquisition of additional transmission capacity in conjunction with the implementation of the Tribal PFR Alternative or the restructuring of existing transmission agreements on the WTS and STS in conjunction with any of the PFR alternatives.
- Reclamation would pay costs through billings to CAP and proceeds of excess power marketed to other customers.
- Monetary values are expressed in 2015 dollars.
- CAWCD would continue to obtain and use 300,000 MW hours per year of energy from Reclamation's Hoover Dam and purchased from other sources. CAWCD's costs of such energy; $14.3 million per year, are assumed to remain constant over time.
- Interim calculations of projected changes in energy costs are rounded to the nearest ten-cent increment, with final results rounded to the nearest whole dollar. This level of precision allows differences between alternatives to be distinguished.
- Reclamation would not build and own a new generation source for replacement power, but rather would work with CAWCD to contract for the purchase of replacement power from other sources.
- Power and energy from a replacement energy source would be dedicated to supplying CAP, with NGS power used to meet the CAP's remaining needs and for sale as surplus.
- The costs of energy from the alternative sources would be borne by the CAWCD.
- The analysis assumes agreement among the NGS participants allowing for the long-term curtailment of a portion of the federal share of NGS output by the quantities associated with the PFR alternatives.
- Potential changes in long-term rates that would be associated with future reductions in deliveries to the Agricultural Settlement Pool are not considered in this analysis.
- The analysis does not specifically account for future cost impacts of residual NGS plant retirement costs. Those costs would accrue under all scenarios, although the timing would differ under the various alternatives.
- Projections of changes in water rates do not include adjustments for the potential effects associated with possible reductions in deliveries associated with shortages on the Colorado River or shifts in deliveries from the agricultural settlement pool to M&I customers.
- Under the No Action Alternative, CAWCD would secure power from a portfolio of sources, using a combination of short and long-term power purchase agreements.

CAP's Future Energy Costs

The projection of future energy costs to CAP begins with a base case of future costs of NGS assuming a continuation of the existing cost structure, allowing for minor increases in operating costs over time. Incremental costs that would occur post-2019, such as the cost of selective catalytic reduction installation, are estimated and summed with the base case costs to derive future costs. For the PFR alternatives, future costs are the weighted average of NGS energy, energy sourced from lower-emitting technology associated with each PFR alternative, and energy obtained from Hoover Dam and purchased from other sources. Costs are established for three time periods (2020 to 2025, 2026 to 2029, and 2030 to 2044), using projected costs for the mid-point of each time period. Those periods generally correspond to the assumed timing of operational changes affecting future NGS production costs:

2020 to 2025: initial period of post-Record of Decision operations during which a) a new photovoltaic solar facility could be built and operated under the Tribal PFR Alternative, b) installation of selective catalytic reduction would occur under the Proposed Action 3-Unit Operation, and c) implementation of the Natural Gas or Renewable PFR Alternative would occur.

2026 to 2029: installation of selective catalytic reduction under the Proposed Action 2-Unit Operation would occur.

2030 to 2044: covers the extended operations through 2044 during which the PFR alternative is assumed to be operational, culminating with the assumed end of the proposed operating period.

Future cost projections for the lower-emitting and renewable technologies are based on NREL's annual baseline series of energy projections, analysis of energy pricing at the Mead hub completed by NREL, and long-term energy pricing projections from the U.S. Energy Information Administration. A range of costs is presented for natural gas generated power; those that represent construction of new generation capacity and a range of costs associated with future power purchases. Costs for the Renewable PFR Alternative assumes power purchased from existing facilities, while those for the Tribal PFR Alternative assume new construction. The base cost assumptions for the NGS and lower-emitting and renewable technologies are shown in **Table 3.18.A-1**.

Table 3.18.A-1 Base Energy Costs per MW hours – NGS and Lower-Emitting Alternative Technologies

	2020 to 2025	2026 to 2029	2030 to 2044
NGS Base [1]			
3-Unit Operation	$44.70	$46.10	$47.50
2-Unit Operation[2]	$46.70	$48.10	$49.50
Partial Replacement Natural Gas/MW hours [3]			
New Natural Gas Plant	$63.00	$63.00	$63.00
Power purchases (range)	$38.60 - $46.80	$41.10 - $50.20	$45.90 - $56.30
Partial Replacement Renewable/MW hours [4]	$61.80	$60.20	$59.80
Partial Replacement Tribal Solar/MW hours	$60.00	$60.00	$60.00

[1] Includes allowances for increases in coal costs based on EIA pricing projections

[2] Base costs for the 2-Unit Operation include an incremental $2/MW hours for fixed costs. Those costs are then allocated across the remaining output associated with 2-Unit Operation PFRs.

[3] Power purchase prices reflect mid-points of projected peak and off-peak price ranges at the Mead hub. Consequently, prices could be above or below the prices shown, and there is no certainty that the average prices for the period would be within the range shown.

[4] Based on 80 percent solar and 20 percent wind energy. For purposes of this analysis, the cost assumptions per MW hours for land-based wind generation during the three time periods are $69, $61 and $59, respectively.

Source: EIA 2015; NREL 2012a.

Factors driving the future costs would include additional lease payments to the Navajo Nation, capital and financing costs associated with installation of selective catalytic reduction, curtailment costs associated with a PFR energy source, and differences in energy prices between NGS and an alternative source. Future changes in operating costs, such as increases in payroll costs, ad valorem and in lieu taxes, and other capital investments, also could contribute to higher energy costs. The following discussions focus on the primary cost variables.

Amendment No.1 to the Indenture of Lease (Lease Amendment No. 1)

Under the terms of Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as Lease Amendment No. 1) the Navajo Nation would receive substantial increases in annual payments from the NGS participants. Those annual payments would include lease payments of $9,000,000 for the 323 ROW grants, increased annual support for scholarships to roughly $250,000, and an additional annual community payment of approximately $180,000. All of these payments would be subject to escalation based on the Consumer Price Index.[36] An additional annual payment of $34,000,000 also would be implemented, based on a 3-Unit Operation and subject to escalation based on the Consumer Price Index. The additional annual payment would be scaled back under a Proposed Action 2-Unit Operation, to $22,666,667 based on a rated capacity of 1,500 MW.

Average annual energy production for the Proposed Action 3-Unit Operation and 2-Unit Operation are 17,400,000 MW hours and 11,658,000 MW hours, respectively. Allocating the incremental lease costs associated with Lease Amendment No. 1 across that production would yield incremental costs per MW hours of $2.50 and $2.70, respectively. Those costs would increase under the PFR alternatives because the annual costs would be allocated across a smaller base of federal energy production (i.e., fewer MW hours of energy). The higher costs would accrue solely to Reclamation's ledger, increasing proportionately to the level of curtailed production for Reclamation. Thus, the largest increase would occur in conjunction with the 250-MW Natural Gas PFR Alternative.[37]

Capital Cost of Selective Catalytic Reduction Installation and Operation

Installation and operation of the selective catalytic reduction pollution control equipment would be the single largest factor driving future increases in cost. There are three variants of selective catalytic reduction that could be installed: conventional selective catalytic reduction, selective catalytic reduction with sorbent injection and a polishing baghouse, and selective catalytic reduction with sorbent injection and a full baghouse. Installation cost estimates vary substantially between variants, generating units, and sources, from $134.4 million to $410.9 million.[38] A decision on which variant would be implemented has not been made. Consequently, an average of the three estimates is used, yielding initial installed cost of $796 million for the 3-Unit Operation and $531 million for the 2-Unit Operation (2015 USD). Installation costs are assumed to be financed using long-term debt, issued at a 5.0 percent interest rate, with a 20-year term for the 3-Unit Operation and 15 years for the 2-Unit Operation.[39] The resulting annual debt service would be $63.4 million (3-Unit Operation) and $50.7 million (2-Unit Operation), equating to average costs of $3.60 per MW hours and $4.40 per MW hours, respectively. Additionally, an allowance of $0.80 per MW hours in operating costs is included (NREL 2012a). The net result would be a projected

[36] For purposes of this analysis, inflationary effects on the lease related payments are assumed to be zero, because they would affect all action alternatives.

[37] The additional annual payments could be reduced by a decision by the NGS participants to pursue a long-term down-rating of the NGS capacity in connection with a Natural Gas PFR Alternative. The analysis does not consider the effects of such a down-rating on annual payments or associated cost implications on the various participants.

[38] See NREL (2012a) "Navajo Generating Station and Air Visibility Regulations: Alternatives and Impacts" for a description of these technologies and a discussion of estimated installation costs.

[39] For this analysis, it is assumed that no U.S. Treasury funds would be used to finance the federal share of the debt. Rather, either CAWCD or participating utility(s) would issue the necessary debt, with increased rates used to provide debt service.

increase of $4.40 per MW hours for the Proposed Action 3-Unit Operation and $5.20 per MW hours for the Proposed Action 2-Unit Operation (**Table 3.18.A-2**).

Table 3.18.A-2 Incremental Costs of NGS Power Associated with Selective Catalytic Reduction Installation

	3-Unit NGS	2-Unit NGS
Installed Selective Catalytic Reduction Capital Cost (millions) [1]		
Selective Catalytic Reduction	$550.9	$367.3
Selective Catalytic Reduction with sorbent injection, polishing baghouse	$603.9	$402.6
Selective Catalytic Reduction with sorbent injection, full baghouse	$1,232.8	$821.9
Installed Capital Cost – Average (millions [rounded])	$796	$531
Term of debt financing	20 years	15 years
Annual debt service payment at 5% interest (millions)	$63.4	$50.7
Incremental Cost / MW hours, incl. $0.80 additional operating	$4.40	$5.20

[1] Capital costs based on NREL 2012a and a cost escalation factor of 1.09.

The incremental costs per MW hours of energy generated by NGS that would be attributable to selective catalytic reduction installation would rise with higher levels of energy sourced from a lower-emitting or renewable technology.

Table 3.18.A-3 presents the energy supply assumptions for this analysis, outlining the total annual power and energy supplied to CAP by NGS and acquired from alternative sources and the federal share of power generated by NGS that would be available for sale as surplus. Not shown, but included in subsequent energy cost estimates, is 300,000 MW hours of energy assumed to be purchased by CAWCD from Reclamation (Hoover Dam) and other sources.

Table 3.18.A-3 Summary Allocation of Federal Power from NGS and Partial Federal Replacement Sources for CAP

Alternative	NGS Supplied to CAP (MW hours)	NGS Available for Surplus (MW hours)	Total NGS Generated (MW hours)	PFR Supplied Power to CAP (MW hours)
Proposed Action 3-Unit Operation	2,696,000	1,472,000	4,168,000	NA
3-Unit/Natural Gas 100 MW	1,819,000	1,472,000	3,290,000	877,000
3-Unit/Renewable 100 MW	2,184,000	1,472,000	3,656,000	511,000
3-Unit/Tribal 100 MW	2,362,000	1,472,000	3,834,000	333,000
3-Unit/Natural Gas 250 MW	505,000	1,472,000	1,975,000	2,192,500
3-Unit/Renewable 250 MW	1,418,000	1,472,000	2,888,000	1,278,000
3-Unit/Tribal 250 MW	1,864,000	1,472,000	3,334,000	831,000
Proposed Action 2-Unit Operation	2,696,000	1,421,000	4,117,000	NA
2-Unit/Natural Gas 100 MW	1,819,000	1,421,000	3,240,000	877,000
2-Unit/Renewable 100 MW	2,184,000	1,421,000	3,605,000	511,000
2-Unit/Tribal 100 MW	2,362,000	1,421,000	3,783,000	333,000

Table 3.18.A-3 Summary Allocation of Federal Power from NGS and Partial Federal Replacement Sources for CAP

Alternative	NGS Supplied to CAP (MW hours)	NGS Available for Surplus (MW hours)	Total NGS Generated (MW hours)	PFR Supplied Power to CAP (MW hours)
2-Unit/Natural Gas 250 MW	505,000	1,421,000	1,926,000	2,192,500
2-Unit/Renewable 250 MW	1,418,000	1,421,000	2,839,000	1,278,000
2-Unit/Tribal 250 MW	1,862,000	1,421,000	3,283,000	831,000

Note: Annual energy quantities are for a typical year without accounting for the effects of scheduled minor or major maintenance (overhauls) on production.

NA = not applicable.

Charges Associated with Curtailment

The operating agreements for NGS allow a participant to request that power from its share of the plant's output be curtailed. Curtailment would become a common occurrence of normal plant operations under the PFR alternatives. When curtailment occurs, variable operating costs at NGS are reduced. However, certain fixed costs are still incurred and must be allocated to the remaining production. Unavoidable fixed costs are estimated at approximately $14.00 per MW hours for the Proposed Action 3-Unit Operation and $16.00 per MW hours for the Proposed Action 2-Unit Operation. When those fixed charges are re-distributed based on the level of curtailment associated with each PFR alternative, those charges would add between $4,662,000 and $30,695,000 per year to the costs of the remaining federal share of NGS output. On a "per MW hours generated" basis, the curtailment costs would add between $1.20 and $15.90 annually (**Table 3.18.A-4**).

Table 3.18.A-4 Incremental Costs to Reclamation due to NGS Curtailment Related to Partial Federal Replacement Alternatives

	Annual Charges for Curtailment	Annual Cost per MW hours of Federal Energy from NGS
Proposed Action 3-Unit Operation		
3-Unit/Natural Gas 100 MW	$12,278,000	$3.70
3-Unit/Renewable 100 MW	$7,154,000	$2.00
3-Unit/Tribal 100 MW	$4,662,000	$1.20
3-Unit/Natural Gas 250 MW	$30,695,000	$15.50
3-Unit/Renewable 250 MW	$17,892,000	$6.20
3-Unit/Tribal 250 MW	$11,634,000	$3.50
Proposed Action 2-Unit Operation		
2-Unit/Natural Gas 100 MW	$12,278,000	$3.80
2-Unit/Renewable 100 MW	$7,154,000	$2.00
2-Unit/Tribal 100 MW	$4,662,000	$1.20
2-Unit/Natural Gas 250 MW	$30,695,000	$15.90
2-Unit/Renewable 250 MW	$17,892,000	$6.30
2-Unit/Tribal 250 MW	$11,634,000	$3.50

The direct and proportional relationship between the level of curtailment and the incremental cost for the remaining production of federal power is evident above – as the level of curtailment increases, the cost shift to the remaining production also increases. Thus, the incremental costs due to curtailment that would be associated with 250-MW Natural Gas PFR Alternative would be substantially higher than the 100-MW Tribal PFR Alternative.

Supplemental Costs for Firming/Regulation of Renewable Generation

Solar and wind-powered generation is intermittent, both during the day and on a day-to-day and seasonal basis. To meet the CAP's reliability needs, expected variations on a day-to-day and seasonal basis would be factored into the supply of energy to be obtained from NGS. However, unexpected variations during the day would require firming (i.e., backup generating capacity and power from another source that can be supplied rapidly and on a temporary basis). Provisions for such power are available from other sources that feed into the regional electrical transmission and distribution system. For this assessment, such energy needs are estimated at 6 percent of the annual output provided by renewable sources under the Renewable and Tribal PFR alternatives (NREL 2016). It is assumed that the energy would be supplied by a natural gas facility and at the same $63.00 per MW hours assumed for replacement energy.

Total Future Energy Costs

Reclamation's future energy costs on a MW hours basis derived as the sum of the base cost for NGS with incremental costs associated with changes in the lease costs, curtailment, selective catalytic reduction installation, and firming, rounded to the nearest $0.10, are shown in **Table 3.18.A-5**. As shown, the energy cost associated with the Proposed Action 3-Unit Operation and 2-Unit Operation would be lower than those associated with the Renewable and Tribal PFR alternatives in all instances. In the event of sustained low natural gas prices, projected energy costs under the Natural Gas PFR Alternative could be lower than those for the Proposed Action, but also could be higher if natural gas prices rise. In all cases, the capital costs associated with selective catalytic reduction installation and Lease Amendment No. 1 would add $6.90 or more per MW hours.

Table 3.18.A-5 Estimated Future Energy Charges / MW hours for Federal Power from NGS and Partial Federal Replacement Sources

Alternative	CAP Annual Energy Charges / MW hours [1]		
	2020 to 2025	2026 to 2029	2030 to 2044
Proposed Action 3-Unit Operation	$47.20	$53.00	$54.40
3-Unit/Natural Gas 100 MW			
New Natural Gas Plant	$55.30	$60.00	$61.00
Power purchases (range)	$47.80 - $48.50	$53.20 - $54.70	$55.40 - $57.90
3-Unit/Renewable 100 MW	$52.60	$57.80	$58.60
3-Unit/Tribal 100 MW	$50.50	$55.90	$57.10
3-Unit/Natural Gas 250 MW			
New Natural Gas Plant	$63.50	$65.50	$65.70
Power purchases (range)	$45.10 - $57.60	$49.50 - $62.50	$52.80 - $68.90
3-Unit/Renewable 250 MW	$59.80	$63.80	$63.60
3-Unit/Tribal 250 MW	$55.10	$59.90	$60.90

Table 3.18.A-5 Estimated Future Energy Charges / MW hours for Federal Power from NGS and Partial Federal Replacement Sources

Alternative	CAP Annual Energy Charges / MW hours [1]		
	2020 to 2025	2026 to 2029	2030 to 2044
Proposed Action 2-Unit Operation	$49.40	$50.80	$57.50
2-Unit/Natural Gas 100 MW			
New Natural Gas Plant	$56.90	$57.90	$63.30
Power purchases (range)	$49.40 - $54.40	$51.20 - $56.40	$57.70 - $64.20
2-Unit/Renewable 100 MW	$54.40	$55.50	$61.20
2-Unit/Tribal 100 MW	$52.50	$53.70	$60.00
2-Unit/Natural Gas 250 MW			
New Natural Gas Plant	$64.00	$64.30	$66.60
Power purchases (range)	$45.00 - $57.50	$47.50 - $60.50	$52.70 - $68.70
2-Unit/Renewable 250 MW	$61.10	$61.80	$65.60
2-Unit/Tribal 250 MW	$56.60	$57.60	$63.10

[1] These estimates do not include the costs of power that would be obtained from other sources.

Implementation of any PFR alternative would raise the average and total energy costs to operate the CAP. The lowest cost impact would occur in conjunction with the 100-MW Tribal PFR Alternative, which would involve the least curtailment and sustain high levels of operation at NGS. In the 2020 to 2025 period, rates for the Natural Gas PFR Alternative could be lower if natural gas prices remain low, but also may exceed the cost of NGS if natural gas prices increase.

The largest cost impact would occur in conjunction with the 250-MW Natural Gas Alternative, particularly when assuming a 3-Unit Operation and higher natural gas prices. Under the latter scenario, the share of selective catalytic reduction investment, exclusive of financing costs, that would pass through to Reclamation, and consequently to CAWCD and purchasers of surplus power, would exceed $190 million. Those costs would then be recovered based on production that would only be approximately 45 percent of that under the Proposed Action. As shown the fully allocated per MW hours cost for the 250-MW Natural Gas PFR Alternative 3-Unit Operation would be as high as $68.90, which would be as much as 27 percent higher than the Proposed Action. Similar results would occur in conjunction with high levels of replacement from natural gas for the 2-Unit Operation following the installation of Selective Catalytic Reduction.

Implications for CAP's Annual Cost of Pumping Energy

Applying the energy charges presented in **Table 3.18.A-5** to CAP's annual power consumption would yield annual energy costs for energy to be supplied under the Proposed Action or PFR alternatives. The total annual energy costs include a $14.3 million allowance for the cost of energy obtained from Hoover Dam and energy purchases from the market; that value representing CAWCD's average expenditures for such energy in recent years. Availability and annual outlays for such energy are assumed to be unaffected by the Proposed Action or PFR alternatives.

As noted above, the lowest annual energy costs would be those associated with the Proposed Action. All other alternatives would result in higher costs over the long term. Annual costs for the Proposed Action 2-Unit Operation during the 2026 to 2029 period would be lower than for the Proposed Action 3-Unit Operation due to the selective catalytic reduction debt service associated with the latter. However, costs in the subsequent period would be higher after the selective catalytic reduction debt service begins for

the Proposed Action 2-Unit Operation. Ranges of energy charges are shown for the Natural Gas PFR Alternative, including those that would be associated with a new natural gas plant and those associated with purchases from existing sources, the latter being subject to future gas prices. The annual energy charges to CAP for the 2030 to 2044 time period, for all action alternatives, are presented in **Table 3.18.A-6** and shown in **Figure 3.18.A-1**.

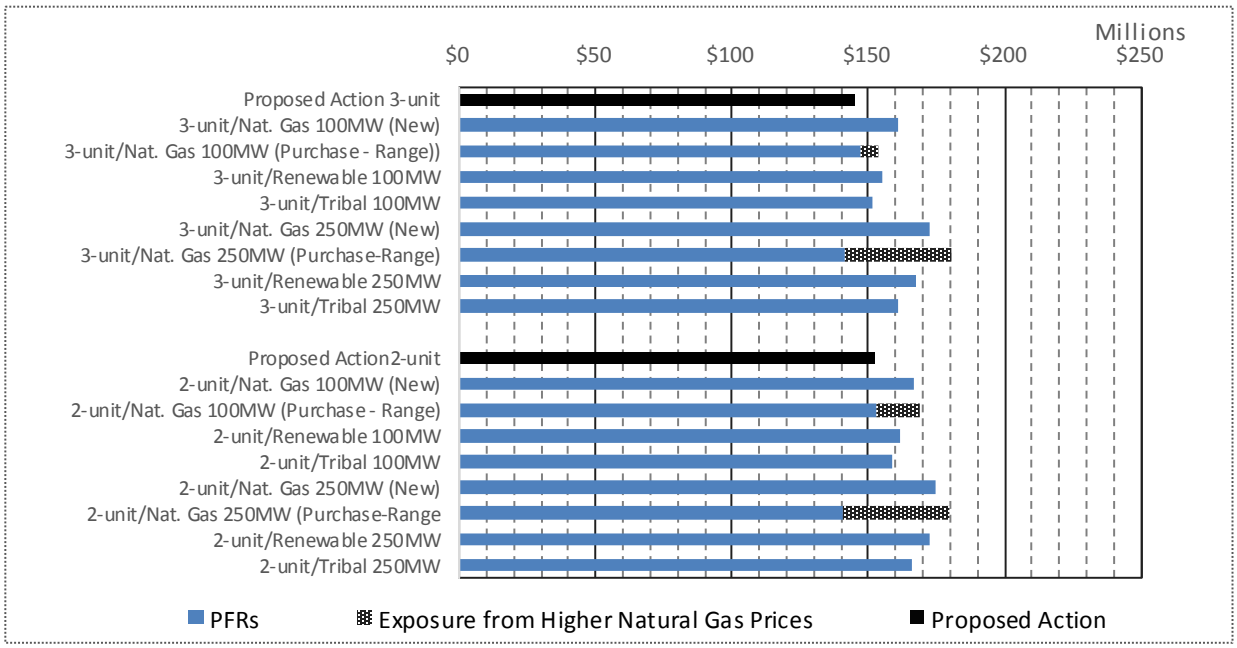

Figure 3.18.A-1 Annual CAP Energy Costs for NGS and Partial Federal Replacement Alternatives, 2030 to 2044

Table 3.18.A-6 Annual Energy Charges to CAP for NGS and Replacement Power

Alternative	Total Annual Energy Charges [1]		
	2020 to 2025	2026 to 2029	2030 to 2044
Proposed Action 3-Unit	$127,250,000	$141,540,000	$144,780,000
3-Unit/Natural Gas 100 MW			
New Natural Gas Plant	$146,930,000	$158,520,000	$160,950,000
Power purchases (range)	$128,870,000 to $130,490,000	$141,810,000 to $145,580,000	$147,200,000 to $153,400,000
3-Unit/Renewable 100 MW	$140,410,000	$153,080,000	$154,960,000
3-Unit/Tribal 100 MW	$135,290,000	$148,490,000	$151,460,000
3-Unit/Natural Gas 250 MW			
New Natural Gas Plant	$166,980,000	$171,830,000	$172,370,000
Power purchases (range)	$122,400,000 to $152,590,000	$132,910,000 to $164,460,000	$141,000,000 to $180,090,000
3-Unit/Renewable 250 MW	$157,990,000	$167,690,000	$167,150,000
3-Unit/Tribal 250 MW	$146,610,000	$158,200,000	$160,620,000
Proposed Action 2-Unit	$132,640,000	$136,150,000	$152,320,000
2-Unit/Natural Gas 100 MW			
New Natural Gas Plant	$150,980,000	$153,400,000	$166,340,000
Power purchases (range)	$132,640,000 to $144,780,000	$126,960,000 to $149,630,000	$152,860,000 to $168,500,000
2-Unit/Renewable 100 MW	$144,720,000	$147,420,000	$161,160,000
2-Unit/Tribal 100 MW	$140,140,000	$143,100,000	$158,470,000
2-Unit/Natural Gas 250 MW			
New Natural Gas Plant	$168,320,000	$168,860,000	$174,530,000
Power purchases (range)	$122,130,000 to $152,320,000	$128,060,000 to $159,600,000	$140,730,000 to $179,550,000
2-Unit/Renewable 250 MW	$161,220,000	$162,840,000	$172,000,000
2-Unit/Tribal 250 MW	$150,000,000	$152,420,000	$165,890,000

[1] Included in the annual energy charges is a $14.3 million annual allowance for the cost of power from Hoover Dam and energy purchases from the market.

Projected annual energy costs on a per acre-foot of water pumped range from $77 to $105 during the 2020 to 2025 period, $83 to $106 during the 2026 to 2029 period, and $88 to $113 during the 2030 to 2044 period (**Table 3.18.A-7**). Costs associated with selective catalytic reduction installation, Lease Amendment No. 1 provisions and underlying increases in basic operating costs would account for approximately $10 of the increase over time for the Proposed Action and PFR alternatives based on a 3-Unit Operation. The corresponding incremental cost for the Proposed Action 2-Unit Operation would be $12. The remaining cost differences between a PFR alternative and the corresponding Proposed Action (**Table 3.18.A-8**), reflect the reallocation of fixed costs, curtailment, firming, and the cost effects of the range of natural gas prices. Future CAP energy costs under the Natural Gas PFR Alternative could be below those of the Proposed Action given sufficiently low natural gas prices.

Table 3.18.A-7 CAP Annual Energy Charges / Acre-Foot

Alternative	Annual Energy Charges / Acre-Foot [1,2]			
	2020 to 2025	2026 to 2029	2030 to 2044	Net Change 2020 to 2044 (across the row)
Proposed Action 3-Unit	$80	$88	$90	$10
3-Unit/Natural Gas 100 MW				
New Natural Gas Plant	$92	$99	$101	$9
Power purchases (range)	$81 to $82	$89 to $91	$92 to $96	Up to $15
3-Unit/Renewable 100 MW	$88	$96	$97	$9
3-Unit/Tribal 100 MW	$85	$93	$95	$10
3-Unit/Natural Gas 250 MW				
New Natural Gas Plant	$104	$107	$108	$4
Power purchases (range)	$77 to $95	$83 to $103	$88 to $113	Up to $36
3-Unit/Renewable 250 MW	$99	$105	$104	$5
3-Unit/Tribal 250 MW	$92	$99	$100	$8
Proposed Action 2-Unit	$83	$85	$95	$12
2-Unit/Natural Gas 100 MW				
New Natural Gas Plant	$94	$96	$104	$10
Power purchases (range)	$83 to $91	$86 to $94	$96 to $105	Up to $32
2-Unit/Renewable 100 MW	$90	$92	$101	$11
2-Unit/Tribal 100 MW	$88	$89	$99	$11
2-Unit/Natural Gas 250 MW				
New Natural Gas Plant	$105	$106	$109	$4
Power purchases (range)	$76 to $95	$80 to $100	$88 to $112	Up to $36
2-Unit/Renewable 250 MW	$101	$102	$108	$7
2-Unit/Tribal 250 MW	$94	$95	$104	$10

[1] Based on 1,600,000 acre-feet per year.

[2] Equivalent rate for 2016 is $76 / acre-feet (CAWCD 2015b).

Table 3.18.A-8 Difference in CAP Annual Energy Charges / Acre-Foot

Alternative	Difference in Annual Energy Charges / Acre-Foot [1]		
	2020 to 2025	2026 to 2029	2030 to 2044
Proposed Action 3-Unit	na	na	na
3-Unit/Natural Gas 100 MW			
New Natural Gas Plant	$12	$11	$11
Power purchases (range)	$1 to $2	$1 to $3	$2 to $6
3-Unit/Renewable 100 MW	$8	$8	$7
3-Unit/Tribal 100 MW	$5	$5	$5
3-Unit/Natural Gas 250 MW			
New Natural Gas Plant	$24	$19	$25
Power purchases (range)	-$3 to $15	-$5 to $15	-$2 to $23
3-Unit/Renewable 250 MW	$19	$17	$14
3-Unit/Tribal 250 MW	$12	$11	$10
Proposed Action 2-Unit	na	na	na
2-Unit/Natural Gas 100 MW			
New Natural Gas Plant	$11	$11	$9
Power purchases (range)	$0 to -$11	$1 to $11	$1 to $10
2-Unit/Renewable 100 MW	$13	$7	$6
2-Unit/Tribal 100 MW	$5	$4	$4
2-Unit/Natural Gas 250 MW			
New Natural Gas Plant	$12	$21	$14
Power purchases (range)	-$7 to $11	-$5 to $15	-$7 to $17
2-Unit/Renewable 250 MW	$18	$17	$13
2-Unit/Tribal 250 MW	$11	$10	$9

[1] Differences are compared to the appropriate Proposed Action 3-Unit Operation or 2-Unit Operation.

Surplus energy sales of the federal share of NGS power historically have served an important role in CAP financing and in meeting CAWCD's federal debt repayment obligations. Such sales are heavily contingent upon the cost of power from NGS being lower than those from other sources and being available during periods of peak demand. Consequently, rate increases under the PFR alternatives would erode the potential for and realizable revenues from future surplus energy sales. In recent years, gross surplus sales revenue has averaged approximately $42 million annually. Net revenues have been much lower, contributing about one-fourth of CAPs annual repayment obligation.

The per acre-foot energy rate projections shown in **Tables 3-18.A-7** and **Table 3-18.A-8** suggest that the increases in rates stemming from installation of selective catalytic reduction and effects of curtailment on costs associated with the PFR alternatives could pose threats to surplus energy sales, with the incremental costs increasing as a direct function of the levels of replacement energy. For the Natural Gas PFR Alternative, continued low natural gas prices could offer lower rates and result in savings to CAP. On the other hand, rising natural gas prices also would raise rates and undermine surplus energy sales and revenues. As noted above, reductions or the total elimination of such revenues due to the high cost of energy would represent a financial risk to CAP's customers. To compensate for future reductions in surplus revenues would require adjustments by CAP to fund debt service. In addition to surplus, resources available to CAWCD for debt service would include the capital charges assessed to M&I

customers, reserves, and ad valorem/property taxes. CAWCD currently imposes the maximum permissible rate for the latter.

Annual Pumping Energy Costs under No Action

A decision to withhold federal approval of those actions necessary to allow operation of NGS and the proposed KMC to continue would necessitate actions on the part of CAWCD to secure an alternative source(s) of 2.7 TW hours of electrical power and energy to operate the CAP system.[40] Replacement energy supply and delivery agreement(s) would need to be in place and operational not later than December. 22, 2019, when NGS would be taken off line. The replacement agreement could involve a short-term purchase agreement to acquire energy from existing generating sources and a long-term agreement based on power from new source(s), including renewable sources. NREL's analysis indicates projected long-term rates for new construction at approximately $63 per MW hours. Such rates translate to pumping energy costs of $104 per acre-foot. When combined with the long-term uncertainties associated with natural gas rates and the loss of surplus energy sales that would result, construction of a new facility is seen as impractical.

Based on NREL's analysis, the low-cost short-term option likely would be energy supplied by existing natural gas sources. Depending on market conditions, energy could be available at lower cost from existing sources. **Table 3.18 A-9** presents the comparative energy pumping rates and energy costs for the No Action Alternative and the Proposed Action.

Table 3.18.A-9 Energy Costs Per MW hours – Proposed Action and No Action Alternatives

	2020	2026	2030
Energy Pumping Rates per Acre-Foot			
Proposed Action 3-Unit	$80	$88	$90
Proposed Action 2-Unit	$83	$85	$95
No Action (new natural gas plant)	$104	$104	$104
No Action (power purchase – range)	$64 to $87	$70 to $98	$78 to $110
Annual Pumping Energy Charges for CAP			
Proposed Action 3-Unit	$127,250,000	$141,540,000	$144,780,000
Proposed Action 2-Unit	$132,640,000	$136,150,000	$152,320,000
No Action (new natural gas plant)	$165,800,000	$165,800,000	$165,800,000
No Action (power purchase – range)	$101,640,000 to $139,110,000	$112,690,000 to $156,100,000	$124,290,000 to $175,510,000

Compared to the effects under the Proposed Action, the No Action Alternative would result in substantial reductions in regional income and consumer, business, and government expenditures to pay for energy; the loss of surplus revenue sales; and the elimination of continued contributions towards CAP's debt service repayments, plant reclamation and retirement costs, and retiree health care. CAP's energy costs under No Action could be lower or higher than under the Proposed Action depending largely on the future prices of natural gas.

[40] For purposes of this assessment, it is assumed that energy from Hoover Dam and other sources would continue to be available to CAWCD at the same cost and in the same quantities as it would be assuming the Proposed Action or PFR alternatives.

Conclusion

Implementation of either Proposed Action operation would result in higher energy costs to operate the CAP system compared to historical operations (**Table 3.18.A-10**). The higher costs would result from increases in NGS operating costs, increases in lease payments to the Navajo Nation, and environmental compliance costs necessary for operations to continue. The increases in lease payments would be the first substantive increase in such payments since the NGS became operational. The costs increases borne by the CAP, on a per MW hours basis, would be comparable to those borne by all participants in NGS.

Table 3.18.A-10 Annual Energy Charges to CAP for NGS Power – Proposed Action

Alternative	Annual Energy Charges [1]			
	2020 to 2025	2026 to 2029	2030 to 2044	Net Change 2020 to 2044
Proposed Action 3-Unit Operation				
Annual Energy Charges for NGS-Related Power	$127,250,000	$141,540,000	$144,780,000	$17,530,000
Estimated Energy Rate / acre-foot	$80	$88	$90	$10
Proposed Action2-Unit Operation				
Annual Energy Charges for NGS-Related Power	$132,640,000	$136,150,000	$152,320,000	$19,680,000
Estimated Energy Rate / acre-foot	$83	$85	$95	$10

[1] These costs reflect only the cost of power from NGS, power obtained from Hoover Dam, and purchases from other sources. Costs for transmission and costs associated with load shaping, scheduling or other purposes are not included.

The estimated energy costs in 2020 under the Proposed Action 3-Unit Operation would be $80 per acre-foot, as compared to historical (2016) costs of approximately $76 per acre-foot. Consequently, the estimated future costs in 2020 would represent a 5 percent increase in the energy pumping rate component of CAP's rate, with the $88 costs in 2026 through 2029 representing a 16 percent increase compared to 2016 costs. When considered relative to the total annual costs for the four major categories of customers, the $4 per acre-foot incremental costs between 2020 and 2025 [$80 - $76 = $4] would represent increases of between 2 percent and 5 percent (**Table 3.18.A-11**). The largest relative impact would be for users in the Agricultural Settlement Pool that pay only energy charges. The $14 per acre-foot increment in 2030 to 2044 [$90 - $76] would represent an effective increase of between 8 percent and 18 percent of the current rates. Any future increases in the fixed operations and maintenance of CAPs rates would compound the effects of higher pumping energy costs for M&I customers.

Table 3.18.A-11 Comparative Impact of Energy Charges for CAP Customers

	Total Annual Energy Charges			
	M&I Long-term Subcontract	M&I Non-subcontract and Recharge	Federal	Agricultural Settlement Pool
Firm 2016 Rate per acre-foot	$161	$184	$161	$76
$4 increase as a percent of 2016 firm rate	2%	2%	2%	5%
$14 increase as a percent of 2016 firm rate	9%	8%	9%	18%

In relative terms, the impacts of the higher rates would be more substantive on Indian and non-Indian agricultural interest that use CAP water for irrigation. Because agricultural producers are not able to set the prices for their commodities, increases in production costs typically come from the "bottom line", i.e.,

lower farm income. Increased production costs and lower income may result in farming operations being scaled back, changes in cropping patterns or the amount of land in production, or in extreme instances, could result in cessation of farming. Agricultural use of water represents approximately 25 to 30 percent of the annual water deliveries by CAP.

For M&I users, the effects of higher energy rates are tempered by the relatively low share that water costs represent to the ultimate cost of potable water to the consumer. Water treatment, storage, distribution and system administration account for the majority of ultimate costs to the consumer. Municipal and industrial water use, including water leased by tribes to other M&I users, represents approximately half of the annual deliveries by CAP. Presumably, those leases provide for energy pumping costs to pass through to the lessee.

The third major customer group is the Central Arizona Groundwater Recharge District and the Arizona Water Banking Authority. The increases in energy costs would result in a direct increase in the water acquisition costs for these two entities. Both entities are funded by a combination of public funds and user and water management fees. Increases in costs may require increases in fees, use of reserves, or other means to address the higher costs.

The increase in energy costs (**Table 3.18.A-12**) would require reductions in consumer, business and government expenditures for other goods and services, some of which would occur within the region, but some of which also would affect non-local expenditures.

Table 3.18.A-12 Difference in CAP Annual Energy Charges / Acre-Foot

Alternative	Difference in Annual Energy Charges / Acre-Foot [1]		
	2020 to 2025	2026 to 2029	2030 to 2044
Proposed Action 3-Unit Operation			
3-Unit/Natural Gas 100 MW			
New Natural Gas Plant	$12	$11	$11
Power purchases (range)	$1 to $2	$1 to $3	$2 to $6
3-Unit/Renewable 100 MW	$8	$8	$7
3-Unit/Tribal 100 MW	$5	$5	$5
3-Unit/Natural Gas 250 MW			
New Natural Gas Plant	$24	$19	$25
Power purchases (range)	-$3 to $15	-$5 to $15	-$2 to $23
3-Unit/Renewable 250 MW	$19	$17	$14
3-Unit/Tribal 250 MW	$12	$11	$10
Proposed Action 2-Unit Operation			
2-Unit/Natural Gas 100 MW			
New Natural Gas Plant	$11	$11	$9
Power purchases (range)	-$11 to $0	$1 to $11	$1 to $10
2-Unit/Renewable 100 MW	$13	$7	$6
2-Unit/Tribal 100 MW	$5	$4	$4

Table 3.18.A-12 Difference in CAP Annual Energy Charges / Acre-Foot

Alternative	Difference in Annual Energy Charges / Acre-Foot [1]		
	2020 to 2025	2026 to 2029	2030 to 2044
2-Unit/Natural Gas 250 MW			
New Natural Gas Plant	$12	$21	$14
Power purchases (range)	-$7 to $11	-$5 to $15	-$7 to $17
2-Unit/Renewable 250 MW	$18	$17	$13
2-Unit/Tribal 250 MW	$11	$10	$9

[1] Differences are as compared to the appropriate Proposed-Action 3-Unit Operation or 2-Unit Operation.

Surplus energy sales of the federal share of NGS power have historically served an important role in CAP financing and in meeting CAWCD's federal debt repayment obligations. Such sales are heavily contingent upon the cost of power from NGS being lower than those from other sources, and being available during periods of peak demand. Consequently, rate increases under the PFR alternatives would erode the potential for revenues from future surplus energy sales. In recent years, gross surplus sales revenue has averaged approximately $42 million annually. Net revenues have been much lower, contributing about one-fourth of CAP's annual repayment obligation.

The per acre-foot energy rate projections shown in **Tables 3-18.A-7** and **Table 3-18.A-8** suggest that the increases in rates stemming from installation of selective catalytic reduction and effects of curtailment on costs associated with the PFR alternatives could pose threats to surplus energy sales, with the incremental costs increasing as a direct function of the levels of replacement energy. For the Natural Gas PFR Alternative, continued low natural gas prices could offer lower rates and result in savings to CAP. Conversely, rising natural gas prices also would raise rates and undermine surplus energy sales and revenues. As noted above, reductions or elimination of such revenues due to the high cost of energy represents a financial risk to CAPs customer's compensation for future reductions in surplus revenues would require adjustments by CAP to fund debt service. Surplus resources available to CAWCD for debt service include the capital charges assessed to M&I customers, reserves, and ad valorem/property taxes. CAWCD currently imposes the maximum permissible rate for the latter.

Annual Pumping Energy Costs under No Action

A decision to withhold federal approval of those actions necessary to allow continued operation of NGS and the proposed KMC would necessitate actions on the part of CAWCD to secure an alternative source(s) of 2.7 TW hours of electrical power and energy annually, to operate the CAP system.[41] Replacement energy supply and delivery agreement(s) would need to be in place and operational not later than December 22, 2019, when NGS is taken off-line. The replacement agreement could involve a short-term power purchase agreement from existing generating sources and subsequent long-term agreements to acquire power from new source(s), including renewable sources. NREL's analysis indicates projected long-term rates for new construction at approximately $63 per MW hour, which translates to pumping energy costs of $104 per acre-foot. When combined with the long-term uncertainties associated with natural gas rates, and the loss of surplus energy sales that would result, construction of a new facility is seen as impractical.

[41] For purposes of this assessment, it is assumed that energy from Hoover Dam and other sources would continue to be available to CAWCD at the same cost and in the same quantities as under the Proposed Action or PFR alternatives.

Based on NREL's analysis, the low-cost short-term option likely would be energy supplied by existing natural gas sources. Depending on market conditions, energy could be available at lower cost from existing sources. **Table 3.18 A-13** presents the comparative energy pumping rates and energy costs for the No Action Alternative and the Proposed Action.

Table 3.18.A-13 Energy Costs Per MW hours – Proposed Action and No Action Alternatives

	2020	2026	2030
Energy Pumping Rates per Acre-Foot			
Proposed Action 3-Unit Operation	$80	$88	$90
Proposed Action 2-Unit Operation	$83	$85	$95
No Action (new natural gas plant)	$104	$104	$104
No Action (power purchase – range)	$64 to $87	$70 to $98	$78 to $110
Annual Pumping Energy Charges for CAP			
Proposed Action 3-Unit Operation	$127,250,000	$141,540,000	$144,780,000
Proposed Action 2-Unit Operation	$132,640,000	$136,150,000	$152,320,000
No Action (new natural gas plant)	$165,800,000	$165,800,000	$165,800,000
No Action (power purchase – range)	$101,640,000 to $139,110,000	$112,690,000 to $156,100,000	$124,290,000 to $175,510,000

As compared to the effects under the Proposed Action, the No Action would result in substantial reductions in regional income and consumer, business, and government expenditures to pay for energy. In addition, the No Action Alternative would result in the loss of surplus revenue sales, and elimination of continued contributions towards CAP's debt service repayments, plant reclamation and retirement costs, and retiree health care. CAP's energy costs under No Action could be lower or higher than under the Proposed Action depending largely on future natural gas prices used to fire combined cycle power plants.

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Section 3.19

Environmental Justice

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Acronyms and Abbreviations

1969 Lease	Navajo Project Indenture of Lease
BART	Best Available Retrofit Technology
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BM&LP Railroad	Black Mesa & Lake Powell Railroad
BO	Biological Opinion
CAP	Central Arizona Project
CAWCD	Central Arizona Water Conservation District
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO_2	carbon dioxide
COPEC	Chemicals of potential ecological concern
Co-tenants	Salt River Project, Arizona Public Service Company, NV Energy, and Tucson Electric Power Company
Development Fund	Lower Colorado River Basin Development Fund
EIS	Environmental Impact Statement
ERA	Ecological Risk Assessment
ESA	Endangered Species Act of 1973
HHRA	Human Health Risk Assessment
HQ	Hazard quotient
km	kilometer
KMC	Kayenta Mine Complex
kV	kilovolt
kW	kilowatt
MW	megawatt
N-Aquifer	Navajo Aquifer
NEPA	National Environmental Policy Act of 1969, as amended
NGS	Navajo Generating Station
NGS Participants	U.S. (Reclamation), Salt River Project, Arizona Public Service Company, NV Energy, and Tucson Electric Power Company
NHPA	National Historic Preservation Act
NNEPA	Navajo Nation Environmental Protection Agency
NO_2	nitrogen dioxide
NO_X	nitrogen oxide
OSMRE	Office of Surface Mining Reclamation and Enforcement
PA	Programmatic Agreement
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PFR	Partial Federal Replacement

PWCC	Peabody Western Coal Company
Reclamation	U.S. Bureau of Reclamation
ROW	Right-of-way
SO_2	sulfur dioxide
SRP	Salt River Project Agricultural Improvement and Power District
STS	Southern Transmission System
TCP	traditional cultural property
tpy	tons per year
U.S.	United States
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WTS	Western Transmission System

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3.19 Environmental Justice

Environmental justice is defined by the U.S. Environmental Protection Agency (USEPA) 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" (USEPA 1998).

3.19.1 Regulatory Overview

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, tasks "…each Federal agency [to] make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high adverse human health and environmental effects of its programs, policies, and activities on minority populations and low-income populations." The Executive Order makes clear that its provisions apply fully to programs involving Native Americans (Council on Environmental Quality [CEQ] 1997).

The memorandum accompanying Executive Order 12898 states that each federal agency shall analyze the environmental effects on minority communities and low-income communities, when such analysis is required by the National Environmental Policy Act (NEPA) (USEPA 1994). The accompanying memorandum identifies the following ways to consider environmental justice under NEPA.

1. Each federal agency should analyze the environmental effects, including human health, economic, and social effects, of federal actions, including effects on minority communities and low-income communities when such analysis is required by NEPA.
2. Mitigation measures outlined or analyzed in an Environmental Assessment, Environmental Impact Statement (EIS), or Record of Decision, whenever feasible, should address significant and adverse environmental effects of proposed federal actions on minority communities and low-income communities.
3. Each federal agency shall provide opportunities for community input in the NEPA process, including identifying potential effects and mitigation measures in consultation with affected communities and improving the accessibility of meetings, crucial documents, and notices (Executive Order 12898).

The CEQ environmental justice guidance states that, "Agencies should recognize that the impacts within minority populations, low-income populations, or Indian tribes may be different from impacts on the general population due to a community's distinct cultural practices." One of CEQ's general principles for environmental justice assessment is "Agencies should recognize the interrelated cultural, social, occupational, historical, or economic factors that may amplify the natural and physical environmental effects of the proposed agency action. These factors should include the physical sensitivity of the community or population to particular impacts; the effect of any disruption on the community structure associated with the proposed action; and the nature and degree of impact on the physical and social structure of the community" (CEQ 1997).

The U.S. Department of the Interior NEPA policy states that "To comply with the environmental justice policy established by the Secretary of the Interior, bureaus and offices should identify and evaluate, during the scoping and\or planning processes, any anticipated effects, direct or indirect, from the proposed project, action or decision on minority and low-income populations and communities, including the equity of the distribution of the benefits and risks" (U.S. Department of Interior 1995).

The environmental justice assessment conducted for this EIS includes the following elements:

- Determination of whether the action under consideration would have adverse environmental, human health, economic, social, or cultural effects on any population;
- Description of the environmental justice populations within areas where adverse environmental, human health, economic, social, or cultural effects would occur;
- Determination of whether such environmental, human health, economic, social, or cultural effects would be disproportionately high and adverse on identified environmental justice populations; and
- Description of the opportunities provided for effective participation in the NEPA process.

3.19.2 Study Areas

3.19.2.1 Proposed Action and Alternatives

3.19.2.1.1 Navajo Generating Station and Proposed Kayenta Mine Complex

The Proposed Action and alternatives involve activities on tribal lands within the external boundaries of the Navajo Nation and Hopi Reservation. Although most direct effects of the Proposed Action and alternatives would be concentrated in proximity to the Navajo Generating Station (NGS) and the proposed Kayenta Mine Complex (KMC), secondary effects associated with direct, indirect, and induced economic, employment, and fiscal effects of the Proposed Action and alternatives would accrue throughout the Navajo Nation and Hopi Reservation and in Coconino and Navajo counties in Arizona. The air quality study area includes a 300-kilometer (km) radius from NGS. The public health and human health risk assessment (HHRA) study area includes a 50-km radius from the NGS and proposed KMC emission points. The assessments conducted for air quality and the HHRA did not identify adverse environmental or human health effects on any population within the 300-km or 50-km study areas for those assessments. Consequently, the NGS and proposed KMC environmental justice study area is limited to the Navajo Nation and Hopi Reservation.

3.19.2.1.2 Transmission Systems and Communication Sites

Descriptions of the transmission systems and communication sites are provided in Section 1.7.3 and Section 3.18.3.2. The Western Transmission System (WTS) is approximately 275 miles in length and crosses portions of the Navajo, Kaibab Paiute, and Moapa Paiute reservations, the latter within a Bureau of Land Management reserved right-of-way (ROW) corridor. The Southern Transmission System (STS) is approximately 257 miles in length and crosses portions of the Navajo Nation. There are 19 radio communication sites supporting operations of the plant, railroad, and transmission systems.

3.19.2.1.3 Central Arizona Project Area of Indirect Socioeconomic Effects

The environmental justice assessment for the Central Arizona Project (CAP) area of indirect socioeconomic effects is focused on the counties and reservations where the CAP water deliveries are made to CAP customers and where the associated indirect socioeconomic effects likely could occur, rather than on the areas surrounding the entire physical CAP system. The study area for potential indirect environmental justice effects on CAP customers includes those parts of Maricopa, Pinal, and Pima counties in central and southern Arizona (**Table 3.18-1**) where CAP water deliveries are made.

Section 1.3 and Section 3.18.3.3 describe the CAP and its relationship to the NGS. The 336-mile-long CAP system traverses much of southwestern Arizona, from Lake Havasu in La Paz County to the southern boundary of the San Xavier Indian Reservation southwest of Tucson in Pima County. CAP water deliveries are made to municipal and industrial water users, agricultural users, and CAP tribes in Maricopa, Pinal, and Pima counties, Arizona. Portions of the San Carlos Apache tribal land are located in Gila and Graham counties, Tonto Apache tribal land is located in Yavapai County, and White Mountain Apache tribal land is located in Navajo and Apache counties; however, none of the CAP

system is located in those counties. Fort McDowell,Yavapai Apache, and the Salt River Pima-Maricopa Indian Community do not currently utilize CAP water on their reservations, allowing them to direct their CAP allocations for other purposes.

3.19.2.2 Cumulative

The cumulative study areas for environmental justice are the same as those described for the Proposed Action and alternatives.

3.19.3 Affected Environment

The resident population of the Navajo Nation and Hopi Tribe includes sufficient numbers of minority and low-income residents to warrant consideration under the environmental justice guidelines of Executive Order 12898. **Table 3.19-1** summarizes minority population characteristics for the Navajo and Hopi tribes, as well as Navajo and Coconino counties, the latter of which contain portions of the Navajo Nation and the entire Hopi Reservation. CEQ guidelines specify that, “Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis” (CEQ 1997). In 2010, Native Americans and other racial and ethnic minorities comprised 97.9 percent of all residents on the Navajo Nation and 97.5 percent of all residents on the Hopi Reservation. As might be expected, the vast majority of these minority populations were Native Americans. Consequently on the basis of race alone, the Navajo Nation and Hopi Reservation qualify as environmental justice populations.

The population of Navajo County was comprised of 56.1 percent Native Americans and other racial and ethnic minorities, and Coconino County was comprised of 44.8 percent. The Coconino and Navajo County racial and ethnic minority populations include the Navajo and Hopi within the respective counties. In comparison, the State of Arizona as a whole was comprised of 42.2 percent minorities, and the population of the U.S. at the time of the 2010 census was 36.3 percent minority (U.S. Census Bureau 2010).

Table 3.19-1 2010 Minority Populations in the Study Area and Comparative Reference Areas

Geographic Area	Total Population	Percent White and Not Hispanic or Latino	Percent Minority	Percent Native American
Navajo Nation (Arizona portion)	101,835	2.1	97.9	97.1
Hopi Reservation	7,185	2.5	97.5	96.2
Apache County	71,518	20.4	79.6	74.5
Coconino County	134,421	55.2	44.8	28.9
Navajo County	107,449	43.9	56.1	44.9
State of Arizona	6,392,017	57.8	42.2	5.5
United States	308,745,538	63.7	36.3	1.7

Source: U.S. Census Bureau 2010.

The two reservations qualify as low-income-related environmental justice populations. The incidence of poverty on the Navajo Nation and Hopi Reservation is much higher than the State of Arizona as a whole (**Table 3.19-2** and Section 3.18.3.1 discussion of Personal Income). The U.S. Census Bureau’s 2009 to 2013 American Community Survey estimated that 41.2 percent of the residents on the Arizona portion of the Navajo Nation and 31.8 percent of the population on the Hopi Reservation had incomes below the poverty threshold. The comparable estimates were 30.3 percent for Navajo County and 23 percent for

Coconino County. In comparison, 17.9 percent of the population in the State of Arizona and 15.4 percent of the population in the U.S. were estimated to be below the poverty level.

Table 3.19-2 2010 Low Income Populations in the Study Area and Comparative Reference Areas

Geographic Area	Per Capita Income (2013 dollars)	Income Below Poverty[1] (percent)
Navajo Nation (Arizona portion)	$10,840	41.2
Hopi Reservation	$12,989	31.8
Apache County	$12,709	36.2
Coconino County	$23,382	23.0
Navajo County	$16,626	30.3
State of Arizona	$25,358	17.9
United States	$28,155	15.4

[1] Based on 2009-2013 American Community Survey.

Source: U.S. Census Bureau 2014a,b.

3.19.3.1 Navajo Generating Station and Proposed Kayenta Mine Complex

In addition to the CEQ (1997) environmental justice guidance noted above, CEQ environmental justice guidance under NEPA further specifies that, “In identifying minority communities, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a geographically dispersed/transient set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect. The selection of the appropriate unit of geographic analysis may be the jurisdiction of a governing body, a neighborhood, census tract, or other similar unit that is to be chosen so as to not artificially dilute or inflate the affected minority population (CEQ 1997).

Within the larger environmental justice populations on the Navajo Nation, persons living near NGS and associated facilities primarily have voiced concerns about the effects of emissions from NGS. Persons residing within the vicinity of the proposed KMC have been and continue to be affected by mining activities, relocation, withdrawal of grazing lands, alteration and removal of traditional cultural properties (TCPs), sacred sites, and burials, and change in the cultural landscape and setting (Section 3.18.3.1). In defining the purpose and authority of the Black Mesa Review Board (described in the Kayenta/Black Mesa Lease Area Oversight and Planning subsection in Section 3.18.3.1), the Navajo Nation Code acknowledges the potential for adverse effects and impacts of coal mining and related operations on the socioeconomic and environmental interests of Navajo families living within the five chapters (Black Mesa, Chilchinbeto, Forest Lake, Kayenta, and Shonto) that contain or are adjacent to the proposed KMC (Title 2 Navajo Nation Code, Chapter 3, Subchapter 11, Article 5, Section 902). Therefore, persons living within and adjacent to the proposed KMC merit specific consideration under environmental justice guidelines.

3.19.3.2 Central Arizona Project Area of Indirect Socioeconomic Effects

As described in Section 3.18.3.3, the CAP delivers water to municipal and industrial water users, agricultural users, and CAP tribes in Maricopa, Pinal, and Pima counties, Arizona, which had a combined 2010 population of 5,173,150 (**Table 3.18-24**). At the time of the 2010 Census, 58.7 percent of the Maricopa and Pinal County population and 55.3 percent of the Pima County population was white alone, not Hispanic or Latino. Maricopa and Pinal counties were 42.2 percent all other races, and Pima County was 44.7 percent all other races. The comparable percentages for the U.S. were 63.7 percent white alone, Hispancic, or Latino and 36.3 percent minority (U.S. Census Bureau 2016). Consequently,

considered in their entirety, the residents of the three counties as a whole do not comprise an environmental justice population on the basis of race.

Within the three counties, the percentage of persons living below the poverty level at the time of the 2010 Census was 13.9 percent for Maricopa County, 13.5 percent for Pinal County, and 16.4 percent for Pima County. The comparable statistic for the U.S. was 13.8 (**Table 3.18-26**). Consequently, the residents of the three counties considered in their entirety do not comprise an environmental justice populations on the basis of income.

The reservations of the 10 tribes with Colorado River allocations (**Table 3.18-24**) are environmental justice populations based on racial considerations. Eight of the 10 tribes, excluding the Fort McDowell Yavapai and the Pascua Yaqui, also are considered environmental justice populations based on the meaningfully greater percentage of reservation residents below the poverty level as compared to those in surrounding counties, the State of Arizona, and the nation as a whole (**Table 3.18-26**).

3.19.4 Environmental Consequences

3.19.4.1 Issues

Impacts to environmental justice populations in the areas surrounding the NGS and within and adjacent to the proposed KMC are discussed relative to each of the following resources.

- Air Quality
- Water Resources
- Hazardous Materials
- Public Health and Human Health
- Cultural Resources
- Socioeconomic Conditions

Impacts to environmental justice populations in the CAP area of indirect socioeconomic effects pertain primarily to changes in:

- Electrical power and pumping costs for CAP and its users; and
- Contributions to the development fund.

3.19.4.2 Assumptions and Impact Methodology

Section 3.19.2.1 describes the study area for the environmental justice assessment for NGS and the proposed KMC. In Section 3.19.3, residents of the Navajo Nation and Hopi Reservation were identified as environmental justice populations based on the concentration of minority and low-income populations on both reservations.

The assessment for environmental justice draws on the findings of the air quality, water, geology, minerals, soils, and biological resources; land use; public health and human health; hazardous materials; cultural and paleontological resources; and socioeconomic assessments conducted for this EIS to identify:

- Whether the Proposed Action or alternatives would have adverse environmental, human health, economic, social, or cultural effects on any population; and
- Whether such environmental, human health, economic, or social effects would be disproportionately high and adverse on identified environmental justice populations.

For determination of disproportionately high and adverse human health effects, CEQ (1997) guidance requires consideration of the following:

(a) Whether the health effects would be significant (as employed by NEPA) or above generally accepted norms;

(b) Whether the risk or rate of hazard exposure by a minority population, low-income population, or Tribe to an environmental hazard would be significant (as employed by NEPA) and would appreciably exceed the risk or rate to the general population or other appropriate comparison group; and

(c) Whether health effects would occur in a minority population, low-income population, or Tribe affected by cumulative or multiple adverse exposures from environmental hazards.

For determination of disproportionately high and adverse environmental effects, CEQ (1997) guidance requires consideration of the following three factors:

(a) Whether there is or would be an impact on the natural or physical environment that would significantly (as employed by NEPA) and adversely affects a minority population, low-income population, or Tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Tribes when those impacts are interrelated to impacts on the natural or physical environment;

(b) Whether environmental effects would be significant (as employed by NEPA) and have an adverse impact on minority populations, low income populations, or Tribes that would appreciably exceed those on the general population or other appropriate comparison group; and

(c) Whether the environmental effects would occur in a minority population, low-income population, or Tribe affected by cumulative or multiple adverse exposures from environmental hazards.

CEQ environmental justice guidance 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" (CEQ 1997).

3.19.4.2.1 Public Participation of Minority and Low-Income Populations

As noted in Section 3.19.1, providing opportunity for community input is a requirement for the process to address potential environmental justice concerns. The U.S. Bureau of Reclamation (Reclamation) initially held 10 public scoping meetings in 2014. Meeting sites were located to encourage participation from Tribal governments, residents of communities near the NGS and the Kayenta Mine, and water users in the CAP service area. The meetings were conducted in an informal open house format. Court reporters were available at each meeting to record oral comments. At scoping meetings held on the Navajo and Hopi reservations, Navajo and Hopi interpreters were available to assist attendees in conversing with project team members in attendance, interpret information presented on a series of posters, and assist with the interpretation of oral comments made to the court reporters. English, Navajo, and Hopi language versions of a project video were available for viewing at each meeting, providing an overview of the NEPA process, the Proposed Action, environmental assessment topics, public involvement opportunities, and guidelines for providing substantive comments.

The Office of Surface Mining Reclamation and Enforcement conducted informal conferences concurrently with the open house scoping meetings at Forest Lake Chapter and Kayenta on the Navajo Nation, and at Kykotsmovi on the Hopi Reservation. A handout with summaries of the poster, a comment form, and a fact sheet were supplied for the informal conferences, as required by Surface Mining Control and Reclamation Act regulations for the Kayenta Mine permit revision application.

At the request of the Hopi Tribe, Reclamation reinitiated and extended the public scoping comment period, publishing a notice in the July 25, 2014 *Federal Register* announcing extension of the public scoping comment period through August 31, 2014. The extension provided an opportunity for expanded public involvement activities including community outreach and an additional public scoping meeting on the Hopi Reservation.

Reclamation and Office of Surface Mining Reclamation and Enforcement held meetings with residents living in the vicinity of the proposed KMC on July 26, 2015, and August 28, 2015. These meeting were to allow residents to voice issues and concerns regarding the mine and mining activities. Both meetings were held at the Peabody Western Coal Company (PWCC) Human Resources Center. More than 65 residents attended the two meetings, 29 of whom offered comments. A Navajo translator was provided for those who preferred to offer comments in the Navajo language (note that no Hopi live within the proposed KMC area). The meetings were followed by a series of resident interviews to further explore these issues, again with the assistance of a Navajo language interpreter.

The Navajo Nation is a Cooperating Agency for the EIS and Cooperating Agency status has been offered to the Hopi Tribe. Section 1.10 provides more detail regarding the scoping process conducted for this EIS and the specific opportunities provided for low income and minority participation in the scoping process. This section also provides a description of the Government-to-Government consultations between Reclamation and the affected tribes during the EIS process.

3.19.4.3 Proposed Action

3.19.4.3.1 Navajo Generating Station

3.19.4.3.1.1 Air Quality

According to Section 3.1.4.3, air quality impacts from NGS operations would be moderate under the Proposed Action. All criteria pollutant emissions would be in compliance with the national ambient air quality standards, and not expected to cause deleterious impacts to human health or the environment. Negligible direct and indirect impacts to ozone, regional haze, and acid deposition would be anticipated. Although increases in fugitive dust and equipment emissions would occur during decommissioning over a 5 to 10 year period starting in 2044, increases would be short-term and minor. Based on these findings, no disproportionately high and adverse air quality effects on environmental justice populations are anticipated under the Proposed Action.

3.19.4.3.1.2 Water Resources

NGS obtains water from Lake Powell from Arizona's share of the Upper Colorado River Basin. The use of Colorado River water by NGS is supported by Navajo tribal resolution.

As described in Section 1.7.1.4 and Section 3.7.4.2, NGS withdrawals from Lake Powell would create negligible impacts on reservoir water levels and the extent of the lake water surface. Negligible amounts of arsenic, mercury, or selenium would be deposited on Lake Powell or the nearby Colorado River from plant emissions. NGS is designed to be a zero discharge facility and has implemented a Groundwater Protection Plan, a Perched Water Dewatering Plan, and compliance measures for USEPA's Coal Combustion Residual Rule. These plans and measures include groundwater monitoring, formalized inspections and testing, engineering controls to avoid and minimize loss and transmission of NGS plant waters into the ground, measures to capture and reclaim water that has saturated soils, and implementation of additional Best Management Practices for protecting groundwater. These plans and

measures were designed to ensure that water quality in the regional Navajo Aquifer (N-Aquifer), approximately 900 feet below the surface level, would not be impacted by operations and decommissioning. See Section 3.7.4.2 and **Appendix 1B** for a full description of these plans and requirements.

Under the Proposed Action, the operating and support facilities at the plant site would be dismantled and demolished to ground level by the end of 2045, unless the Navajo Nation continues NGS operations beyond 2044. The overall decommissioning process is described in **Appendix 1B**. A comprehensive environmental site assessment would be conducted to determine if there would be any sources or paths of contamination and to identify environmental receptors and develop remedial alternatives, if applicable. Phase I of the site assessment would include a records review, site visit, regulatory review, and hydrogeologic review to determine if environmental contamination, which may result in future environmental liability likely would be present at the property. Phase II of the site assessment would consist of on-site sampling to determine if environmental issues exist. A sampling and analysis plan would be developed to identify sample locations, sampling methodologies, analytical parameters, and a quality assurance plan. As required in the 1969 Lease, the land would be restored as closely as possible to original condition.

Based on the findings of the water assessment conducted for the EIS (Section 3.7.4) and the above-described decommissioning requirements, no disproportionately high and adverse effects on environmental justice populations from NGS-related changes in water resources would be anticipated in association with the Proposed Action.

3.19.4.3.1.3 Hazardous Materials

<u>Coal Combustion Residuals</u>

As noted in Section 3.15 and **Appendix 1B**, the disposal of NGS coal combustion residuals in compliance with USEPA's Coal Combustion Residual Rule, which includes groundwater and air quality protection measures, would result in minor impacts to the environment. As described under water resources above, performance of the Phases I and II Comprehensive Environmental Site Assessment and compliance with the provisions of the1969 Lease would mitigate the risk of long-term storage of coal combustion residuals on the NGS site. Consequently, no disproportionately high and adverse effects on environmental justice populations would be anticipated in association with disposal of coal combustion residuals under the Proposed Action.

<u>Products and Chemical Transportation</u>

As described in Section 3.15, large quantities of both anhydrous ammonia and diesel fuel would be transported to NGS under the Proposed Action. Based on the analysis conducted for this EIS, the immediate effects of a transportation incident or accident could be severe for either substance, especially if cargo or fuel tanks were to rupture and major spill occurred. However, the probability of an accident or in-transit release would be low, and the potential adverse effects would be short-term and localized. Moreover, the risk of transportation accidents would occur along all major transportation routes from product origins to NGS and would be similar to the risks associated with other fuel and chemical transportation risks on those routes with negligible impacts. NGS maintains a hazardous response team that would be available for spills in the area. Consequently, no adverse health or safety effects or disproportionately high and adverse effects on environmental justice populations associated with products and chemical transportation would be anticipated under the Proposed Action.

3.19.4.3.1.4 Public Health and Human Health

Two HHRAs were conducted for this EIS. These HHRAs concluded that emissions from NGS as well as the combined emissions from NGS and the proposed KMC would result in negligible impacts on human health in the vicinity of NGS. The HHRA was designed to ensure that a high degree of conservatism was

built into the risk assessment methods and thresholds, resulting in an assessment that was highly protective of public health (Section 3.16). The HHRAs concluded that no adverse health effects or disproportionately high and adverse effects on environmental justice populations would result under the Proposed Action.

3.19.4.3.1.5 Cultural Resources

As noted in Section 1.7.1, it is possible that the NGS coal combustion residual landfill would be expanded under the Proposed Action 3-Unit Operation to accommodate the disposal of nearly 23 million cubic yards of coal combustion residuals. The actual quantity that would be placed in the landfill would depend on the amount of fly ash marketed during the 2019 to 2044 time period. Continued operation could require up to an additional 80 acres within the current area leased for the landfill.

Additional wastewater evaporation pond capacity may be required under the Proposed Action 3-Unit Operation to facilitate the efficient operation of the zero discharge facility (Section 1.7.1). Any future pond construction would occur within the existing plant site, following the guidelines described in **Appendix 1B**.

According to Section 3.17, the foreseeable maximum footprint of the coal combustion residual landfill was previously investigated for cultural resources and no National Register of Historic Places-eligible or listed historic properties identified were within this area. Section 3.17 also describes the NGS Programmatic Agreement identifying the steps that Reclamation and the consulting parties agree to follow in resolving any adverse effects that the project might have on historic properties. The NGS Programmatic Agreement has been developed in consultation with the agencies, Tribes, and organizations listed on **Table 3.17-3**. This programmatic agreement outlines general and specific measures that Reclamation would take to fulfill its responsibilities to protect historic properties under the National Historic Preservation Act as well as Tribal and state laws. Any adverse effects on historic properties that may result from the project alternatives would be resolved through implementation of the stipulations in the NGS Programmatic Agreement.

Under the Proposed Action 2-Unit Operation, no additional landfill capacity or new evaporation ponds would be required, thereby avoiding concerns of future effects on cultural resources. No new disturbance in association with operations and maintenance of the Black Mesa & Lake Powell Railroad would be anticipated under the Proposed Action.

Based on the requirements of the NGS Programmatic Agreement and the participation of the affected tribes in developing and implementing the Proposed Actions, impacts to cultural resources would be negligible. No adverse impacts to cultural resources or disproportionately high and adverse cultural resource-related effects on environmental justice populations would be anticipated for NGS under either the Proposed Action 3-Unit Operation or 2-Unit Operation.

3.19.4.3.1.6 Socioeconomic Conditions

Under the Proposed Action, NGS would generate substantial economic, employment and fiscal benefits for the Navajo Nation and Coconino County from 2020 to 2044. The current economic, fiscal and social benefits associated with NGS would increase compared to levels associated with existing operations, based on higher NGS payments to the Navajo Nation (Section 3.18.4.3). Under the Proposed Action 3-Unit Operation, NGS would support an estimated total of 2,164 direct, indirect and induced jobs (**Table 3.18-33**). Most of the direct, onsite contractor, annual overhaul, and related tribal jobs at NGS would be held by Native American (primarily Navajo) workers. Additionally, many of the more than 1,100 estimated indirect and induced jobs also would be held by Navajo workers. Estimated NGS payments to the Navajo Nation would total $43 million per year and over $1.07 billion over the period from 2020 to 2044 (**Table 3.18-35**). This would represent a 1,400 percent increase in payments compared to current lease payments. These fiscal benefits would fund tribal services throughout the Navajo Nation.

Under the Proposed Action 2-Unit Operation, total NGS-related employment (direct, indirect, and induced) would total 1,616 jobs, which would be 25 percent lower than under the 3-Unit Operation (**Table 3.18-33**). Estimated NGS payments to the Navajo Nation would total nearly $32 million per year and $793 million over the period from 2020 to 2044, which would be 26 percent less than the 3-Unit Operation (**Table 3.18-35**). This would represent a 1,000 percent increase in payments compared to current lease payments.

Both the Proposed Action 3-Unit Operation and 2-Unit Operation would provide income to the Navajo Nation, which in turn could support tribal employment. Implementation of the 2-Unit Operation would result in lower direct employment at NGS than either the 3-Unit Operation or existing operations. The reductions in NGS direct jobs and much of the reductions in indirect and induced jobs likely would involve Navajo workers residing in Page, LeChee, Kaibiito, and Kayenta. Jobs added in response to higher NGS payments more likely would be located in Window Rock and elsewhere throughout the Navajo Nation, which could result in higher unemployment in Page and the chapters surrounding NGS than that described in Section 3.18.3.1.

Given that both the 3-Unit Operation and 2-Unit Operation would support substantial economic, employment and fiscal benefits for Navajo workers and the Navajo Nation as a whole, no disproportionately high and adverse socioeconomic effects on environmental justice populations would be anticipated in association with the Proposed Action.

3.19.4.3.2 Proposed Kayenta Mine Complex

3.19.4.3.2.1 Air Quality

The conclusions of Section 3.1.4.3 indicate that air quality impacts from the Proposed Action would be below the ambient air quality standards for all criteria air pollutants. Short-term minor increases in fugitive dust and equipment emissions would occur during decommissioning over a 2- to 3-year period starting in 2044. Consequently, no disproportionately high and adverse effects on environmental justice populations from proposed KMC emissions would be anticipated in association with the Proposed Action.

3.19.4.3.2.2 Water Resources

Under the Proposed Action, water withdrawals from the N-Aquifer would continue, and the Navajo Nation and Hopi Tribe would receive future water fees, averaging more than $1.3 million annually and $33 million over the period from 2020 to 2044. Water fees in the future are expected to be higher under the Proposed Action. An increase in water rates, retroactive to 2015, is pending approval by the Hopi Tribal Council and the Secretary of the Interior. To date, details of the new rate have not been released.

There would be no changes to N-Aquifer water quality. Effects on stream baseflows would be none to negligible, depending on the stream. Similarly, the potential impacts to discharges at N-Aquifer springs from either Proposed Action operation would be none to negligible.

Project impacts on groundwater levels in the Wepo Formation and alluvial aquifers within and adjacent to the leasehold would be negligible. Water quality effects in the Wepo Formation, alluvial aquifers, and associated springs and seeps would range from none to minor, and would be localized to a few isolated locations within the leasehold. Any impacts to existing water uses would be mitigated by the mine through ponds and impoundments and ongoing seep mitigation. Impacts on water quantity and quality in the Wepo Aquifer also would be negligible.

Based on the findings in Section 3.7.4.2, impacts to water resources associated with Proposed Action mining activities would be negligible to minor; therefore, no disproportionately high and adverse effects on environmental justice populations would be anticipated under the Proposed Action.

3.19.4.3.2.3 Hazardous Materials

As discussed in Section 3.15, the most commonly used products and chemicals at the Kayenta Mine are diesel fuel and blasting explosives. Based on the analysis conducted for this EIS, the risk of a diesel fuel-related transportation incident would be low at the volumes estimated for the Proposed Action and fuel deliveries would be substantially reduced under the Proposed Action 5.5 million tons per year (tpy) Operation. Consequently, no disproportionately high and adverse effects on environmental justice populations would be anticipated from transportation of diesel fuel under the Proposed Action.

Storage and use of blasting explosives occurs at the mine in conformance with federal regulations (30 Code of Federal Regulations Parts 56, 57, and 816.61 – 68, Safety Standards for Explosives at Metal and Nonmetal Mines; Use of Explosives) and numerous federal mine safety policies and procedures, including local notification procedures. PWCC has established procedures to monitor possible structural damage due to blasting as described in Section 3.18.3.1. Consequently, no disproportionately high and adverse human and environmental effects from storage and use of explosives would be anticipated under the Proposed Action.

3.19.4.3.2.4 Public Health and Human Health

Cancer and non-cancer risk estimates for the general population associated with proposed KMC emissions and fugitive dust would be within USEPA acceptable risk ranges for the Proposed Action (Section 3.16.4). Particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$) concentrations associated with proposed KMC operations would meet national ambient air quality standards criteria and would have little to no effects on the health of the general population.

The public health assessment concluded that the sustained employment associated with continued operations of the NGS and proposed KMC under the Proposed Action, the associated increase in revenues to the Navajo Nation and Hopi Tribe through extension of lease and coal royalties, and the income associated with sustained long-term employment, and potentially increased employment opportunities, could lead to major positive health impacts, continued or improved access to health services, better nutrition, and better overall well-being. These positive effects would accrue to direct, indirect, and induced workers and their families associated with NGS and the proposed KMC, a large percentage of which would be Navajo and Hopi workers. Furthermore, extending the operating life of NGS and proposed KMC to 2044 would support ongoing employment income and future retirement income for many households beyond the operating life of the plant (Section 3.18). Those benefits take on added importance given the persistent high unemployment and poverty among the Navajo.

For residents living in the vicinity of the proposed KMC area, the public health assessment found a potential for stress-related effects on resident health, well-being, and quality of life associated with noise, effects on cultural resources and setting, relocation of residents, withdrawal of grazing lands, and resident concern for ongoing effects of mining under both Proposed Action. The potential health impact of noise and resident relocation would be moderate; all other health impacts for proposed KMC area residents would be minor. Noise impacts generally would be related to blasting, which would affect a limited number of residences. Blasting occurs approximately 20 to 30 times per month. Noise and vibration impacts would not be expected to exceed federal regulations, and would not be considered capable of producing injury or property damage but could cause annoyance depending on the distance to the receptor.

Although the potential health impacts of relocation of residents would be moderate, it should be noted that future relocation under the Proposed Action would involve a maximum of eight residences under 8.1 million tpy coal production and up to six residences under 5.5 million tpy coal production. Based on the PWCC relocation procedures described in Section 3.18.3.1, resident relocation also has a potential to be beneficial and could result in reduced stress for those residents who would prefer new homes with improved amenities, those relocated near their customary use areas, and those who might prefer to reside near other family members. The potential health impacts of withdrawal of grazing lands would be

minor. Future withdrawal of grazing lands would affect up to six grazing permittees who would be compensated for the loss of or reduction in their grazing areas.

For residents living in the vicinity of the proposed KMC, the public health assessment found the potential for minor health impacts on sensitive sub-populations associated with $PM_{2.5}$ with mine operations, even though ambient air quality criteria would be met. The assessment noted that while small increases in ambient $PM_{2.5}$ concentrations could lead to minor negative health effects associated with existing health conditions of sensitive subpopulations, most cases of health problems among the affected population are associated with causes unrelated to $PM_{2.5}$ exposure.

The public health assessment also noted concerns among some residents living in the vicinity of the proposed KMC for the effects of continued mining activities under the Proposed Action. It was concluded that whether the community concerns were related to direct health effects associated with mine operations or indirect effects such as visual disturbances, conflicts with traditional lifestyles (see Section 3.18.3.1 for a discussion of Native American traditional values), or public safety related to nearby mining, these factors potentially could cause emotional stress, which would lead to an impact on overall well-being and/or psychosocial health.

The Proposed Action would result in potential major positive public health effects for workers (and their families) holding NGS and proposed KMC direct, indirect, and induced jobs. There also would be potential for moderate to minor adverse health effects associated with mining-related noise, effects on cultural resources and the traditional setting, relocation of residents, withdrawal of grazing lands, and concern for ongoing effects of mining for residents living in the vicinity of the proposed KMC, but these effects by themselves would not constitute a disproportionately high and adverse impact for those residents who are part of the environmental justice population on the Navajo Nation.

3.19.4.3.2.5 Cultural Resources

Potential effects on cultural resources that may result from the Proposed Action would be resolved through implementation of the stipulations in the proposed KMC Programmatic Agreement. As noted in the preceding public health and HHRA, some individuals could be affected more than others by effects on cultural resources. Within the vicinity of the proposed KMC, there would be potential for environmental justice impacts related to the long-term occupancy by families in the area, and the potential that cultural resources important to them may be affected by mining.

A National Historic Preservation Act Section106 process was conducted during the Black Mesa Archaeological Project which occurred during the 1980s. Approved processes for burials, traditional cultural properties, sacred and ceremonial sites, and unidentified finds have been in place in PWCC's approved Surface Mining Control and Reclamation Act of 1977 permits for more than 20 years. Measures to resolve potential adverse effects on archaeological sites, historical-period resources, and TCPs would include avoidance, monitoring, or resolving direct and indirect adverse effects through the development of a Historic Properties Treatment Plan. This plan would be developed in consultation with the Tribes, Bureau of Indian Affairs, State Historic Preservation Office, and other consulting parties to the programmatic agreement. Treatment of historic properties would be completed prior to the commencement of any applicable mine-related activity. The potential impact of effects on cultural resources would be minor based on the avoidance and provisions of the proposed KMC Programmatic Agreement. Consequently, no disproportionately high and adverse cultural resources-related effects on environmental justice populations would be anticipated for the Proposed Action.

3.19.4.3.2.6 Socioeconomic Conditions

Under the Proposed Action, the economic, fiscal and sociocultural benefits associated with the proposed KMC would continue through 2044 (Section 3.18.4.3). The direct, indirect and induced employment benefits within the project study area would accrue predominantly to Navajo and Hopi workers and their families, allowing these workers to remain on their respective reservations and support extended

families. Fiscal benefits of the Proposed Action would accrue throughout the Navajo Nation and Hopi Reservation, supporting a continuation of tribal services and related employment. As noted in Section 3.18.4.3, these beneficial effects would be considered major for the Navajo Nation and Hopi Tribe.

Economic and fiscal benefits would be the highest under the Proposed Action 8.1 million tpy coal production. Under the 5.5 million tpy coal production, total proposed KMC-related employment would be 31 percent lower (Section 3.18.3.1). The lower number of proposed KMC-related direct jobs and many indirect and induced jobs under the 5.5 million tpy coal production (compared to existing employment levels) likely would involve workers residing in the Kayenta, Tuba City, Shonto, Forest Lake, and Pinon chapters, and on the Hopi Reservation. In the case of the Hopi, the lower KMC-related payments to the Tribe associated with the 5.5 million tpy coal production likely would result in the need to reduce tribal services and employment, absent a comparable new source of revenue. The social effects of these job losses would be compounded by the fact that many Navajo and Hopi workers reportedly support an extended family household. Given that equivalent employment opportunities would not be available in the affected areas, these impacts likely would be long-term as described in Section 3.18.4.3.

There would be fewer jobs associated at the proposed KMC under Proposed Action 5.5 million tpy coal production, compared to either existing operations or the Proposed Action 8.1 million tpy coal production. The socioeconomic effects of the differences would be adverse and accrue disproportionately to the environmental justice population in surrounding Navajo Nation communities and the Hopi Reservation. Nonetheless, the 5.5 million tpy coal production still would provide substantial employment and revenues to the two tribes, which would support tribal services and additional employment.

As noted in Section 3.19.1, factors considered in environmental justice assessments should include the "physical sensitivity of the community or population to particular impacts; the effect of any disruption on the community structure associated with the proposed action; and the nature and degree of impact on the physical and social structure of the community" (CEQ 1997). Additionally, U.S. Department of the Interior NEPA policy requires identification and evaluation of the equity of the distribution of the benefits and risks for minority and low-income populations and communities (U.S. Department of Interior 1995).

Within the environmental justice population on the Navajo Nation, residents living in the vicinity of the proposed KMC merit special consideration. See Section 3.18.3.1 for a discussion of current and historic social and cultural conditions within in the lease area.

As noted in the preceding Public Health and Human Health subsection, up to eight additional households may require relocation under the Proposed Action. To date all relocated residents have voluntarily accepted relocation or compensation (PWCC 2012 et seq.). Relocated households are given a choice of relocation or compensation, and PWCC works with relocated household to procure and prepare the homesite, construct homes and other structures, and prepare the homes for utility service. Nevertheless, given the traditional attachment of Navajo to their homesites relocation may be stressful for some households.

Raising sheep and other livestock is culturally important for some Navajo. As many as six grazing areas would be withdrawn from active use under the Proposed Action (Section 3.18.3.1). Although grazing permittees would receive compensation for use of their grazing areas during the period that the areas are withdrawn, finding replacement grazing areas is difficult and costly. This difficulty is compounded by temporary restrictions on grazing in reclaimed areas within the proposed KMC to allow reclaimed areas to recover from drought and overgrazing. It is not known when residents would be allowed to resume grazing in reclaimed areas that occupy their customary use areas. The resulting reclaimed grassland communities are intended to increase the livestock carrying capacity and improve the potential for grazing management (Office of Surface Mining Reclamation and Enforcement 2011).

Under the Proposed Action, residents living in the vicinity of the Proposed KMC, many of whom are the descendants of the residents of the area at the time mining was initiated, would continue to coexist with mining activities, resident relocations, withdrawal of grazing lands, and altered landscapes. These factors would continue to change the traditional setting and social structure. Although active mining areas are fenced and gated, many residents would continue to travel mine roads that also are used by industrial traffic and heavy equipment to get to and from their homes and grazing areas. As noted for the public health assessment, these factors contribute to concern for continued mining among some residents. For some residents, the belief that mining is incompatible with Navajo traditional values is particularly concerning.

Under the Proposed Action, benefits of the proposed KMC would accrue to mine employees and all members of the Navajo Nation and the Hopi Tribe through services and employment funded by proposed KMC lease, royalty, and other payments. The impacts in the vicinity of the proposed KMC, which have been described by the Navajo Nation Council as adversely affecting or impacting the socioeconomic and environmental interests of area residents (Title 2 Navajo Nation Code, Chapter 3, Subchapter 11, Article 5, Section 902), would fall disproportionately on residents living in the vicinity of the proposed KMC, virtually all of whom are Navajo. These effects, which would be considered direct effects of mining activities, would not impact populations beyond those residing within the vicinity of the proposed KMC.

Although the above described impacts would affect all residents living in the vicinity of the proposed KMC, for some residents, particularly those with a family member employed at the mine, more beneficial impact such as employment, replacement residences or compensation, payments for withdrawn grazing lands, and PWCC supported amenities and services including free coal, water, road maintenance, and emergency medical aid could be seen as offsetting these adverse impacts. For others, the mining activity, perceived health and safety risks, and the change in the landscape and cultural setting would not be offset by these benefits. Consequently, while economic and fiscal effects of the proposed KMC under the Proposed Action would be largely beneficial for the Navajo Nation and Hopi Tribe, direct social and cultural effects would be considered adverse and accrue disproportionately to residents living in the vicinity of the proposed KMC who are part of the environmental justice population and warrant special consideration because of their proximity to mining operations.

Within the proposed KMC area, the 5.5 million tpy coal production would correspondingly result in less traffic, fewer changes in the landscape and cultural setting, less disturbance of TCPs, fewer relocations, and withdrawals of less grazing lands. Although these impacts would be reduced as compared to the 8.1 million tpy coal production, they would still fall disproportionately on residents residing within the vicinity of the proposed KMC.

3.19.4.3.3 Transmission Systems and Communication Sites

The configuration and operation of both the WTS and STS are anticipated to remain unchanged under all action alternatives. With the exception of the southern terminus of the STS, the ROWs for both transmission lines are located away from any concentrations of populations. Future maintenance activities for the communication sites, transmission lines, and access roads would be infrequent, short duration, and localized (**Appendix 1B**). For example, transmission line structure maintenance and repair would occur on an as-needed basis; routine actions, such as vegetation clearing, would occur once every 5 years, or less frequently depending on need; repair of access roads and tower infrastructure would occur along localized sections of the lines or roads; and annual maintenance of access roads would occur once or twice a year, but equipment would move through the areas quickly. The foreseeable environmental impacts of these activities are negligible. Consequently, no adverse environmental or health impacts associated with continued operations of the WTS and STS and associated communication sites would be anticipated under any alternative Operation of the WTS and STS would continue for the life of the project. The timing of decommissioning and final reclamation requirements for

the WTS and STS ROWs ultimately would be determined by the authorities with responsibility for ROW issuance.

CEQ environmental justice guidance under NEPA states, "Where a proposed agency action would not cause any adverse environmental impacts, and therefore would not cause any disproportionately high and adverse human health or environmental impacts, specific demographic analysis may not be warranted" (CEQ 1997). Based on the conclusion that the Proposed Action and action alternatives would result in negligible environmental or health impacts associated with continued operations of the transmission systems and communications sites, specific demographic environmental justice analyses were not conducted for the transmission systems and communication sites.

3.19.4.3.4 Central Arizona Project Area of Indirect Socioeconomic Effects

In 2014, CAP water deliveries of 1,525,960 acre-feet were made to 77 customers; 50 municipal and industrial customers and 16 receiving water deliveries from Indian water allocations, which include non-tribal entities that have leased water from tribes. Deliveries for municipal and industrial use accounted for 39 percent of the total deliveries, with those deliveries accounting for 50 percent of the municipal water supply in the three counties (Central Arizona Water Conservation District [CAWCD] 2014). Water deliveries allocated to CAP-affected tribes accounted for 35 percent of the 2014 water deliveries. Non-tribal agricultural deliveries and water used in CAP's recharge program accounted for the remaining 26 percent of deliveries (CAWCD 2014).

Changes in energy costs associated with the Proposed Action would affect water costs for CAP customers (Section 3.18.4.3), with the relative magnitude of change varying across the different categories of customers. Reclamation has no control over those costs and they would be associated with the continued operation of the NGS.

For municipal and industrial customers on long-term contracts, pumping energy costs represent approximately half of the total water rate. For many municipal and industrial customers, subsequent treatment, distribution, and system operation costs would reduce the relative effect of increased pumping costs on individual consumers. Increased costs would result in higher costs of doing business, reductions in consumer disposable income for other purposes, and higher costs for the public sector (e.g., for irrigation, public recreation and potable uses). Secondary effects of such impacts could include reductions in employment and income. Higher water costs would boost ongoing efforts towards conservation and improved irrigation efficiency.

The largest relative impact would be for users in the Agricultural Settlement Pool that pay only energy charges. The impact of the higher rates also would be substantial on agricultural interest that use water for irrigation. Because agricultural producers are not able to set the prices for their commodities, increases in production costs typically come from the bottom line (i.e., lower farm income). These factors may result in farming operations being scaled back, changes in cropping patterns, changes in the amount of land in production, or in extreme instances, could result in cessation of farming and conversion of land to other uses. As noted above, agricultural use of water represents more than one-third of the annual water deliveries by CAP.

Higher energy rates also could hamper plans for CAP-affected tribes to support future agricultural and development uses and population growth and affect their ability to reestablish traditional irrigation-based agriculture on their reservations. CAP-affected tribes also would have fewer revenues to fund tribal services.

For individual tribes and users, higher water costs could result in reductions in the quantity of water used and acreages under cultivation, changes in crops raised, and cutbacks in farm employment. As with municipal and industrial users, higher water costs also could promote conservation and efforts to

improve irrigation efficiency. Higher rates for CAP water could prompt some current users to resume or increase groundwater pumping.

CAP water users would face potential indirect consequences from higher energy costs as a result of lower revenues that would accrue to the Lower Colorado River Basin Development Fund (Section 3.18.3.3). Annual revenues from surplus power sales are deposited to the Fund and then available for application to CAP's debt repayment obligation to the federal government for the capital cost of the CAP system. As a result, reductions in revenues from surplus energy sales would pose a risk for CAP's municipal and industrial subcontract users, who could face higher capital charges to fund CAWCD's repayment obligation.

Economic and social effects related to the potential increases in the pumping costs and potential changes in contributions to the Development Fund would apply broadly to all CAP customers. Due to the intensity of water use for irrigation, the relative effects on agricultural users, including those tribes with CAP water allocations that use all or parts of their allocation for agriculture, could be higher than for municipal and industrial users. Again these costs would accrue to all agricultural users of CAP water. Based on these conclusions, adverse socioeconomic effects of increases in CAP water delivery costs and potential decreases in contributions to the Development Fund would not represent a disproportionate impact on the environmental justice populations identified for this assessment.

3.19.4.3.5 Project Impact Summary – All Project Components

The assessments conducted for this EIS did not identify high and adverse air quality, water resources, ecological, or safety impacts for any population from implementation of the Proposed Action. Adverse human health and sociocultural impacts were not identified for northeastern Arizona, the majority of the Navajo Nation, or the Hopi Reservation.

Sociocultural and potential minor to moderate human health impacts were identified for residents living in the vicinity of the proposed KMC. These effects would continue to alter the traditional setting and social structure in the area. For some of these residents, employment, replacement residences or compensation, per acre payments for withdrawn grazing lands, and PWCC-supported amenities and services could be seen as offsetting these effects. For others, the mining activity, perceived health and safety risks, and the change in the landscape and cultural setting would not be offset by these benefits. These adverse impacts would not affect populations in other areas of the Navajo Nation, the Hopi Reservation, or northeastern Arizona that are not considered environmental justice populations. Consequently, residents living in the vicinity of the proposed KMC who are part of the environmental justice population on the Navajo Nation would experience disproportionately high and adverse sociocultural impacts under the Proposed Action.

The 5.5 million tpy coal production would result in lower Navajo and Hopi employment and comparable or lower revenues to the two tribes as compared to 8.1 million tpy coal production; however, employment and revenue levels would still be much higher than under the No Action Alternative. Although sociocultural effects on residents living in the vicinity of the proposed KMC would be reduced as compared to the 8.1 million tpy coal production, they would still fall disproportionately on this environmental justice population and would not affect other Navajo and Hopi, or non-environmental justice populations in northeastern Arizona. Consequently environmental justice effects would be similar for both 8.1 million tpy and 5.5 million tpy coal productions for the Proposed Action.

Users of CAP water, including CAP-affected tribes, would experience indirect effects associated with increases in pumping costs related to higher energy costs under the Proposed Action. The effects of those increases would be greatest for entities that use CAP-delivered water for agricultural purposes (including the agricultural uses of CAP-affected tribes) as pumping costs are essentially all or the majority of their costs. CAP water users would face potential further indirect effects related to lower revenues that would accrue to the Lower Colorado River Basin Development Fund, and its ability to

repay CAP's debt obligation to the federal government. Because these effects would apply broadly to all CAP customers, no disproportionately high and adverse impacts to environmental justice populations would be anticipated.

3.19.4.3.6 Cumulative Effects

3.19.4.3.6.1 Navajo Generating Station

The assessments conducted for this EIS for NGS did not identify past, present, or reasonably foreseeable future activities in conjunction with activities associated with the Proposed Action that would result in other than negligible to minor environmental, human health, economic, or social effects on any population. Consequently no high and adverse cumulative impacts on identified environmental justice populations would be anticipated.

3.19.4.3.6.2 Proposed Kayenta Mine Complex

According to the assessments conducted for this EIS for the proposed KMC, past, present, and reasonably foreseeable actions in conjunction with activities associated with the Proposed Action would not result in other than negligible to minor environmental or economic effects on any population. Potentially minor to moderate public health and sociocultural effects would occur for residents living in the vicinity of the proposed KMC.

The sociocultural assessment (Section 3.18.3.1) concluded that past and present mining activities on the proposed KMC lease area, which include operations of the former Black Mesa Mine and over 40 years of operation of the Kayenta Mine, has resulted in sociocultural effects on area residents, many of whom have coexisted with mining activities and altered landscapes for decades. These impacts are due to sharing access roads with heavy industrial traffic, noise, altered landscapes, effects on cultural resources, relocation, and withdrawal of grazing lands. In combination with other factors such as poverty, population growth, and the Navajo-Hopi Land Resettlement Act, these impacts have resulted in substantial change in both the traditional setting and social structure.

The public health and sociocultural assessments noted the concern for continued mining among some residents living in the vicinity of the proposed KMC. Whether the community concerns are related to direct health effects associated with mine operations or indirect effects such as visual disturbances, changes in the traditional and cultural setting, or public safety related to nearby mining, these concerns could cause emotional stress, leading to an impact on overall well-being and/or psychosocial health. For some residents, the belief that mining is incompatible with Navajo traditional values is particularly stressful. With the exception of conflicts with traditional values, these direct effects of mining activities would accrue to residents living in the vicinity of the proposed KMC; no other populations would be affected.

Regarding reasonably foreseeable future activities in the lease area, phases 1 and 2 of the Many Mules water project would supply water to a number of households. Three further planned phases are dependent on funding.

For some residents residing within the vicinity of the proposed KMC, employment, relocation or compensation for homes; compensation for withdrawn grazing land; PWCC-provided amenities and services; and the prospect of receiving water service could be seen as offsetting these adverse effects. For others, these benefits would not be considered as offsetting the adverse effects.

Consequently, cumulative adverse sociocultural effects of past and present actions combined with the effects of the Proposed Action would disproportionately affect the environmental justice population residing within the vicinity of the proposed KMC lease area.

3.19.4.3.6.3 Central Arizona Project Area of Indirect Socioeconomic Effects

No past or present actions when considered in combination with the Proposed Action likely would appreciably affect the CAP water deliveries. The primary reasonably foreseeable factor affecting the price of water delivered to CAP customers would be potential Colorado River water shortages. Decreases in water deliveries would occur under a declared shortage on the Colorado River, such that fixed operation, maintenance, and recovery costs would need to be recovered based on a lesser quantity of water deliveries. Preliminary assessment from CAWCD estimates that rates could increase by as much as 25 percent based on Stage I shortage conditions (reduction of 320,000 acre-feet withdrawn). Additional rate increases would occur in the event of Stage II or Stage III shortage conditions. These effects would apply broadly to all CAP customers; therefore, no disproportionately high and adverse cumulative impacts to CAP area environmental justice populations would be anticipated.

3.19.4.4 Natural Gas Partial Federal Replacement Alternative

Under the Natural Gas Partial Federal Replacement (PFR) Alternative, 100 megawatts (MW) to 250 MW of power generation at NGS would be replaced by alternative power purchased from an unknown, but existing source(s). The net result of these purchases would be between 0.88 tera-watt hours (TW-hours) and 2.19 TW-hours of energy sourced from replacement sources annually The site(s) of the existing source(s) is unknown but would not be within the local study area.

3.19.4.4.1 Navajo Generating Station

The assessments for this EIS concluded that the Natural Gas PFR Alternative would result in negligible adverse impacts to air quality (all emissions would be slightly less than those associated with the Proposed Action and fall within ambient air quality standards), negligible impacts to water resources, and negligible impacts on human health. Although NGS emissions would be reduced under the Natural Gas PFR Alternative, sensitive subpopulations could experience some minor impacts due to exacerbation of existing health conditions. However, the likelihood of the impact is lower for the Natural Gas PFR Alternative than for the Proposed Action, which were determined to be minor.

There would be a small potential for impacts to cultural resources under the 3-Unit Operation, but if such impacts occurred, they would be offset by the provisions of the NGS Programmatic Agreement.

The Natural Gas PFR Alternative would result in less local economic benefit compared to the Proposed Action. For the Natural Gas PFR 2-Unit Operation, the employment reductions would be more related to the shutdown of one NGS unit than to the partial replacement of federal power. NGS-related revenues to the Navajo Nation under the Natural Gas PFR Alternative would be the same as under the Proposed Action.

The social and economic effects of reductions in employment and tribal revenues associated with the Natural Gas PFR Alternative and all reductions in NGS power would fall disproportionately on members of the Navajo Nation; however, employment and revenues would be substantially higher than the No Action Alternative.

Based on these findings, no high and adverse impacts on environmental justice populations would be anticipated from NGS and the associated facilities under the Natural Gas PFR Alternative.

3.19.4.4.2 Proposed Kayenta Mine Complex

The assessments conducted for this EIS concluded that the Natural Gas PFR Alternative would result in negligible impacts to air quality (all emissions would fall within ambient air quality standards), water quantity, and water quality. Cultural resources could be disturbed, but disturbance would be offset by the provisions of the KMC Programmatic Agreement. Particulate emissions under the Natural Gas PFR Alternative would meet national ambient air quality standards criteria.

The public health assessment and HHRA concluded that human air and soil pollutant exposure for the Natural Gas PFR Alternative would be considered acceptable and have a negligible impact on human health. Particulate emissions under the Natural Gas PFR Alternative would have little adverse effect on the health of the general population. Although proposed KMC emissions would be reduced under both Natural Gas PFR Alternative, sensitive subpopulations could experience some minor impacts due to exacerbation of existing health conditions. However, the likelihood of the impact would be even lower for the Natural Gas PFR Alterative than for the Proposed Action, which would be minor.

Employment and tribal revenues associated with the Natural Gas PFR Alternative would be lower than those associated with either the Proposed Action or existing conditions, depending on the amount of energy at NGS that would be replaced.

For residents living in the vicinity of the proposed KMC, the public health assessment identified potential health impact of noise, effects on cultural resources, relocation of residents, and withdrawal of grazing lands. Of these, health impacts of resident relocation and noise would be moderate; others would be considered minor. Fewer residents potentially would be relocated and fewer grazing areas withdrawn to accommodate mining under the Natural Gas PFR Alternative than under the Proposed Action.

Although mine-related traffic, changes in the landscape, traditional setting and social structure, disturbance of TCPs, relocations, and withdrawals of grazing lands would be lower for the Natural Gas PFR Alternative, these effects would fall disproportionately on residents living in the vicinity of the proposed KMC.

Residents living in the vicinity of the proposed KMC would continue to coexist with mining activities and altered landscapes and cultural settings. These impacts, which are seen as adverse by some, are considered direct effects of mining activities and would not impact populations beyond those residing within the vicinity of the proposed KMC.

As noted previously, proposed KMC employment would be reduced under the Natural Gas PFR Alternative, reducing potential offsetting benefits to area residents. Other PWCC-provided amenities and services would continue.

Economic and fiscal effects of the proposed KMC under the Natural Gas PFR Alternative would be considered beneficial for the Navajo Nation and Hopi Tribe. Direct sociocultural effects of the Natural Gas PFR Alternative would be considered adverse for some residents living in the vicinity of the proposed KMC and accrue disproportionately to those residents who are part of the environmental justice population and warrant special consideration because of their proximity to mining operations.

3.19.4.4.3 Central Arizona Project Area of Indirect Socioeconomic Effects

Users of CAP water, including CAP-affected tribes, would experience indirect effects associated with differences in pumping costs related to energy costs under the Natural Gas PFR Alternative compared to those under the Proposed Action (Section 3.18.4.4). Depending on the future prices of natural gas, pumping costs under the Natural Gas PFR Alternative could range from somewhat lower to substantially higher than those under the Proposed Action. The differences would be minor to major impacts to users, depending on the rates. The effects of those differences would be most pronounced for entities that use CAP-delivered water for agricultural purposes (including the agricultural uses of CAP-affected tribes) due to potential increases in pumping costs. The differences in energy costs under this alternative could affect the economic feasibility of future sales of surplus energy, which provides revenue to support to the Development Fund. At the upper end of the cost range, the additional costs could make it economically unjustifiable for CAWCD to purchase energy and power from NGS (Section 3.18.4.4).

The potential differences in pumping costs for CAP water users under the Natural Gas PFR Alternative also would result in indirect impacts to all CAP users. Higher contributions to the Lower Colorado River

Basin Development Fund could correspond to lower pumping costs, easing the debt repayment burden on CAP users. Conversely, higher rates would hamper the ability to repay CAP's debt obligation to the federal government. Because the latter effects would apply broadly to all CAP customers, no disproportionately high and adverse impacts to CAP area environmental justice populations would be anticipated under the Natural Gas PFR Alternative.

3.19.4.4.4 Project Impact Summary – All Project Components

The assessments for this EIS concluded that air quality, water resources, ecological, and safety effects of the Natural Gas PFR Alternative would be negligible for any population under either the 3-Unit Operation or 2-Unit Operation. Adverse human health and sociocultural impacts were not identified for populations in northeastern Arizona, the majority of the Navajo Nation, or the Hopi Reservation; however, human health and sociocultural impacts potentially would be minor to moderate for residents living in the vicinity of the proposed KMC. For some of these residents, potential impacts could be offset by project employment, replacement residences or compensation, per acre payments for withdrawn grazing lands, and PWCC-supported amenities and services. For others, particularly those that do not have a family member employed at the mine and/or believe that mining is not compatible with Navajo traditional values (Section 3.18.3.1), the mining activity, perceived health and safety risks, and the change in the landscape and cultural setting would not be offset by these benefits. These adverse impacts would not affect the remainder of the Navajo Nation, the Hopi Reservation, or non-environmental justice populations in northeastern Arizona. Consequently, residents living in the vicinity of the proposed KMC who are part of the environmental justice population on the Navajo Nation would experience disproportionately high and adverse sociocultural impacts under the Natural Gas PFR Alternative.

Although the Natural Gas PFR Alternative would result in a reduction in Navajo and Hopi employment and revenues compared to existing conditions, employment and revenue levels still would be much higher than under the No Action Alternative. Public health and sociocultural effects on residents living in the vicinity of the proposed KMC would be reduced under the Natural Gas PFR Alternative compared to the Proposed Action, and the reduction in effects would increase as the amount of federal replacement power increased. These effects still would fall disproportionately on this environmental justice population and would not affect the rest of the Navajo Nation, the Hopi Reservation, or the non-environmental justice populations in northeastern Arizona.

Pumping energy costs for the CAP would increase under either Natural Gas PFR Alternative. Although low natural gas prices could result in energy costs being lower than those under the Proposed Action, pumping energy costs potentially could be much higher with 250 MW of replacement energy and higher future gas prices. The higher energy costs under such conditions could affect the economic feasibility of future sales of surplus energy to support the Development Fund. These effects would apply broadly to all CAP customers; therefore, no disproportionately high and adverse impacts to CAP area environmental justice populations would be anticipated under the Natural Gas PFR Alternative.

3.19.4.4.5 Cumulative Impacts

3.19.4.4.5.1 Navajo Generating Station

According the assessments conducted for this EIS for NGS, past, present, and reasonably foreseeable activities in conjunction with activities associated with the Natural Gas PFR Alternative would result in only negligible to minor environmental, human health, economic, or social effects on any population. Consequently no high and adverse cumulative impacts on identified environmental justice populations would be anticipated.

3.19.4.4.5.2 Proposed Kayenta Mine Complex

The proposed KMC past, present, and reasonably foreseeable activities in conjunction with activities associated with the Natural Gas PFR Alternative would result in only negligible to minor environmental

effects on any population. Potential public health and sociocultural effects were identified for residents living in the vicinity of the proposed KMC. The public health assessment identified potential minor to moderate health impact of noise, effects on cultural resources, relocation of residents, and withdrawal of grazing lands. Of these, impacts from noise and resident relocation would be moderate; health effects associated with disturbance of cultural resources and withdrawal of grazing lands would be minor. It is possible that fewer residents would be relocated and fewer grazing areas would be withdrawn to accommodate mining under the Natural Gas PFR Alternative than under the Proposed Action. The potential for relocations and grazing displacement would be reduced as the amount of federal energy replacement increased.

The sociocultural assessment (Section 3.18.3.1) concluded that past and present mining activities on the proposed KMC, which include operations of the former Black Mesa Mine and over 40 years of operation of the Kayenta Mine has resulted in sociocultural effects on area residents, many of whom have coexisted with mining activities and altered landscapes and cultural settings for decades. These include sharing access roads with heavy industrial traffic, noise, altered landscapes, traditional settings and social structure, effects on cultural resources, relocation, and withdrawal of grazing areas. In combination with other factors such as poverty, population growth, and the Navajo-Hopi Land Resettlement Act, these impacts have resulted in substantial change in both the traditional setting and social structure.

The public health assessment noted concern among some proposed KMC area residents for continued mining. It concluded that the community concerns related to direct health effects associated with mine operations or indirect effects (e.g., visual disturbances, loss of traditional and cultural lifestyles, or public safety related to nearby mining) potentially could cause emotional stress, leading to an impact on overall well-being and/or psychosocial health. For some residents, the belief that mining is incompatible with Navajo traditional values could result in considerable stress. These direct effects of mining activities would accrue to residents living in the vicinity of the proposed KMC. No other populations would be affected.

Regarding reasonably foreseeable future activities in the lease area, phases 1 and 2 of the Many Mules water project would supply water to a number of households. The remaining three phases are dependent on funding.

For some residents residing within the vicinity of the proposed KMC, employment, relocation or compensation for homes, compensation for withdrawn grazing land, PWCC-provided amenities and services, and the prospect of receiving water service would offset these adverse impacts. For others, these benefits would not be consider as offsetting the adverse effects.

Consequently, cumulative adverse sociocultural effects of past and present actions combined with effects associated with the Natural Gas PFR Alternative would disproportionately affect the environmental justice population residing within the vicinity of the proposed KMC.

3.19.4.4.5.3 Central Arizona Project Area of Indirect Socioeconomic Effects

Cumulative effects on the CAP customers under the Natural Gas PFR Alternative would be similar to those associated with the Proposed Action with the exception that pumping costs could be lower or higher depending on natural gas prices, which could exacerbate or moderate the economic effects of declared Colorado River water shortages for CAP customers. These effects would apply to all CAP customers; therefore, no disproportionately high and adverse impacts to CAP area environmental justice populations would occur under the Natural Gas PFR Alternative.

3.19.4.5 Renewable Partial Federal Replacement Alternative

Under this alternative, assumes NGS output would be curtailed to lower the federal share of NGS energy by between 100 MW and 250 MW of generating capacity over a 14-hour period, that duration generally corresponding to the period of high commercial and residential demand and the availability of renewable

generation in the southwest. A corresponding amount of energy would be supplied by power purchased from non-NGS sources, with a stipulation that the generating source(s) be renewable technology. The net result would be between 0.51 TW-hours and 1.28 TW-hours of energy sourced from renewable sources annually with the replacement power providing the equivalent of between 58.3 megawatt hours (MW-hours) and 145.8 MW-hours per hour over the course of a 24-hour period. That power would be acquired through a power purchase agreement with one or more existing, but presently unidentified, sources of renewable energy. Energy deliveries from the renewable sources would be monitored and curtailment at NGS scheduled to achieve the necessary reduction in NGS production and associated reductions in coal combustion. NGS curtailment would not necessarily be concurrent with the scheduled delivery of energy from the renewable sources to the CAP. Non-concurrent curtailment provides flexibility to optimize operations of NGS, while assuring achievement of the established levels of emission reductions, and maintaining the availability of surplus energy from NGS at about the same quantities as under the Proposed Action.

3.19.4.5.1 Navajo Generating Station

The assessments conducted for this EIS concluded that the Renewable PFR Alternative would result in negligible impacts to air quality (all emissions would be slightly less than those associated with the Proposed Action and fall within ambient air quality standards), water resources, and human health for the general population.

There would be a small potential for impacts to cultural resources under the 3-Unit Operation, but such impacts would be mitigated by the provisions of the NGS Programmatic Agreement.

The Renewable PFR Alternative would result in lesser employment at NGS compared to the Proposed Action. NGS-related revenues to the Navajo Nation under the Renewable PFR Alternative would be the same as under the Proposed Action.

The social and economic effects of reductions in employment and tribal revenues associated with the Renewable PFR Alternative under the 2-Unit Operation compared to existing conditions would fall disproportionately on Navajo Nation employees; however, employment and revenues still would be substantial. Positive socioeconomic benefits associated with increased revenue and continued and future employment opportunities at NGS would result in major health benefits for the affected workers and their families. Implementation of the Renewable PFR Alternative would reduce the magnitude of those positive impacts, and the magnitude of reduction would increase commensurate with the amount of federal energy replaced.

Based on these assessments, no disproportionate high and adverse impacts on environmental justice populations would be anticipated from NGS under the Renewable PFR Alternative.

3.19.4.5.2 Proposed Kayenta Mine Complex

The assessments conducted for this EIS concluded that the Renewable PFR Alternative would result in negligible impacts to air quality (all emissions would fall within ambient air quality standards), water quantity, and water quality. Cultural resources could be disturbed, but disturbance would be offset by the provisions of the NGS Programmatic Agreement. The public health assessment and HHRAs conducted for the Renewable PFR Alternative concluded that human air and soil pollutant exposure would be considered acceptable and have negligible effects on human health.

Employment and tribal revenues associated with the Renewable PFR Alternative would be lower than those associated with either the Proposed Action or existing conditions. The Renewable PFR Alternative would support 45 to 114 fewer jobs than the Proposed Action, depending on the amount of energy at NGS that would be replaced. Proposed KMC-related revenues would be reduced by 5 to 13 percent compared to the Proposed Action, depending on the amount of energy at NGS that would be replaced.

Potential health impacts of noise, effects on cultural resources, relocation of residents, and withdrawal of grazing lands, which all were moderate to minor under the Proposed Action, would be lower under the Renewable PFR Alternative. It is possible that fewer residents would be relocated and fewer grazing areas withdrawn to accommodate mining under the Renewable PFR Alternative than under the Proposed Action. The potential for relocations and grazing displacement would be reduced as the amount of federal energy replacement increased.

Although mine traffic, changes in the landscape, disturbance of TCPs, relocations, and withdrawals of grazing lands would continue at reduced rates for the Renewable PFR Alternative, they still would fall disproportionately on residents living in the vicinity of the proposed KMC, compounding the impacts of job losses described above.

Residents living in the vicinity of the proposed KMC would continue to coexist with mining activities and altered landscapes, traditional settings, and social structure. These impacts would fall disproportionately on residents residing within the vicinity of the proposed KMC, virtually all of whom are Navajo. These effects, which are considered direct effects of mining activities, would not impact populations beyond those residing within the vicinity of the proposed KMC.

As noted previously, proposed KMC employment would be reduced under the Renewable PFR Alternative, reducing potential offsetting benefits to area residents. Other PWCC-provided amenities and services would continue.

Economic and fiscal effects of the proposed KMC under the Renewable PFR Alternative would be considered positive for the Navajo Nation and Hopi Tribe. Direct sociocultural effects would accrue disproportionately to residents living in the vicinity of the proposed KMC who are part of the environmental justice population and warrant special consideration because of their proximity to mining operations

3.19.4.5.3 Central Arizona Project Area of Indirect Socioeconomic Effects

Pumping energy costs for the CAP would increase under the Renewable PFR Alternative. Costs associated with curtailment and firming would account for the majority of the increases, particularly as the amount of energy provided by the Renewable PFR rises. The likely impacts of those increases would comprise a minor to major impact for users. The higher energy costs under this alternative could affect the economic feasibility of future sales of surplus energy, which would continue to provide revenue to support to the Development Fund. These effects could make it economically unjustifiable for CAWCD to purchase energy and power from NGS (Section 3.18.4.4).

The substantially higher pumping costs for CAP water users under the Renewable PFR Alternative would result in greater indirect affects to all CAP users. Lower contributions to the Colorado River Basin Development Fund, would hamper the Fund's ability to repay CAP's debt obligation to the federal government. These effects would apply broadly to all CAP customers; therefore, no disproportionately high and adverse impacts to CAP area environmental justice populations would be anticipated under the Renewable PFR Alternative.

3.19.4.5.4 Project Impact Summary – All Project Components

The assessments conducted for this EIS did not identify high and adverse air quality, water resources, ecological, or safety impacts for any population that would result from implementation of the Renewable PFR Alternative; therefore, impacts would be negligible. Adverse human health and sociocultural impacts were not identified for northeastern Arizona, the majority of the Navajo Nation, or the Hopi Reservation, but sociocultural impacts and potential moderate to minor human health impacts were identified for residents living in the vicinity of the proposed KMC. For some of these residents, potential impacts could be offset by project employment, replacement residences or compensation, per acre payments for withdrawn grazing lands, and PWCC-supported amenities and services. For others,

particularly those that do not have a family member employed at the mine and/or believe that mining is not compatible with Navajo traditional values, the mining activity, perceived health and safety risks, and the change in the landscape, traditional setting, and social structure would not be offset by these benefits. These impacts would not affect the remainder of the Navajo Nation, the Hopi Reservation, or non-environmental justice populations in northeastern Arizona. Consequently, residents living in the vicinity of the proposed KMC who are part of the environmental justice population on the Navajo Nation would experience disproportionately high and adverse social and cultural impacts under the Renewable PFR Alternative.

Although the Renewable PFR Alternative would result in a reduction in Navajo and Hopi employment and revenues compared to existing conditions, employment and revenue levels would still be much higher than under the No Action Alternative. Public health and sociocultural effects on residents living in the vicinity of the proposed KMC would be reduced under the Renewable PFR Alternative compared to the Proposed Action. Although the reduction in effects would increase as the amount of federal replacement power increased, they would still fall disproportionately on this environmental justice population and would not affect non-environmental justice populations in northeastern Arizona.

The substantially higher pumping costs for CAP water users under the Renewable PFR Alternative would result in greater indirect affects to all CAP users, including lower contributions to the Lower Colorado River Basin Development Fund. These effects would apply broadly to all CAP customers; therefore, no disproportionately high and adverse impacts to CAP area environmental justice populations would be anticipated under the Renewable PFR Alternative.

3.19.4.5.5 Cumulative Impacts

3.19.4.5.5.1 Navajo Generating Station

According the assessments conducted for this EIS for NGS, past, present, and reasonably foreseeable activities in conjunction with activities associated with the Renewable PFR Alternative would not result in other than negligible to minor adverse environmental, human health, economic, or social effects on any population. Consequently no high and adverse cumulative impacts on identified environmental justice populations would be anticipated.

3.19.4.5.5.2 Proposed Kayenta Mine Complex

According to the assessments conducted for this EIS for the proposed KMC, past, present, and reasonably foreseeable activities in conjunction with activities associated with the Renewable PFR Alternative would not result in other than negligible to minor environmental effects on any population. Potentially adverse public health and sociocultural effects would occur for residents living in the vicinity of the proposed KMC. The public health assessment identified potential health impacts of noise, effects on cultural resources, relocation of residents, and withdrawal of grazing lands. Of these, health impacts of noise and resident relocations would be major, and health effects of associated with disturbance of cultural resources and withdrawal of grazing lands would be considered minor. Fewer residents possibly would be relocated and fewer grazing areas withdrawn to accommodate mining under the Renewable PFR Alternative than under the Proposed Action. The potential for relocations and grazing displacement would be reduced as the amount of federal energy replacement increased.

The sociocultural assessment (Section 3.18.3.1) concluded that past and present mining activities on the proposed KMC lease area, which included operations of the former Black Mesa Mine and over 40 years of operation of the Kayenta Mine, has resulted in sociocultural effects on area residents, many of whom have coexisted with mining activities and altered landscapes and cultural settings for decades. These include sharing access roads with heavy industrial traffic, noise, altered landscapes, effects on cultural resources, relocation, and withdrawal of grazing areas. In combination with other factors such as poverty, population growth, and the Navajo-Hopi Land Resettlement Act, these impacts have resulted in substantial change in both the traditional setting and social structure.

The public health assessment noted concern for continued mining among some proposed KMC area residents. It concluded that the community concerns related to direct health effects associated with mine operations or indirect effects (e.g., visual disturbances, loss of traditional and cultural lifestyles, or public safety related to nearby mining) potentially could cause emotional stress, leading to an impact on overall well-being and/or psychosocial health. For some residents, the belief that mining is incompatible with Navajo traditional values could result in considerable stress. These direct effects of mining activities would accrue to residents living in the vicinity of the proposed KMC. No other populations would be affected.

Regarding reasonably foreseeable future activities in the lease area, phases 1 and 2 of the Many Mules water project would supply water to a number of households. The remaining three phases are dependent on funding.

For some residents living in the vicinity of the proposed KMC, employment, relocation or compensation for homes, compensation for withdrawn grazing land, PWCC-provided amenities and services, and the prospect of receiving water service would offset these other impacts. For others, these benefits would not be considered as offsetting the adverse effects.

Consequently, cumulative adverse sociocultural effects of past and present actions combined with effects associated with the Renewable PFR Alternative would disproportionately affect the environmental justice population residing within the vicinity of the proposed KMC.

3.19.4.5.5.3 Central Arizona Project Area of Indirect Socioeconomic Effects

Cumulative effects on the CAP system under the Renewable PFR Alternative would be similar to those associated with the Proposed Action, with the exception that the higher pumping costs for this alternative would exacerbate the economic effects of declared Colorado River water shortages for CAP customers. These effects would apply to all CAP customers; therefore, no disproportionately high and adverse impacts to CAP area environmental justice populations would be anticipated under either Renewable PFR Alternative.

3.19.4.6 Tribal Partial Federal Replacement Alternative

Under this alternative, power and energy would be purchases from photovoltaic solar facility(ies) located on the lands of one or more affected tribes. Energy from the PV solar facility(ies) would be dedicated to meet a portion of CAP demands during daylight hours (e.g., 12 hours a day, delivering between 100 MW to 250 MW to the CAP during the midday. The net result would be between 0.33 TW-hours and 0.84 TW-hours of energy sourced from the Tribal photovoltaic solar facility(ies) annually with the replacement solar power providing an average of between 38 MW-hours and 94.9 MW-hours per hour over a typical 24-hour period. Energy deliveries from the photovoltaic source(s) would be monitored and NGS curtailment scheduled to achieve the necessary reduction in NGS production and associated reductions in coal combustion. NGS curtailment would not necessarily be concurrent with the scheduled delivery of energy from the photovoltaic sources to the CAP. Non-concurrent curtailment provides flexibility to optimize operations of NGS, while assuring achievement of the established levels of emission reductions, and maintaining the availability of surplus energy from NGS at about the same quantities as under the Proposed Action.

Construction of a new photovoltaic generation site on tribal land would require the commitment of land, estimated at between 1,200 and 3,00 acres, and would result in new surface disturbance at a location subject to evaluation in a subsequent NEPA action. Sites selected for installation of a photovoltaic generation project would be subject to U.S. trust responsibilities. Record searches, and interviews with tribal members would be required to identify TCPs located within and near the proposed site development area as part of site feasibility reviews and pre-construction surveys. If the project were constructed and owned by a Tribe, the revenues from electrical generation would accrue directly to the Tribe.

Tribal Employment Rights Ordinance requirements likely would result in substantial employment opportunities for tribal members during construction and operations of the photovoltaic generation facility. Jobs created by the facility would generate additional indirect and induced jobs, some of which also likely would be filled by members of the host tribe. Site lease revenues or revenues generated by energy sales from the photovoltaic facility could support tribal services and infrastructure, at the discretion of the host tribe's governing body.

3.19.4.6.1 Navajo Generating Station

The assessments conducted for this EIS concluded that the Tribal PFR Alternative would result in negligible impacts to air quality (all emissions would be slightly less than those associated with the Proposed Action and fall within ambient air quality standards), no impacts to water resources, and negligible impacts on human health for the general population.

There would be a small potential for impacts to cultural resources under the 3-Unit Operation, but if such impacts were to occur, they would be mitigated by the provisions of the NGS Programmatic Agreement.

The Tribal PFR Alternative would result in as many as 50 fewer jobs at NGS compared to the Proposed Action.

NGS-related revenues to the Navajo Nation under the Tribal PFR Alternative would be the same as under the Proposed Action.

The social and economic effects of reductions in employment and tribal revenues associated with the Tribal PFR Alternative compared to existing conditions would fall disproportionately on Navajo Nation employees; however, employment and revenues still would be substantial. Positive socioeconomic benefits related to increased revenue and continued and future employment opportunities at NGS would result in major health benefits for the affected workers and their families. Implementation of the Tribal PFR Alternative would reduce the magnitude of such positive effects, and the magnitude of reduction would increase commensurate with the amount of federal energy replaced.

Based on these assessments, no high and adverse impacts on environmental justice populations would be anticipated from NGS and the associated facilities under the Tribal PFR Alternative.

3.19.4.6.2 Proposed Kayenta Mine Complex

The assessments conducted for this EIS concluded that the Tribal PFR Alternative would not result in adverse impacts to air quality (all emissions would fall within ambient air quality standards), and impacts to water quantity and quality would be negligible. Cultural resources could be disturbed, but disturbance would be mitigated by the provisions of the NGS Programmatic Agreement.

The public health and HHRA conducted for the Tribal PFR Alternative concluded that human air and soil pollutant exposure would be considered acceptable and would have a negligible impact on human health for the general population. Particulate emissions under the Tribal PFR Alternative would meet national ambient air quality standards criteria, and proposed KMC operations would have little to no effect on the health of the general population. Although proposed KMC emissions would be reduced under the Tribal PFR Alternative, sensitive subpopulations still could experience some impacts due to exacerbation of existing health conditions; however, the likelihood of the impacts would be lower for the Tribal PFR Alternative than for the Proposed Action, which were deemed to be minor.

Employment and tribal revenues associated with the Tribal PFR Alternative would be lower than those associated with either the Proposed Action or existing conditions. The Tribal PFR Alternative would support as many as 77 to 114 fewer jobs than the Proposed Action, depending on the amount of curtailment at NGS. Proposed KMC-related revenues would be reduced by 5 to 13 percent compared to the Proposed Action, depending on the amount of curtailment at NGS.

For residents living in the vicinity of the proposed KMC, the public health assessment identified potential minor to moderate health impacts of noise, effects on cultural resources, relocation of residents, and withdrawal of grazing lands. It is possible that fewer residents would be relocated and fewer grazing areas would be withdrawn to accommodate mining under the Tribal PFR Alternative than under the Proposed Action. The potential for relocations and grazing displacement would be reduced as the amount of federal energy replacement increased.

Although mine traffic, changes in the landscape, traditional setting and social structure, disturbance of TCPs, relocations, and withdrawals of grazing lands would continue at reduced rates for the Tribal PFR Alternative, they still would fall disproportionately on residents living in the vicinity of the proposed KMC, compounding the impacts of job losses described above.

Residents living in the vicinity of the proposed KMC would continue to coexist with mining activities as well as altered landscapes and cultural settings. These impacts, which are seen as adverse by some residents, would fall disproportionately on residents living in the vicinity of the proposed KMC, virtually all of whom are Navajo. These effects, which are considered direct effects of mining activities, would not impact populations beyond those residing within the vicinity of the proposed KMC.

As noted above, proposed KMC employment would be reduced under the Tribal PFR Alternative, reducing potential offsetting benefits to area residents. Other PWCC-provided amenities and services would continue.

Economic and fiscal effects of the proposed KMC under the Tribal PFR Alternative would be considered beneficial for the Navajo Nation and Hopi Tribe. Direct sociocultural effects would be considered adverse and accrue disproportionately to some residents living in the vicinity of the proposed KMC who are part of the environmental justice population and warrant special consideration because of their proximity to mining operations.

3.19.4.6.3 Central Arizona Project Area of Indirect Socioeconomic Effects

Pumping energy costs for the CAP would increase under the Tribal PFR Alternative, with energy costs potentially much higher with 250 MW of replacement energy (Section 3.18.4.6). The likely impacts of those increases would comprise a minor to major impact for users. The higher energy costs under this alternative could affect the economic feasibility of future sales of surplus energy, which provides revenue to support to the Colorado River Basin Development Fund.

The substantially higher pumping costs for CAP water users under the Tribal PFR Alternative would result in greater indirect affects to all CAP users. Lower contributions to the Colorado River Basin Development Fund, would hamper the Fund's ability to repay CAP's debt obligation to the federal government. Because these effects would apply broadly to all CAP customers, no disproportionately high and adverse impacts to CAP area environmental justice populations would be anticipated under the Tribal PFR Alternative.

3.19.4.6.4 Project Impact Summary – All Project Components

The assessments conducted for this EIS did not identify high and adverse air quality, water resources, ecological, or safety impacts for any population that would result from implementation of the Tribal PFR Alternative.

Adverse human health and sociocultural impacts were not identified for northeastern Arizona, the majority of the Navajo Nation, or the Hopi Reservation, but sociocultural impacts and potential human health impacts were identified for residents living in the vicinity of the proposed KMC. For some of these residents, potential impacts could be offset by project employment, replacement residences or compensation, payments for withdrawn grazing lands, and PWCC-supported amenities and services. For others, particularly those that do not have a family member employed at the mine and/or believe that

mining is not compatible with Navajo traditional values, the mining activity, perceived health and safety risks, and the change in the landscape, traditional setting, and social structure would not be offset by these benefits. These impacts would not affect the rest of the Navajo Nation, the Hopi Reservation, or non-environmental justice populations in northeastern Arizona. Consequently, residents living in the vicinity of the proposed KMC, who are part of the environmental justice population on the Navajo Nation would experience disproportionately high and adverse sociocultural and health impacts under the Tribal PFR Alternative.

Although the Tribal PFR Alternative would result in a reduction in Navajo and Hopi employment and revenues to the two tribes compared to existing conditions, employment and revenue levels still would be much higher than under the No Action Alternative. Sociocultural and health effects on residents within the vicinity of the proposed KMC would be reduced under the Tribal PFR Alternative compared to the Proposed Action. Although the reduction in effects would increase as the amount of federal replacement power increased, they still would fall disproportionately on this segment of the environmental justice population and would not affect the rest of the Navajo Nation, the Hopi Reservation, or non-environmental justice populations in northeastern Arizona.

The higher pumping costs for CAP water users under the Tribal PFR Alternative would result in greater indirect affects to all CAP users. Lower contributions to the Colorado River Basin Development Fund would hamper the Fund's ability to repay CAP's debt obligation to the federal government. Because these effects would apply broadly to all CAP customers, no disproportionately high and adverse impacts to CAP-area environmental justice populations would be anticipated under the Tribal PFR Alternative.

3.19.4.6.5 Cumulative Impacts

3.19.4.6.5.1 Navajo Generating Station

According the assessments conducted for this EIS for NGS, past, present, and reasonably foreseeable activities in conjunction with activities associated with the Tribal PFR Alternative would result in no more than negligible to minor adverse environmental, human health, economic, or social effects on any population. Consequently no high and adverse cumulative impacts on identified environmental justice populations would be anticipated.

3.19.4.6.5.2 Proposed Kayenta Mine Complex

According to the assessments conducted for this EIS for the proposed KMC, past, present, and reasonably foreseeable activities in conjunction with activities associated with the Tribal PFR Alternative would result in no more than negligible to minor adverse environmental or economic effects on any population. Potentially adverse public health and sociocultural effects were identified for residents living in the vicinity of the proposed KMC. The public health assessment identified potential minor to moderate health impacts of noise, effects on cultural resources, relocation of residents, and withdrawal of grazing lands. It is possible that fewer residents would be relocated and fewer grazing areas would be withdrawn to accommodate mining under the Tribal PFR Alternative than under the Proposed Action. The potential for relocations and grazing displacement would be reduced as the amount of federal energy replacement increased.

The sociocultural assessment (Section 3.18.3.1) concluded that past and present mining activities on the proposed KMC, which include operations of the former Black Mesa Mine and over 40 years of operation of the Kayenta Mine, has resulted in sociocultural effects on area residents, many of whom have coexisted with mining activities and altered landscapes and cultural settings for decades. These include sharing access roads with heavy industrial traffic, noise, altered landscapes, effects on cultural resources, relocation, and withdrawal of grazing areas. In combination with other factors such as poverty, population growth, and the Navajo-Hopi Land Resettlement Act, these impacts have resulted in substantial change in both the traditional setting and social structure.

The public health assessment also noted the concern for continued mining among proposed KMC area residents. It concluded that the community concerns related to direct health effects associated with mine operations or indirect effects (e.g., visual disturbances, loss of traditional and cultural lifestyles, or public safety related to nearby mining) potentially could cause emotional stress, leading to an impact on overall well-being and/or psychosocial health. For some residents, the belief that mining is incompatible with Navajo traditional values could result in considerable stress. These direct effects of mining activities would accrue to residents living in the vicinity of the proposed KMC. No other populations would be affected.

Regarding reasonably foreseeable future activities in the lease area, phases 1 and 2 of the Many Mules water project would supply water to a number of households. The remaining three phases are dependent on funding.

For some residents living in the vicinity of the proposed KMC, employment, relocation or compensation for homes, compensation for withdrawn grazing land, PWCC-provided amenities and services, and the prospect of receiving water service would offset these other impacts. For others, these benefits would not be considered as offsetting the adverse effects.

Consequently, cumulative adverse sociocultural effects of past and present actions combined with effects associated with the Tribal PFR Alternative would disproportionately affect the environmental justice population residing within the vicinity of the proposed KMC.

3.19.4.6.5.3 Central Arizona Project Area of Indirect Socioeconomic Effects

Cumulative effects to the CAP system under the Tribal PFR Alternative would be similar to those associated with the Proposed Action, with the exception that the higher pumping costs for this alternative would exacerbate the economic effects of any declared Colorado River water shortages for CAP customers. These effects would apply to all CAP customers; therefore, no disproportionately high and adverse impacts to CAP-area environmental justice populations would be anticipated under the Tribal PFR Alternative.

3.19.4.7 No Action

In the absence of the Proposed Action, major socioeconomic effects would occur throughout the study area.

3.19.4.7.1 Navajo Generating Station and the Proposed Kayenta Mine Complex

Under the No Action Alternative, operation of NGS and the Kayenta Mine would cease by December 23, 2019. Decommissioning and reclamation plans, policies and requirements for NGS are described in Section 2.3.1.1 and **Appendix 1B**. As required in the 1969 Lease, the land would be restored as closely as possible to original condition where the surface of any leased land has been modified or improved. Decommissioning and reclamation plans, policies and requirements for the Kayenta and former Black Mesa mines are described in Section 2.3.1.2, and **Appendix 1B**. Based on the conclusions of the assessments conducted for this EIS, the potential for air quality, water quality, health and safety, and cultural impacts would be associated with decommissioning and reclamation activities at NGS and the Kayenta and former Black Mesa mines, which would be temporary and short-term.

In contrast, implementation of the No Action Alternative and the resultant cessation of operations at these facilities would result in major, widespread, and long-lasting socioeconomic impacts for the Navajo Nation and Hopi Tribe. These impacts would directly and indirectly affect NGS and Kayenta Mine workers, Navajo and Hopi tribal services and employment, Navajo and Hopi households, and businesses. The loss of jobs and income and the reductions in revenues paid to the tribes would result in major adverse effects, given persistently high unemployment and poverty among on-reservation Navajo and Hopi, the importance of the revenues paid to the tribal governments in supporting tribal employment

and the provision of services on a reservation wide basis. The importance of the jobs, income, and revenues is underscored by the lack of any currently identified or reasonably foreseeable new industrial or commercial development that offers prospects to offset the losses.

Implementation of the No Action Alternative would result in the loss of up to 3,090 jobs in the region (Section 3.18.4.7). The Navajo Nation and Hopi Tribe are the single largest employers on their respective reservations. They, along with local governments and public education providers, would see combined reductions in net revenues of more than $58.5 million per year, which is equivalent to more than 23 percent of the combined annual general fund revenues of the two tribes. Foregone revenues to the Navajo under Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1) would be the equivalent of another 18 percent loss in general fund revenues. The losses would be particularly severe for the Hopi Tribe for which mining related revenues account for more than 80 percent of the tribal general fund that supports the tribe's executive, legislative, and judicial functions as well as various services provided to its members. Both tribes would continue to receive various federal grants and contract funds and operate their respective enterprise activities, but those grants and contract funds generally are dedicated to sustaining the enterprises and providing specific programs (e.g., housing); consequently, they are unavailable to meet general government expenses.

Given that 86 percent of NGS employees are Native American (primarily Navajo), 96 percent of the Kayenta Mine workforce is Native American (primarily Navajo), the majority of employees of the tribal services supported by NGS and Kayenta Mine-related revenues are either Navajo or Hopi, and many of the indirect and induced jobs supported by the two facilities are held by either Navajo or Hopi workers, the No Action Alternative-related job losses would disproportionately affect the Navajo Nation and Hopi Tribe.

Although reductions in Tribal employment likely would occur across the two reservations, direct and induced job losses would mainly affect the Navajo chapters near NGS and the Kayenta Mine and the Hopi Reservation.

Positive benefits on health associated with the income and community stability that the NGS and Kayenta Mine provide to the local community also would be eliminated. The elimination of the jobs and income would result in widespread unemployment, emigration of Navajo and Hopi families or wage earners in search of employment, and a reduced material standard of living for many Navajo and Hopi families. These effects would be compounded by the fact that many Navajo and Hopi wage earners support an extended family. These effects could have potentially dramatic indirect effects because general health and well-being are closely correlated to community socioeconomic conditions. In general, communities with low income potential and high unemployment have much poorer health statistics and reduced access to health care.

The scholarship and other charitable and service initiatives supported by NGS and PWCC likely would end over time. PWCC-provided amenities such as free coal and water, road maintenance, and the Kayenta Mine Emergency Clinic would be terminated.

Closure of the Kayenta Mine, would begin to bring a sense of resolution to Navajo and Hopi who view mining and burning of coal on tribal lands and the use of tribal water for mining as incompatible with their respective traditional values. This would be in part because mining and coal-fired electric power generation activities would cease and reclamation would occur 25 years sooner than under all action alternatives.

Under the No Action Alternative, no additional residents living in the vicinity of the proposed KMC would be relocated, no additional grazing lands would be withdrawn, and substantially fewer, if any, TCPs, places, or landscapes that have cultural and religious significance would be disturbed. The land would be reclaimed, but not returned to its pre-mining condition because the reclamation program is designed

to increase the livestock carrying capacity and improve the potential for grazing management. The concerns of residents regarding previous relocations, grazing withdrawals, disturbance of cultural resources, and removal of artifacts and burial sites could persist.

The No Action Alternative would result in major social and economic impacts related to reductions in employment, income and local government revenues throughout northeastern Arizona. These social, economic and associated public health impacts would accrue disproportionately to the Navajo Nation and Hopi Tribe, which are the environmental justice populations identified for this EIS. The adverse social and economic effects of the No Action Alternative would be greater than those under any of the action alternatives and would accrue disproportionately to a larger environmental justice population than the social and economic effects of any of the action alternatives.

The NGS transmission system is an established part of the western U.S. transmission grid and supports reliability and delivery of power throughout the region, well beyond the power generated by the NGS. Therefore, under the No Action Alternative it is likely that that one, several, or all of the land owners/managers of the transmission line rights-of-way and communication site leases would renew some portion of the facilities to keep the power grid performing as expected.

In the event it is determined that some or all of the transmission systems and communication site ROWs are not renewed, a lengthy study and permitting process would need to occur before any decommissioning is initiated due to the essential and integral nature of these facilities with the western electric grid. As noted in Section 2.3.3, up to 4,826 acres within and alongside the transmission system corridors could be temporarily disturbed if the entirety of the transmission systems and communication sites were decommissioned and removed.

3.19.4.7.2 Central Arizona Project Area of Indirect Socioeconomic Effects

A decision denying federal approval of the actions necessary to allow operation of NGS and the proposed KMC to continue would necessitate actions on the part of CAWCD to secure an alternative source(s) of electrical power and energy to operate the CAP system. Based on the analysis conducted for this EIS, pumping energy costs under the No Action Alternative could be between 23 percent less costly and 21 percent more costly compared to the costs under the Proposed Action, depending on market conditions and future prices of natural gas. Due to the uncertainty regarding natural gas prices, future energy rates under No Action may be more variable over time than under the Proposed Action. **Table 3.18-78** presents the comparative energy pumping rates and energy costs for the No Action and the Proposed Action Alternatives.

Surplus energy sales and revenues to support the Colorado River Basin Development Fund would cease under the No Action Alternative, regardless of whether pumping energy costs were higher or lower than those under the Proposed Action. Compensating for the loss of such revenues would require adjustments by CAP to fund debt service. The loss of surplus revenue sales could increase pumping energy rates on the order of $10 to $15 per acre-foot (Section 3.18.4.7).

Indirect socioeconomic effects of the No Action Alternative would depend on the ultimate cost of power and pumping costs to the CAP. Higher power costs, coupled with the costs resulting from cessation of contributions to the Colorado River Basin Development Fund, would represent a major socioeconomic impact for CAP customers. Conversely, substantially lower energy costs could compensate for the cessation of contributions to the Development Fund, resulting in minor impacts. In either case, these effects would apply broadly to all CAP customers. No disproportionately high and adverse impacts to CAP area environmental justice populations would be anticipated under the No Action Alternative.

3.19.4.7.3 No Action Impact Summary – All Project Components

Implementation of the No Action Alternative would result in cessation of emissions from operations at NGS and the Kayenta Mine. Based on the conclusions of the assessments conducted for this EIS, the

potential for air quality, water quality, health and safety and cultural impacts associated with decommissioning and reclamation activities at NGS and the Kayenta and former Black Mesa mines, would be temporary and short-term.

Effects of mining, including relocation, withdrawal of grazing lands, disturbance of cultural resources, and conflicts with Navajo and Hopi traditional values, would effectively cease after 2019. Some traffic and noise effects would continue through the decommissioning and reclamation period, but at greatly reduced levels.

Economic effects would include the loss of over 3,000 total existing jobs in the region, many of which are currently held by Navajo and Hopi workers. Economic effects also would include the loss of more than $54.8 million in combined revenues annually for the two tribes, which would be equivalent to more than 23 percent of the combined annual general fund revenues of the two tribes. Foregone revenues to the Navajo under Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1) would be the equivalent of another 18 percent loss in general fund revenues. The losses would be particularly severe for the Hopi Tribe for which mining related revenues account for more than 80 percent of its general fund. The reductions in tribal revenues would in turn reduce services and employment on the two reservations, which would be major, long-term adverse impacts for the two tribes. Employment losses would have corresponding social effects and potentially result in relocation for affected Navajo and Hopi families or wage earners. These economic and social impacts would be considered high and adverse and would accrue disproportionately to the Navajo Nation and Hopi Tribe, which are environmental justice populations identified for this EIS.

Although indirect socioeconomic effects of the No Action Alternative could range from major to minor for CAP customers, including CAP-affected Indian tribes, the effects would apply broadly to all CAP customers. Consequently no disproportionately high and adverse impacts to CAP area environmental justice populations would be anticipated.

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Section 3.20

Indian Trust Assets

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Acronyms and Abbreviations

1969 Lease	Navajo Project Indenture of Lease
BART	Best Available Retrofit Technology
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BM&LP Railroad	Black Mesa and Lake Powell Railroad
BO	Biological Opinion
CAP	Central Arizona Project
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO_2	carbon dioxide
Co-tenants	Salt River Project, Los Angeles Department of Water and Power, Arizona Public Service, NV Energy, and Tucson Electric Power Company
Development Fund	Lower Colorado River Basin Development Fund
EIS	Environmental Impact Statement
ERA	Ecological Risk Assessment
ESA	Endangered Species Act of 1973
HHRA	Human Health Risk Assessment
Indian trust asset	Indian Trust Asset
km	kilometer
KMC	Kayenta Mine Complex
kV	kilovolt
kW	kilowatt
MW	megawatt
N-Aquifer	Navajo Aquifer
NEPA	National Environmental Policy Act of 1969, as amended
NGS	Navajo Generating Station
NGS Participants	U.S. (Reclamation), Salt River Project, Los Angeles Department of Water and Power, Arizona Public Service, NV Energy, and Tucson Electric Power Company
NHPA	National Historic Preservation Act
NNEPA	Navajo Nation Environmental Protection Agency
NO_2	nitrogen dioxide
NO_X	nitrogen oxide
OSMRE	Office of Surface Mining Reclamation and Enforcement
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PFR	Partial Federal Replacement
PWCC	Peabody Western Coal Company
Reclamation	U.S. Bureau of Reclamation
ROW	Right-of-way

SO_2	sulfur dioxide
SRP	Salt River Project Agricultural Improvement and Power District
STS	Southern Transmission System
tpy	tons per year
U.S.	United States
USEPA	U.S. Environmental Protection Agency
WTS	Western Transmission System

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3.20 Indian Trust Assets

Indian trust assets are "…'legal interests' in 'assets' held in 'trust' by the Federal Government for federally recognized Indian tribes or individual Indians" (United States [U.S.] Bureau of Reclamation [Reclamation] 1994). Trust assets may include lands, minerals, hunting and fishing rights, water rights, and instream flows. Cultural and paleontological resources located on Indian trust lands also may be Indian trust assets in some specific situations. The U.S., with the Secretary of the Interior as the Trustee, holds many assets in trust for Indian tribes or Indian individuals (Reclamation 1993a). The U.S. Bureau of Indian Affairs (BIA) further states, "In several cases discussing the trust responsibility, the Supreme Court has used language suggesting that it entails legal duties, moral obligations, and the fulfillment of understandings and expectations that have arisen over the entire course of the relationship between the U.S. and the federally recognized tribes" (BIA 2016).

3.20.1 Regulatory Framework

The U.S. has a trust responsibility to protect and maintain rights reserved by or granted to Indian tribes and individuals by treaties, statutes, and executive orders. These rights are sometimes further interpreted through court decisions and regulations. This trust responsibility requires federal agencies, including Reclamation, to take all actions reasonably necessary to protect trust assets (Reclamation 1993a). The Secretary of Interior must approve actions involving and affecting Indian trust assets. The Secretary has delegated that responsibility to the Bureau of Indian Affairs (BIA) (Reclamation 1994). The BIA has authority over rights-of-way (ROWs) on Indian lands according to 25 Code of Federal Regulations (CFR) Part 169 including subpart 112 (monetary compensation for ROW over or across Indian Land); over leasing on Indian land for housing, economic development, and other purposes according to 25 CFR Part 162; and over leasing of tribal and allotted lands for mineral development according to 25 CFR Parts 211 and 212. The BIA also enforces reclamation on lands mined prior to the passage of Surface Mining Control and Reclamation Act.

The Office of Surface Mining Reclamation and Enforcement (OSMRE) is the federal regulatory authority for reviewing proposed mining plans, issuing permits, and regulating compliance for surface coal mining and reclamation operations on Indian Lands (Section 1.5.1). The Bureau of Land Management (BLM) is responsible for approvals for all operations on Indian coal leases, including exploration, mining, and operations under 43 CFR Part 3480. BLM is responsible for the approval of Resource Recovery and Protection Plans for coal operations under 43 CFR Part 3482.

According to OSMRE Directive 979, which sets forth policies and procedures the agency follows to ensure that actions comply with Indian trust asset responsibilities OSMRE "personnel must ensure that bureau actions identify, conserve, and protect lands and other resources that the Department holds in trust for federally recognized Indian tribes." The directive also states that OSMRE must consult with Indian Tribes and the BIA for actions with potential impacts on trust lands or trust resources and requires OSMRE to "Respect Indian tribal self-government and sovereignty, honor tribal treaty and other rights, and strive to meet the responsibilities that arise from the unique legal relationship between the Federal Government and Indian tribal governments" (OSMRE 2013).

According to the Kayenta Mine Permit Renewal Environmental Assessment, "The primary statutes governing the leasing of Indian coal assets for the benefit of an Indian tribe or nation are the Indian Mineral Leasing Act of 1938 and the Indian Mineral Development Act of 1982. An American Indian Coal Lease is obtained by direct negotiation with Indian tribal authorities, but is subject to approval and administration by the United States Department of the Interior. The authority by which coal reserves that are Indian trust assets are leased is described in 25 U.S. Code Section 396a and concerns leases of unallotted lands for mining purposes. It states the following: "On or after May 11, 1938, un-allotted 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 10 years and as long thereafter as minerals are produced in paying quantities" (OSMRE 2011).

The Navajo Nation is working toward assuming primacy to implement and enforce the Surface Mining Control and Reclamation Act on trust lands and it is anticipated that the Navajo Nation will assume primacy in 2017. Navajo Nation primacy would not affect the actions that are the subject of this EIS because the Navajo Nation program must be as stringent as, or more stringent than, the rules under the OSMRE program.

3.20.1.1 Consultation and Public Involvement

National Environmental Policy Act (NEPA) procedures for Reclamation require the agency to conduct a public involvement program designed to elicit an appropriate level of input from Indian persons and entities at all stages of the NEPA compliance process (Reclamation 2012). Section ITA 4.B. – Public Involvement of the Indian Trust Chapter: Assessment of Impact's on Indian trust assets (Reclamation 1993b), states that, "…Public involvement should be used to: (i) assist to identify potentially affected ITAs and assess potential impacts; (ii) provide potentially affected Indian people with information about the actions being studied; and (iii) involve potentially affected Indian communities in the decision making process. The public involvement program for actions potentially affecting ITAs will include consultation with interested and affected individuals, organizations, agencies, tribal governments, and other governmental entities having jurisdictional responsibilities for the assets."

Section 1.10 of this EIS identifies past Reclamation government-to-government consultations with affected tribes in conjunction with this project. Government-to-government tribal consultations will continue to occur at key stages of the project, as requested by tribal governments. Section 1.11 describes the Public Scoping process undertaken for this EIS, including the information provided prior to and during the scoping meetings.

3.20.2 Study Areas

3.20.2.1 Proposed Action and Action Alternatives

The Navajo Generating Station (NGS) is located entirely within the boundaries of the Navajo Nation. Consequently, the study area for potential effects on Indian trust assets includes the Navajo Nation with a focus on the areas within and surrounding the NGS and the Black Mesa and Lake Powell (BM&LP) Railroad.

The proposed Kayenta Mine Complex (KMC) is located entirely within the boundaries of the Navajo Nation and the Hopi Tribe; therefore, the study area for potential effects on Indian trust assets includes the Navajo Nation and Hopi Tribe with a focus on the areas surrounding and within the proposed KMC.

The Southern Transmission System (STS) ROW includes 3,913 acres of Navajo Nation trust land and does not cross other Indian lands. The Western Transmission System (WTS) ROW includes 54.5 acres of Navajo Nation land and 138 acres of Kaibab Paiute trust land. On the Moapa Paiute Indian Reservation within the BLM administered Moapa Corridor, the WTS is located within a 341-acre ROW issued by BLM. The study area for transmission systems and communication sites includes affected trust lands of these three tribes.

The Indian trust asset assessment for the Central Arizona Project (CAP) focuses on the 10 tribes with CAP water allocations (i.e., CAP-affected tribes). These include the Ak-Chin Indian Community, Fort McDowell Yavapai Nation, Gila River Indian Community, Pascua Yaqui Tribe, Salt River Pima-Maricopa Indian Community, San Carlos Apache Tribe, Tohono O'odham Nation, Tonto Apache Tribe, White Mountain Apache Tribe, and Yavapai-Apache Nation.

3.20.2.2 Cumulative

Given the influences of past and present actions and reasonably foreseeable actions on the affected Indian trust assets and the location and influences of the Proposed Action and alternatives, the study areas for the cumulative assessment are the same as those described for the Proposed Action and action alternatives.

3.20.3 Affected Environment

3.20.3.1 Navajo Nation

The Navajo Nation is a federally recognized Indian tribe whose reservation covers 12.5 million acres within New Mexico, Utah, and Arizona. The reservation initially was established by treaty in 1868 and has been expanded by Executive Orders in 1884, 1900, and 1930. The affected environment for Navajo Nation Indian trust assets includes those trust assets that may be affected by the Proposed Action or action alternatives. The majority of these assets are located within the northwest portion of the Navajo Nation, in Arizona. These assets include, but are not limited to, water, lands, minerals, and hunting. The project components that may potentially affect Indian trust assets include the NGS (including associated facilities and the BM&LP Railroad), the proposed KMC, and the transmission systems and communication sites.

Portions of the Navajo Nation are located within the Upper Colorado River Basin watershed in Arizona. Portions of the Little Colorado River watershed are located within the Navajo Nation, as well. The Navajo Nation has not yet been adjudicated a right to Upper Colorado River water, nor have water rights to the Little Colorado River watershed been adjudicated.

3.20.3.2 Hopi Tribe

The Hopi Tribe is a federally recognized Indian tribe whose reservation was established in 1882, by Executive Order. The original reservation covered 2.5 million acres in Arizona. Today, the Hopi Reservation occupies 1.5 million acres including Moenkopi. Moenkopi is a 97 square-mile portion of the Hopi Reservation separated from and located west of the main reservation. Both the main reservation and Moenkopi are surrounded by the Navajo reservation. The assets potentially affected by the Proposed Action or action alternatives include water, land, minerals, and hunting. The project component that potentially may affect Hopi Indian trust assets is the proposed KMC.

Portions of the Little Colorado River watershed are located on lands of the Hopi Tribe. The Hopi Tribe has not yet been adjudicated a right to Little Colorado River water.

3.20.3.3 Kaibab Band of Paiute Indians

The Kaibab Band of Paiute Indians is a federally recognized Indian tribe whose reservation was established by Executive Orders in 1913 and 1917. The reservation encompasses approximately 121,000 acres in Arizona, with its northern boundary coinciding with the Arizona-Utah boundary. Land is the only trust asset potentially affected by the Proposed Action or action alternatives. The project component that potentially may affect the Kaibab Band of Paiute Indians is the WTS, which crosses through the Kaibab Paiute trust lands. Additionally, one communication site is located on the Kaibab Paiute Reservation at Pipe Spring.

3.20.3.4 Moapa Band of Paiute Indians

The Moapa Band of Paiute Indians is a federally recognized tribe whose reservation consists of 71,954 acres located in Nevada. Originally 2 million acres were set aside in 1874 for the Moapa River Indian Reservation, but the area was reduced to 1,000 acres in 1876. In 1980, 70,000 acres were added. Land is the only trust asset potentially affected by the Proposed Action or action alternatives. The project

component that potentially may affect the Moapa Band of Paiute Indians is the WTS, which crosses through the Moapa River Indian Reservation on federal land administered by the BLM.

3.20.3.5 CAP-affected Tribes

There are 10 federally recognized Indian tribes in Arizona that have received allocations of Colorado River and/or CAP water, some of which have been obtained through water settlements. These tribes are identified in **Table 3.20-1**. Water rights are the only trust asset potentially affected by the Proposed Action or action alternatives.

Table 3.20-1 Tribes with CAP Water Allocations

Tribe / Reservation	County	Reservation Land Area (acres)	Annual CAP Water Allocation (acre-feet)	Obtained through Water Settlement
Ak-Chin Indian Community	Pinal	21,840	75,000 [1] (up to 85,000 if available)	Yes
Fort McDowell Yavapai Nation	Maricopa	24,680	18,233	Yes
Gila River Indian Community	Maricopa and Pinal	371,933	311,800	Yes
Pascua Yaqui Tribe	Pima	892	500	No
Salt River Pima-Maricopa Indian Community	Maricopa	52,729	39,200	Yes
San Carlos Apache Tribe	Gila and Graham	1,853,841	30,845 [2]	Yes
Tohono O'odham Nation	Pinal and Pima	2,774,370	74,000	Yes, except for 8,000 af
Tonto Apache Tribe	Gila	85	128	No
White Mountain Apache	Navajo, Gila, Apache	1,664,972	25,000	Yes
Yavapai-Apache Nation	Yavapai	640	1,200	No
TOTALS	**—**	**6,765,982**	**575,906**	

3.20.4 Environmental Consequences

3.20.4.1 Issues

Indian trust assets in the areas surrounding the NGS include water resources and land, particularly with regard to impacts from disturbance and uses. Indian trust assets within and adjacent to the proposed KMC also include water and land as well as minerals and hunting. Therefore, Indian trust assets for the Navajo Nation and Hopi Tribe include land, water, minerals, and hunting.

Land is the only Indian trust assets for the transmission systems and communication sites; therefore, it would be the only trust asset for the Kaibab Band of Paiute Indians and the Moapa Band of Paiute Indians.

Water is the Indian trust assets for the CAP, particularly with regard to water rights for the CAP-affected tribes.

3.20.4.2 Impact Methodology

For the assessment of potential effects of the Proposed Action and alternatives on Indian trust assets, sections of this EIS that evaluated water, land and land use, minerals, and tribal revenues were reviewed to identify affected Indian trust assets and potential impacts on those assets. Due to the tribal-centric nature of Indian trust assets, discusssions regarding the resources evaluated are organized by tribe rather than by project component.

3.20.4.3 Proposed Action

Under the Proposed Action, NGS would continue operating through 2044, and decommissioning activities would occur through 2045. For purposes of the analysis of impacts to the trust assets described above, future NGS operations would include either 3-Unit Operation or 2-Unit Operation and essentially be consistent with historical operations, including the use of coal supplied by the proposed KMC and transported by the BM&LP Railroad, use of water from Lake Powell for cooling, ash disposal both in the on-site disposal landfill and sold for off-site use, and periodic overhauls. The transmission systems and communication sites would continue to be operated, maintained, and repaired on an as-needed basis. Periodic routine inspections would continue to occur.

3.20.4.3.1 Navajo Nation

Under the Proposed Action, surface lands would be leased from the Navajo Nation for the NGS site, overland conveyor, and portions of the transmission systems and communication sites. The lease amendment has been negotiated between SRP (on behalf of the NGS Participants) and the Navajo Nation; if approved by the Secretary of the Interior, it would be considered consistent with the Department of the Interior's trust responsibilities for Indian trust assets.

Under the terms of Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1), the Navajo Nation would realize substantial increases in payments from the NGS Co-tenants (Section 3.18.4.3). For the 3-Unit Operation, the changes would yield a 1,400 percent increase in payments compared to current lease payments. Under the 2-Unit Operation, the additional payments would be scaled back based on a rated capacity of 1,500 megawatts (MW) for the two remaining operational generating units; therefore, the net increase would be nearly 1,000 percent. Total NGS-related payments to the Navajo Nation from 2020 to 2044 would be an estimated $1.075 billion under the Proposed Action 3-Unit Operation and $793 million under the 2-Unit Operation.

The projected $43 million in annual payments accruing to the Navajo Nation under the 3-Unit Operation would represent nearly a 15 percent increase in the tribe's annual general revenues over historical conditions. Under the 2-Unit Operation, future annual revenues to the Navajo Nation of $31.7 million would represent an increase of nearly 11 percent in the Navajo Nation's annual general revenues over historical conditions.

3.20.4.3.1.1 Water

Navajo Nation water trust assets that potentially would be affected by the Proposed Action include groundwater located beneath the NGS used at the proposed KMC for mining operations. The groundwater used at the proposed KMC would primarily be N-Aquifer water.

Water diverted from Lake Powell and surface water within the Little Colorado River are not Indian trust assets for the proposes of this assessment. As noted in Chapter 1.0, Arizona holds an Upper Colorado River Basin annual apportionment of 50,000 acre-feet of Colorado River water. The Navajo Nation has not been adjudicated a right to Upper Colorado River Basin water. In approving the 1969 Lease and subsequent Lease Amendment No. 1, the Navajo Nation has not given up any separate claim of right to use water from the Upper Colorado River Basin from Arizona's share on the Navajo Reservation.

Consequently, water diverted and used by NGS pursuant to the 1969 Lease, as amended, and the renewed Water Service Contract, is not an Indian trust asset for purposes of this assessment.

As part of the 1969 Lease, the Navajo Nation agreed that NGS could consumptively use 34,100 acre-feet per year from Arizona's share of the Upper Colorado River Basin apportionment. Section 15 of the 1969 Lease sets forth this provision, which includes an agreement by the Navajo Nation that use of water on Navajo lands in the Upper Basin of Arizona would not reduce the availability of 34,100 acre-feet per year for use by NGS. Reclamation's water service contract with SRP (on behalf of the NGS Participants) does not preclude the Navajo Nation from asserting a claim for water rights uses in Arizona. Under the Proposed Action, pursuant to Lease Amendment No. 1, Section 15 would remain in effect and the NGS Participants would continue to divert and use water pursuant to a renewed Water Service Contract with Reclamation through 2044, plus decommissioning. The NGS Co-tenants hold a certificate of water right issued by the Arizona Department of Water Resources for use of Arizona's Upper Colorado River Basin apportionment at NGS. Impacts to surface water resulting from operation of NGS under the Proposed Action are described in Section 3.7.4.2, Water Resources.

As noted earlier, the Navajo Nation also has not yet been adjudicated a right to Little Colorado River water; therefore, it is not considered to be a Navajo Nation Indian trust asset for purposes of this assessment. The Little Colorado River watershed encompasses all proposed KMC components. The Coal Mine, Dinnebito, and Moenkopi washes emanate in or near the Kayenta Mine permit area and flow southwestward as tributaries to the Little Colorado River. Impacts to these surface waters from the Proposed Action are discussed in the Section 3.7.4.2, Water Resources.

Prior to construction of the NGS, the depth of the N-Aquifer at the plant site was approximately 900 feet below ground surface. As noted in Section 3.7.3.2, recharge from Lake Powell is anticipated to cause the N-Aquifer to rise 1 to 2 feet per year for the next 50 to 100 years, when hydraulic equilibrium would be reached. At that point, the N-Aquifer would be approximately 700 to 766 feet below ground surface or more at the plant site, and approximately 824 feet below ground surface or more at the dry ash disposal area. As noted in Section 3.7.4.2, groundwater monitoring and site inspections are part of existing site management. Implementation of both a Groundwater Protection Plan and a Perched Water Dewatering Plan would monitor and address any leakage problems that arise. Prior to decommissioning NGS, measures would be implemented consistent with the Groundwater Protection Plan, Perched Water Dewatering Plan, and Resource Conservation and Recovery Act requirements, including Phase I and II Environmental Site Assessments (and remediation as required), to ensure the groundwater quality has not been impaired. A long-term monitoring plan for groundwater quality, consistent with USEPA's Coal Combustion Residuals rule, also would be implemented (Section 3.7, and **Appendix 1B**). Based on the findings of Section 3.7.4.2, no impacts to Navajo Nation water trust assets would result from Proposed Action operations at NGS.

At the proposed KMC, water withdrawals from the N-Aquifer would continue at essentially the same rate for the Proposed Action 3-Unit Operation and 2-Unit Operation. Compliance with Surface Mining Control and Reclamation Act regulations and the approved Kayenta Mine permit would continue to form the basis for water management and monitoring at the Kayenta Mine. The regulatory program guides baseline water resources characterization; assessment of potential impacts; and the design, construction, and operation of water controls to address protection of the hydrologic balance. The Navajo Nation would be compensated for these withdrawals in the form of water fees. Future fee rates for use of water from the N-Aquifer would substantially increase revenues over those that historically have been received by the Navajo Nation.[1] Mine-related pumping due to the Proposed Action would create predicted N-Aquifer drawdowns and would result in increases in pumping lift ranging from zero to a

[1] An increase in water rates, retroactive to 2015, is pending approval by the Hopi Tribal Council and the Secretary of the Interior. Details of the new rate have not been released.

maximum of 3.7 percent over current levels at affected communities. The median value would be 0.7 percent (Section 3.7.5.2).

There would be no changes to N-Aquifer water quality as a result of mining activities at the proposed KMC (Section 3.7.4.2). Effects on stream baseflows would be none to negligible, depending on the stream. Similarly, the potential impacts to discharges at N-Aquifer springs from the Proposed Action would be none to negligible.

Based on the predicted results, these effects would comprise negligible to minor impacts on Navajo Nation water trust assets from Proposed Action pumping, decommissioning, and reclamation at the proposed KMC.

3.20.4.3.1.2 Land

Navajo Nation land trust assets affected by the Proposed Action would include the Navajo Nation trust lands leased by the NGS Co-tenants for the NGS and its associated facilities, the BM&LP Railroad, the trust lands leased by PWCC that would be included in the proposed KMC, and portions of the transmission systems and communication sites that fall within the Navajo Nation. No infrastructure changes would occur to the BM&LP or the transmission systems and communication sites that fall within the Navajo Nation. Maintenance and operations of the BM&LP or the transmission systems and communication sites would be ongoing.

Under the Proposed Action, 3,485 acres of surface would be leased from the Navajo Nation for the NGS site, 67 acres for the overland conveyor, and 4,297 acres for portions of the transmission systems and communication sites located on Navajo Nation tribal trust land. Compensation for the leased lands is included under the terms of Lease Amendment No. 1 (or would be included in a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1).

Upon closure, land disturbed at NGS would be restored as closely as possible to original condition where the surface of any leased land has been modified or improved, as required by the 1969 Lease and Lease Amendment No. 1. Decommissioning of the NGS would entail compliance with the Groundwater Protection Plan, Perched Water Dewatering Plan, Phase I and II Environmental Site Assessments, and USEPA's Coal Combustion Residual Rule, (Section 3.7.4.2 and **Appendix 1B**). Consequently, no negative impacts to Navajo Nation land trust assets would be anticipated from Proposed Action NGS operations, decommissioning, or reclamation.

Under the Proposed Action, the former Black Mesa Mine and Kayenta Mine permit areas would be combined into one permit of 62,930 acres and the combined area would be called the KMC. Of that total, Navajo Nation has surface and 100 percent of the mineral rights to 22,930 acres, surface and 50 percent of the mineral rights to 33,863 acres, and 50 percent of the mineral rights to 6,137 acres. The proposed KMC would have a life-of-mine plan equivalent to the proposed life of the NGS and would continue supplying coal to the NGS through the year 2044. OSMRE approvals to mine would be subject to 5-year permit renewals. No new mining would occur at the former Black Mesa mine area. The support facilities located in the former Black Mesa mine area currently used to support mining at the Kayenta Mine would continue in use through 2044.

Future mining under the Proposed Action 3-Unit Operation would involve the N-10, N-11E, and J-21W areas as well as portions of the N-9, J-19, and J-21 areas. Under the Proposed Action 2-Unit Operation, future mining would not occur in the N-10 area. The Navajo Nation would be compensated for use of the land within the proposed KMC permit area through royalty payments, as described in the following minerals subsection.

Under the Proposed Action 3-Unit Operation, all or parts of six grazing areas would be withdrawn to accommodate mining. Some areas currently withdrawn for mining may be released for grazing following

reclamation. Under the 2-Unit Operation, all or parts of five grazing areas would be withdrawn. The relocation and compensation process is described in Section 3.13.3.2. Grazing permit holders whose lands would be withdrawn would receive compensation for loss of use.

Mined land would be reclaimed pursuant to the approved reclamation plan and existing lease agreements. PWCC would restore the land with equal or greater forage productivity than pre-mining conditions (Section 3.14) or for other approved uses including wildlife habitat and cultural plants. After reclamation is determined satisfactory by the OSMRE and BIA, and following the release of bonds, control of the surface use would revert to the Navajo Nation. Negligible to minor impacts to Navajo Nation land trust assets would be anticipated under Proposed Action operations, decommissioning, and reclamation at the proposed KMC.

3.20.4.3.1.3 Minerals

Based on the findings of Section 3.4, Mineral Resources, there is a low probability that commercially extractable minerals are present in the vicinity of the NGS and a low probability that commercially extractable minerals other than coal are present in the vicinity of the proposed KMC. Therefore coal is the only Navajo Nation mineral trust asset that would be affected by the Proposed Action.

The volume of coal that would be mined in the 2020 to 2044 timeframe under the Proposed Action would depend on the implementation of 3-Unit Operation or 2-Unit Operation at NGS. A 3-Unit Operation would require delivery of approximately 8.1 million tons per year (tpy) of coal, and a 2-Unit Operation would require 5.5 million tpy. The PWCC life-of-mine plan (PWCC 2012 et seq.) anticipates that there would be adequate coal to meet NGS generation requirements from 2020 through 2044 (Section 2.3.1.2, **Table 2-6**). PWCC would not exhaust its previously granted right to mine 670 million tons of coal under either Proposed Action operation (Section 1.3).

Under the coal lease agreements, the Navajo Nation and Hopi Tribe would receive combined annual royalty and bonus payments of approximately $46.4 million per year and estimated total payments of over $1.16 billion over the period from 2020 to 2044 under the 8.1 million tpy coal production. Under the 5.5 million tpy coal production, estimated annual and total payments would be almost $33 million and $787 million, respectively. Approximately 67 percent of these revenues would accrue to the Navajo Nation. These revenues would not be sensitive to fluctuations in interest rates and energy commodity prices and would escalate in response to general inflation. Although Indian trust coal assets would be consumed under the Proposed Action, the compensation received by the tribe would be considered beneficial. The compensation, existing lease agreements, permits, and ROWs were negotiated between PWCC and the Navajo Nation, with BIA oversight; therefore, they are consistent with the U.S. Department of the Interior's trust responsibilities for Indian trust assets. BLM also monitors mining operations and reviews production reports and royalty payments to ensure compliance with lease provisions according to 43 CFR 3480 Subpart 3485 and to perform its trust responsibility over the mineral resources it is charged with overseeing. Consequently, no impacts to Navajo Nation mineral trust assest would be anticipated that would result in a reduction of their value under the Proposed Action.

3.20.4.3.1.4 Hunting

The Navajo Nation has rights to continue hunting on its lands outside the leased area for NGS and outside active mining areas on the proposed KMC. Although active mining areas would be withdrawn from hunting, reclaimed mining areas would be available for these uses. In some cases, the vegetation mix on reclaimed lands would be different than predisturbance conditions, resulting in negligible to minor impacts to these Indian trust hunting assets.

3.20.4.3.2 Hopi Tribe

3.20.4.3.2.1 Water

Hopi water trust assets that potentially may be affected by the Proposed Action includes groundwater, principally the N-Aquifer water used at the proposed KMC for mining operations. As is the case with the Navajo Nation, the Hopi Tribe has not been adjudicated a right to Little Colorado River water; consequently, Little Colorado River water is not considered an Indian trust asset for purposes of this assessment. The Little Colorado River watershed encompasses all of the existing mine components. The Coal Mine, Dinnebito, and Moenkopi washes emanate in or near the Kayenta Mine permit area and flow southwestwardly, as tributaries to the Little Colorado River. Impacts to these surface waters from the Proposed Action are discussed in detail in Section 3.7.4.2, Water Resources.

At the proposed KMC, water withdrawals from the N-Aquifer would continue at the same rate as under the Proposed Action. The Hopi Tribe would receive compensation in the form of water fees. Increased fee rates for use of water from the N-Aquifer are in the process of being negotiated. If approved, revenues would increase substantially over those historically received by the Hopi Tribe. Mine-related pumping due to the Proposed Action would create predicted N-Aquifer drawdowns and would result in increases in pumping lift ranging from zero to a maximum of 3.7 percent over current levels at affected communities. The median value would be 0.7 percent (Section 3.7.5.2). Based on the predicted results, these effects would comprise negligible to minor groundwater impacts from Proposed Action pumping.

No changes in N-Aquifer water quality would be anticipated as a result of mining activities. Effects on stream baseflows would be none to negligible, depending on the stream. Similarly, the potential impacts to discharges at N-Aquifer springs from the Proposed Action operation would be none to negligible.

Based on the conclusions of the water resources assessment (Section 3.7) negligible to minor impacts on Hopi water trust assets would be anticipated from Proposed Action operations, decommissioning, or reclamation at the proposed KMC.

3.20.4.3.2.2 Land

Hopi land trust assets that potentially may be affected by the Proposed Action include the Hopi trust lands leased by PWCC that would be included in the proposed KMC. This includes 6,137 acres for which the Hopi Tribe holds the surface interest and 50 percent of the mineral interests. No new mining would occur at the former Black Mesa mine area. The support facilities located in the former Black Mesa mine area currently being used to support mining at the Kayenta Mine would continue in use through 2044. The proposed KMC would have a life-of-mine plan equivalent to the proposed life of the NGS and would supply coal to the NGS through the year 2044. OSMRE approvals to mine would be subject to 5-year permit renewals. Future mining of Hopi coal under the Proposed Action would involve the J-21W area. Mining in the J-21 coal resource area would progress onto Hopi-owned surface after 2020; Hopi-owned surface is designated as coal resource area J-21W. The Hopi Tribe would be compensated for use of the land within the proposed KMC permit area through royalty payments as described in the following mineral subsection.

Mined land would be reclaimed pursuant to the approved reclamation plan and existing lease agreements. PWCC would restore the land with equal or greater forage productivity than pre-mining conditions (Section 3.14) or for other approved uses including wildlife habitat and cultural plants. After satisfactory reclamation is determined by the OSMRE and BIA, and following the release of bonds, control of Hopi land surface use would revert to the Hopi Tribe. Consequently, negligible to minor impacts to Hopi land trust assets would be anticipated under the Proposed Action from operations, decommissioning, or reclamation at the Proposed KMC.

3.20.4.3.2.3 Minerals

Based on the findings of Section 3.4, Mineral Resources, there is a low probability that commercially extractable minerals other than coal are present in the vicinity of the proposed KMC. Consequently, Hopi mineral trust assets that may be affected by the Proposed Action would be limited to coal. Hopi coal resources associated with the Proposed KMC include the 6,137 acres identified above as land trust assets, and those associated with an additional 33,863 acres, all of which are located within the former Joint Use Area for which the Hopi Tribe holds 50 percent of the mineral interests.

The volume of coal that would be mined at the proposed KMC in the 2020 to 2044 timeframe under the Proposed Action would depend on the implementation of 3-Unit Operation or 2-Unit Operation at NGS. A 3-Unit Operation would require delivery of approximately 8.1 million tons of coal per year, and a 2-Unit Operation would require 5.5 million tpy. PWCC would not exhaust the right to mine 670 million tons of coal located on the proposed KMC under either Proposed Action operation. Un-mined coal reserves would remain.

Under the coal lease agreements, the Hopi Tribe would receive approximately 33 percent of the combined annual royalty and periodic bonus payments described for the Navajo Nation (Section 3.20.4.3.1). These revenues would not be sensitive to fluctuations in interest rates and energy commodity prices and would escalate in response to general inflation. Although coal trust assets would be consumed under the Proposed Action, the compensation received by the tribe would be considered beneficial. The compensation, existing lease agreements, permits, and ROWs were negotiated between PWCC and Hopi Tribe, with BIA oversight; therefore, they are considered consistent with the U.S. Department of the Interior's trust responsibilities for Indian trust assets. BLM also monitors mining operations and reviews production reports and royalty and bonus payments to ensure compliance with lease provisions according to 43 CFR 3480 Subpart 3485, and perform its trust responsibility over the mineral resources it is charged with overseeing.

Consequently, no impacts to mineral trust assets would be anticipated that would result in a reduction of their value for the Hopi Tribe under the Proposed Action.

3.20.4.3.2.4 Hunting

The Hopi Tribe has rights to continue hunting on its lands outside active mining areas on the proposed KMC. Although active mining areas would be withdrawn from hunting, reclaimed mining areas would be available for these uses. In some cases, the vegetation mix on reclaimed lands would be different than predisturbance conditions, resulting in negligible to minor impacts to these hunting trust assets.

3.20.4.3.3 Kaibab Band of Paiute Indians

Kaibab Band of Paiute Indians trust assets that potentially may be affected by the Proposed Action includes 138 acres for the WTS and 0.06 acre for a communicati ons site on tribal trust land. The easement for the WTS was granted in 1972 for a one-time fee, allowing its use as long as its use is for the purpose of permitting the economical operation and maintenance of the WTS. The communications site is under a separate permit, for which the Tribe receives an annual payment. There would be no change in the easement's use or in ongoing operation, maintenance, and repair activities under the Proposed Action. Therefore, there would be no impacts to land trust assets.

3.20.4.3.4 Moapa Band of Paiute Indians

Moapa Band of Paiute Indians trust assets that potentially would be affected by the Proposed Action include 341 acres for the WTS. The easement was reserved by the U.S. prior to creation of the Moapa River Indian Reservation and is administered by the BLM, which is responsible for providing the Moapa Band of Paiute Indians with annual compensation. There would be no change in the easement's use or in ongoing operation, maintenance, and repair activities under the Proposed Action. Therefore, there would be no impacts to land trust assets.

3.20.4.3.5 CAP-affected Tribes

Water rights are the only Indian trust asset potentially affected by the Proposed Action for the CAP-affected tribes. The water rights held by tribes that received CAP water through water settlements, which are held in trust by the federal government, are considered Indian trust assets.

As noted in Chapter 1.0, the CAP system delivers water from the Colorado River to Arizona tribes holding Colorado River water entitlements but whose reservations are not located along the river. NGS provides the power that makes CAP water a feasible alternative to groundwater pumping. In addition, revenues from the sale of the federal share of NGS power that is not used to operate the CAP pumps are deposited to the Lower Colorado River Basin Development Fund (Development Fund). Development Fund revenues are credited against Central Arizona Water Conservation District's annual repayment obligation to the federal government (Section 3.18.3.3). Pursuant to the Arizona Water Settlement Act, any funds remaining in the Development Fund are used for the payment of fixed operation, maintenance, and replacement charges associated with the delivery of CAP water to Arizona Native American tribes and other statutory purposes (Section 3.18.3.3). To the degree that increases in the cost of generating NGS power reduce the marketability of surplus NGS power, revenues to the Development Fund could decrease.

The Proposed Action would not affect the water rights of those tribes having received CAP water entitlements as a result of water settlements, which are held in trust by the federal government. CAP water entitlements of other tribes with water service contracts with the Secretary of the Interior that are not Indian trust assets, also would not be affected. The delivery of the contracted CAP water entitlements would continue to be governed by the availability of CAP water and the priority schedules associated with the tribes' water settlement and contract terms (Section 3.18.4.3).

Increases in the cost of CAP water and reductions in the availability of revenues for the Development Fund could affect the tribes' decisions regarding whether or not it would be economically viable to utilize their CAP water rights and contracted CAP water entitlements. Many tribes utilize their CAP water for irrigation purposes, making it difficult to absorb the higher cost of water to the same degree that municipal and industrial users that are able to pass on water costs to a larger number of end users, such as utility customers. For those tribes that lease their CAP water to other users, increased water costs due to higher CAP pumping costs would be less of an issue. See Section 3.18.4.3 for additional discussion of impacts from the Proposed Action on the use of CAP water.

3.20.4.3.6 Project Impact Summary – All Project Components

Environmental programs and compliance with regulatory requirements at NGS (e.g., Coal Combustion Residuals regulations) and implementation of the Groundwater Protection Plan, Perched Water Dewatering Plan, Phases I and II Environmental Site Assessments (and remediation as required), and USEPA's Coal Combustion Residuals rule would protect Navajo Nation water trust assets at these sites. Ultimately, plant closure, materials disposition, and plant site reclamation would be conducted as described in the decommissioning description (**Appendix 1B**) implemented pursuant to applicable laws and regulations.

Proposed Action effects on Navajo Nation and Hopi Tribe water trust assets including the N-Aquifer and other groundwater resources at the proposed KMC would be negligible to minor at all locations, based on continued compliance with Surface Mining Control and Reclamation Act regulations and the approved Kayenta Mine permit. The Navajo Nation and Hopi Tribe would be compensated for water used in KMC operations, decommissioning, and reclamation.

Land trust assets potentially affected by the Proposed Action would include Navajo Nation trust lands associated with the NGS lease amendment, and Navajo Nation and Hopi Tribe trust lands associated with the proposed KMC. The NGS Lease Amendment No. 1 was negotiated between NGS and the Navajo Nation. The Navajo Nation would receive increased compensation for continued use of the land

under the terms of the lease. If approved by the Secretary of the Interior, Lease Amendment No. 1 would be considered consistent with the U.S. Department of the Interior's trust responsibilities for Indian trust assets. Although moderate land use impacts associated with mining activities would be anticipated, the Navajo Nation and Hopi Tribe would be compensated through mineral royalty payments for the use of land associated with mining activities on the proposed KMC. Residents within mined areas would be relocated or compensated for their residences, and grazing permittees would be compensated for any land withdrawn for mining purposes.

Land disturbed at NGS would be restored as closely as possible to original condition where the surface of any leased land has been modified or improved, as required by the 1969 Lease and Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1. Land mined at the proposed KMC would be reclaimed pursuant to the approved reclamation plan and existing lease agreements.

Coal would be the only Navajo Nation and Hopi Tribe Indian mineral trust asset affected by the Proposed Action. Compensation for coal mined at the proposed KMC would be provided to the Navajo Nation and Hopi Tribe in the form of royalty and bonus payments.

Proposed Action negative effects on Navajo Nation and Hopi Tribe land trust assets at NGS and the proposed KMC would be negligible to minor at all locations. Conversely, effects of the increase in compensation for the Navajo Nation and Hopi Tribe land and minerals would be seen as major and positive for the Navajo Nation and Hopi Tribe under the Proposed Action.

Navajo Nation rights to hunt on lands outside the leased area for NGS and the Navajo Nation and Hopi Tribe rights to hunt on their respective trust lands outside active mining areas on the proposed KMC would not be affected by the Proposed Action. Although active mining areas would be withdrawn from hunting, reclaimed mining areas would be available for these uses. The post-reclamation vegetation mix would differ from that under predisturbance conditions, resulting in improved forage for grazing and negligible to minor impacts to these Indian trust hunting assets.

Operation of the WTS and STS would continue for the life of the project. The timing of decommissioning and final reclamation requirements for the WTS and STS ROWs ultimately would be determined by the authorities with responsibility for ROW issuance.

Kaibab Band of Paiute Indians land trust assets would continue to be used for the WTS corridor. The easement for the WTS would continue to operate under the provisions of the initial agreement, compensated by the one-time fee. The communications site would continue to operate under the existing permit for which the Tribe receives an annual payment. There would be no change in the easements' use, or in ongoing operation, maintenance, and repair activities under the Proposed Action. Consequently, there would be no impacts to Kaibab Band of Paiute Indians land trust assets.

Moapa Band of Paiute Indians land trust assets potentially be affected by the Proposed Action would include land within the WTS easement reserved by the U.S. prior to creation of the Moapa River Indian Reservation. The easement is administered by the BLM, which is responsible for providing the Moapa Band of Paiute Indians with annual compensation. There would be no change in the easement's use, or in ongoing operation, maintenance, and repair activities under the Proposed Action. Consequently, there would be no impacts to the Moapa Band of Paiute Indians' land trust assets.

The Proposed Action would not affect the water rights of those tribes having received CAP water entitlements as a result of water settlements, which are held in trust by the federal government. CAP water entitlements of other tribes with water service contracts with the Secretary of the Interior that are not Indian trust assets also would not be affected. The delivery of these water rights and contracted CAP water entitlements would continue to be governed by the availability of CAP water and the priority schedules associated with the tribes' water settlement and contract terms (Section 3.18.4.3). Under the

Proposed Action the total energy charges for CAP over the period of extended operations from 2020 to 2044 would be $3,501 million under the 3-Unit Operation and $3,625 under the 2-Unit Operation (**Table 3.18-40** and **Technical Supplement 3.18-A**).

Increases in the cost of CAP water and reductions in the availability of revenues for the Development Fund would affect the tribes' decisions regarding whether or not it would be economically viable to utilize their CAP water rights and contracted CAP water entitlements.

3.20.4.3.7 Cumulative Impacts

3.20.4.3.7.1 Navajo Generating Station

As noted above and in Section 3.7.3.2, Water Resources, recharge from Lake Powell would be anticipated to cause the N-Aquifer to rise for the next 50 to 100 years, when hydraulic equilibrium would be reached. These recharge effects, coupled with the Proposed Action, are the only past, present or reasonably foreseeable future activities that have or would affect NGS-related Navajo Nation water trust assets. No impacts to Navajo Nation water trust assets would be anticipated from Proposed Action operations at NGS; therefore, no cumulative impacts to these resources would be anticipated.

Construction and operation of NGS are the only past, present and reasonably foreseeable actions associated with Navajo Nation land trust assets at those sites. The Navajo Nation has been and is compensated for past and present use of Navajo Nation land for those facilities under the terms of the 1969 Lease. The NGS Lease Amendment No. 1, which would be approved by the Secretary of Interior, would allow for continued use of Navajo Nation lands for NGS under the Proposed Action. Under the terms of the amended lease (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1), the Navajo Nation would receive substantially increased revenues for such use (Section 3.20.4.3). No negative impacts to Navajo Nation land trust assets would be anticipated from Proposed Action NGS operations, decommissioning, or reclamation and, as no other activities for these lands are anticipated, no negative cumulative impacts to these trust assets would occur. Conversely, continued use of Navajo Nation trust lands for NGS would generate substantially increased revenues to the Navajo Nation over the period of the lease amendment, which would result in substantial benefit to the Navajo Nation.

3.20.4.3.7.2 Proposed Kayenta Mine Complex

Section 3.7.3.3 describes past and current effects of the Kayenta and former Black Mesa Mine on Navajo and Hopi water resources. Future pumping for the proposed KMC and community water supply withdrawals would be the only reasonably foreseeable future water withdrawal activities anticipated for the proposed KMC.

Current water uses at the Kayenta mine include domestic supply and sanitation, equipment and coal-processing operations and maintenance, dust suppression (as required by federal regulations), and providing water to nearby tribal residents. The PWCC leases and approved Surface Mining Control and Reclamation Act permit specify monitoring and maintenance of the N-Aquifer wells (OSMRE 2011).

The Kayenta Mine currently withdraws groundwater from seven wells that penetrate through the D-Aquifer to the N-Aquifer. In the past, eight wells were used, but one (NAV5) that was not being used has been plugged to prevent downward movement of poorer quality water from the D-Aquifer to the N-Aquifer. As of September 2015, two wells (NAV4 and NAV7) were open to both the D- and N-Aquifers at the proposed KMC. Migration of D-Aquifer water to the N-Aquifer through the wellbores at these locations has the potential to impact N-Aquifer water quality. Under the Proposed Action, there would be no open D-Aquifer zones in PWCC pumping wells.

Maximum N-Aquifer withdrawals for the mine were 4,740 acre-feet in 1982. That use declined substantially after 2005 (to 1,200 acre-feet per year) with the end of coal slurry pipeline operations that

supplied the Mojave Generating Station. The mean annual pumping for 2006 through 2012 was approximately 1,273 acre-feet. Recent pumping from the mine's wells has varied from approximately 1,200 to 1,600 acre-feet per year. On the lease areas, PWCC monitors water levels in the N-Aquifer supply wells and associated observation wells.

In addition to PWCC's groundwater withdrawals for the Kayenta and former Black Mesa mine, studies indicate pumping by 27 tribal centers from 2008 through 2012 in the study area resulted in between 2,500 and 3,100 acre-feet per year being withdrawn for community uses.

Future mine withdrawals would average approximately 1,200 acre-feet per year through 2044, decline to 500 acre-feet per year through 2047 and then continue at 100 acre-feet per year from 2048 through 2057 before ceasing altogether.

Future groundwater drawdown from Proposed Action mine-related pumping combined with projected community water supply withdrawals would create greater depths to water in N-Aquifer wells. Based on the modeling conducted for this EIS, total groundwater pumping at the affected communities in 2110 would be almost six hundred percent of the volume of pumping in those communities in 2011. The maximum-year percentage of increase in lift at affected communities attributable to Proposed Action-related mine pumping for the proposed KMC under the Proposed Action would range from zero to 3.7 percent, with a median value of 0.7 percent. Consequently, while substantial cumulative increases in N-Aquifer withdrawals would occur over the assessment period, only a small portion of the increase would be attributable to pumping at the proposed KMC. This would result in negligible to minor negative impacts to Navajo Nation and Hopi Tribe water trust assets. The Navajo Nation and Hopi Tribe would be compensated for proposed KMC N-Aquifer water withdrawals.

The water assessment also concluded that negligible cumulative effects on N-Aquifer water quality would result from combined community and project-related pumping under the Proposed Action. Impacts on water quantity and quality in the Wepo Aquifer, alluvial aquifers, and streamflows in regional watersheds also would be negligible. Water fees paid to the Navajo Nation and Hopi Tribe for use at the proposed KMC would be expected to increase dramatically under the Proposed Action, mitigating project-related contributions to cumulative effects. Consequently, proposed KMC contributions to cumulative impacts on Navajo Nation and Hopi Tribe water trust assets would be negligible to minor.

Past, present and reasonably foreseeable future activities affecting Navajo Nation and Hopi Tribe land trust assets within the proposed KMC primarily would be associated with mining. Past effects on Navajo and Hopi lands associated with Kayenta and former Black Mesa mining activities are described in Section 3.14.3.2. At the time of this assessment, most of the land disturbed for former Back Mesa Mine activities has been backfilled, graded, topsoil applied, and reseeded. Approximately 75 percent of land disturbed from previous Kayenta Mine activities has been backfilled and graded, and approximately 50 percent has had topsoil applied and has been reseeded. Future effects on land resources would be limited to those associated with reclamation of previously mined lands and with the Proposed Action. Mined land would be reclaimed pursuant to the approved reclamation plan and existing lease agreements. PWCC would restore the land with equal or greater forage productivity than pre-mining conditions (Section 3.14) or for other approved uses including wildlife habitat and cultural plants. After OSMRE and BIA determine that reclamation is satisfactory and following the release of bonds, control of the surface use would revert to the Navajo Nation and Hopi Tribe. Consequently, negligible to minor cumulative impacts to Navajo Nation and Hopi Tribe land trust assets would be anticipated under Proposed Action operations, decommissioning, and reclamation at the proposed KMC.

Past, present, and reasonably foreseeable future effects on Navajo Nation and Hopi Tribe mineral trust assets within the proposed KMC area are associated with mining under the terms of the respective leases. Given that there is a low probability that commercially extractable minerals other than coal are present in the vicinity of the proposed KMC, effects would be limited to the mining of the coal resource. The Navajo Nation and Hopi Tribe have been compensated through royalty payments for mining and

sales of the coal, and future royalty payments under the Proposed Action would represent continued revenues to the Navajo Nation and Hopi Tribe. Consequently, no cumulative impacts to Indian Trust mineral assets would be anticipated.

Past effects of mining on hunting within the proposed KMC have been associated with closure of areas due to active mining and changes in the vegetation mix on reclaimed lands. Those areas reopen as reclamation is completed. Reasonably foreseeable future hunting effects within the proposed KMC on Navajo Nation and Hopi Tribe hunting trust assets would involve closure of active mining areas under the Proposed Action. This would result in minor impacts on Navajo Nation and Hopi Tribe hunting trust assets due in part to the change in vegetation types over the long term in reclaimed mining areas.

3.20.4.3.7.3 Transmission Systems and Communication Sites

Ongoing maintenance, repair, replacement, and improvement of the transmission lines, substations, and communication sites would be the only reasonably foreseeable future activities for those systems and sites. No construction, major replacement, or other activities would be anticipated. Consequently, no cumulative impacts to Kaibab Band of Paiute Indians or Moapa Band of Paiute Indians land trust assets associated with the transmission lines and communication sites would be anticipated.

3.20.4.3.7.4 Central Arizona Project

No reasonably foreseeable future actions would be anticipated that would affect the water rights held in trust by the federal government for the tribes that have received CAP water entitlements as a result of water settlements

Future shortages of Colorado River water could affect the availability of CAP water, although such shortages would not be likely to affect the priority schedules associated with the tribes' water settlements. Decreases in water deliveries would occur under a declared shortage on the Colorado River, such that fixed operation, maintenance, and reclamation costs would need to be recovered based on a lesser quantity of water deliveries (Section 3.18.4.3).

Preliminary assessment from the Central Arizona Water Conservation District indicates that pumping rates for water delivery could increase substantially, commensurate with the stage of water shortage (Section 3.18.4.3). These increases, coupled with Proposed Action increases in CAP water pumping costs and reductions in contributions to the Development Fund, would affect all CAP system customers. This would be particularly true for agricultural users, including CAP-affected tribes who use all or parts of their allocations for agricultural purposes. These cost increases could affect the tribes' decisions regarding whether or not it would be economically viable to utilize their CAP water rights and contracted CAP water entitlements. Cumulative increases in water rates also could result in higher levels of groundwater pumping. This could result in lower farm income, which could in turn result in farming operations being scaled back, changes in cropping patterns, or changes in the amount of land in production. Higher energy rates also could hamper CAP-affected tribes' plans to support future commercial and industrial development uses and population growth and their ability to reestablish traditional irrigation-based agriculture on their reservations.

3.20.4.4 Natural Gas Partial Federal Replacement Alternative

The Natural Gas PFR Alternative would involve replacement of 100 MW to 250 MW of power generation at NGS by alternative power purchased from existing but unknown natural gas generation sources. NGS would curtail its output by the corresponding amount, continuing operations to generate the remaining federal share, including excess energy available to market as surplus.

It is unknown whether the existing natural gas generation facility(ies) would be located on trust lands of a federally recognized Indian tribe. Consequently, prior and future impacts to Indian trust assets cannot not be evaluated for the Natural Gas PFR Alternative source facility. However, because it is assumed that

the replacement power would be purchased from an existing facility, future impacts to Indian trust assets likely would be negligible if the facility were located on tribal trust lands because little if any additional land would be involved.

Under the Natural Gas PFR Alternative, NGS operations would continue through late 2044, and decommissioning activities would occur through 2045. Future NGS operations would include either 3-Unit Operation or 2-Unit Operation and essentially be consistent with historical operations with the exception that NGS would curtail its generation by an amount equivalent to energy purchased from a natural gas fired alternative. Future operations would include the use of coal supplied by the proposed KMC and transported by the BM&LP Railroad, use of water from Lake Powell for cooling, ash disposal both in the on-site disposal landfill and sold for off-site use and periodic overhauls.

3.20.4.4.1 Navajo Nation

3.20.4.4.1.1 Water

Under the Natural Gas PFR Alternative, the effects of NGS operations, decommissioning, and reclamation on groundwater would be the same as those associated with the Proposed Action. Consequently, no impacts on Navajo Nation water trust assets from NGS would be anticipated under the Natural Gas PFR Alternative.

Water use at the proposed KMC would be the same as under the Proposed Action for the Natural Gas PFR Alternative; therefore mine-related N-Aquifer impacts also would be the same. The increased fee rates for use of water from the N-Aquifer would substantially increase revenues over those that historically have been received by the Navajo Nation. Impacts to groundwater levels and quality in shallow aquifers on the leasehold would be the same or slightly less than the Proposed Action due to a reduction in new mining disturbance and the potential for corresponding changes in mine configurations. Consequently, negligible to moderate impacts on Navajo Nation water trust assets from KMC operations under the Natural Gas PFR Alternative would be anticipated.

3.20.4.4.1.2 Land

Land use effects at NGS resulting from implementation of Natural Gas PFR Alternatives would be the same as those associated with the Proposed Action. Land disturbed at NGS would be restored as closely as possible to original condition, as required by the 1969 Lease and Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1. Total NGS-related payments to the Navajo Nation would be the same for the Natural Gas PFR Alternative as for the Proposed Action. The lease amendment has been negotiated between NGS and the Navajo Nation; if approved by the Secretary of the Interior, it would be considered consistent with the U.S. Department of the Interior's trust responsibilities for Indian trust assets. No negative impacts to Navajo Nation land trust assets would be anticipated under the Natural Gas PRF Alternative, and the beneficial effects of higher NGS-related payments to the Navajo Nation would be substantial.

Land use impacts on the proposed KMC would be the same as the Proposed Action except that 5 to 18 percent less surface disturbance could occur because less coal would be mined. This could change the number of residents that would require relocation. Land mined at the proposed KMC would be reclaimed pursuant to the approved reclamation plan and existing lease agreements. The Navajo Nation would be compensated for use of its land through the payment of coal royalties as described in the following minerals subsection. The mitigation and compensation strategies that would be provided and the steps that would be taken as part of decommissioning and reclamation would result in negligible to minor impacts to Navajo Nation land trust assets would be anticipated.

3.20.4.4.1.3 Minerals

Annual coal requirements for the Natural Gas PFR would be between 0.4 million and 1.0 million tons lower than those under the Proposed Action. The differences associated with the 2-Unit Operation would be in addition to the 2.6 million tpy reduction associated with retirement of one unit under the 2-Unit Operation. The lower coal production would reduce future royalty and bonus payments to the Navajo Nation and Hopi Tribe, although the revenues would remain substantial. Over the period of extended operations from 2020 to 2044, royalty and bonus payments to the Navajo Nation and Hopi Tribe would total between $1.14 billion and $682 million. Approximately 67 percent of those revenues would accrue to the Navajo Nation. The compensation, existing lease agreements, permits, and ROWs were negotiated between PWCC and the Navajo Nation with BIA oversight; therefore, they would be consistent with the U.S. Department of the Interior's trust responsibilities for Indian trust assets. BLM also would monitor mining operations and review production reports and royalty and bonus payments to ensure compliance with lease provisions. Negative impacts to Navajo Nation mineral trust assets would be negligible, and beneficial effects of continued coal royalties for the Navajo Nation would be substantial.

3.20.4.4.1.4 Hunting

As with the Proposed Action, the Navajo Nation would maintain hunting rights on lands outside the leased area for NGS and outside active mining areas on the proposed KMC under the Natural Gas PFR Alternative. Fewer lands could be withdrawn from hunting access because 5 to 18 percent less coal would be mined than under the Proposed Action. Although active mining areas would be withdrawn from hunting, reclaimed mining areas would be available for these uses. In some cases the vegetation mix on reclaimed lands would be different than predisturbance conditions, resulting in negligible to minor impacts to Navajo Nation hunting trust assets.

3.20.4.4.2 Hopi Tribe

3.20.4.4.2.1 Water

Water use at the proposed KMC would be the same for the Natural Gas PFR Alternative as under the Proposed Action; therefore, mine-related N-Aquifer impacts would be the same as those from the Proposed Action. Impacts to groundwater levels and quality in shallow aquifers on the leasehold would be the same or slightly less than in the comparable Proposed Action operation due to reductions in new mining disturbance and the potential for corresponding changes in mine configurations. The Hopi Tribe would be compensated for use of N-Aquifer water, and the increased water fee rates would substantially increase revenues over those that historically have been received by the Hopi Tribe. Consequently, moderate to negligible negative impacts on Hopi Tribe water trust assets from KMC operations would be anticipated under the Natural Gas PFR Alternative, and the effects of higher water payments to the Hopi Tribe would be beneficial.

3.20.4.4.2.2 Land

Impacts on Hopi Tribe land trust assets at the proposed KMC would be the same as the Proposed Action except that 5 to 18 percent less surface disturbance could occur because less coal would be mined. Land mined at the proposed KMC would be reclaimed pursuant to the approved reclamation plan and existing lease agreements. The Hopi Tribe would be compensated for use of its land through the payment of coal royalties as described in the following minerals subsection. Because of the mitigation and compensation strategies that would be provided and the steps that would be taken as part of decommissioning and reclamation, negligible to minor impacts to Hopi tribal land trust assets would be anticipated.

3.20.4.4.2.3 Minerals

Annual coal requirements for the Natural Gas PFR Alternative would be between 0.4 million and 1.0 million tons lower than those under the Proposed Action. The differences associated with the 2-Unit

Operation would be in addition to the 2.6 million tpy reduction associated with retirement of one unit under the 2-Unit Operation. The lower coal production would reduce future royalty and bonus payments to the Navajo Nation and Hopi Tribe, although the revenues would remain substantial. Over the period of extended operations from 2020 to 2044, royalty and bonus payments to the Navajo Nation and Hopi Tribe would total between $1.14 billion and $682 million. Approximately 33 percent of those revenues would accrue to the Hopi Tribe. Compensation, existing lease agreements, permits, and ROWs were negotiated between PWCC and the Hopi Tribe with BIA oversight; therefore, they would be consistent with the U.S. Department of the Interior's trust responsibilities for Indian trust assets. BLM would monitor mining operations and review production reports and royalty and bonus payments to ensure compliance with lease provisions. Negative impacts to Hopi Tribe mineral trust assets would be negligible, and beneficial effects of continued coal royalties to the Hopi Tribe would be substantial.

3.20.4.4.2.4 Hunting

As with the Proposed Action, the Hopi Tribe would maintain hunting rights on its land outside active mining areas on the proposed KMC under the Natural Gas PFR Alternative. Fewer lands could be withdrawn from hunting access because 5 to 18 percent less coal would be mined than under the Proposed Action. Although active mining areas would be withdrawn from hunting, reclaimed mining areas would be available for these uses. In some cases the vegetation mix on reclaimed lands would be different than predisturbance conditions, resulting in negligible to minor impacts to Hopi Tribe hunting trust assets.

3.20.4.4.3 Kaibab Band of Paiute Indians

Effects of the Natural Gas PFR Alternative on Kaibab Band of Paiute Indians trust land assets would be the same as those described for the Proposed Action. There would be no change in either the WTS or communication site easement use or in ongoing operation, maintenance, and repair activities; consequently, there would be no impacts to Kaibab Band of Paiute Indians trust land assets.

3.20.4.4.4 Moapa Band of Paiute Indians

Effects of the Natural Gas PFR Alternative on Moapa Band of Paiute Indians trust land assets would be the same as those described for the Proposed Action. There would be no change in the easement's use or in ongoing operation, maintenance, and repair activities; consequently, there would be no impacts to Moapa Band of Paiute Indians trust land assets.

3.20.4.4.5 CAP-affected Tribes

As with the Proposed Action, implementation of the Natural Gas PFR Alternative would not affect water rights held by tribes who received CAP water through water settlements, which are held in trust by the federal government and are considered Indian trust assets.

Users of CAP water, including CAP-affected tribes, would experience indirect effects associated with differences in pumping costs related to energy costs under the Natural Gas PFR Alternative compared to those under the Proposed Action (Section 3.18.4.4). Under the Natural Gas PFR Alternative, the CAP's total energy charges over the period of extended operations between 2020 and 2044 would be between $3,381 million and $4,275 million under a 3-Unit Operation and between $3,356 million and $4,246 million under a 2-Unit Operation (**Table 3.18-50** and **Technical Supplement 3.18-A**). Those costs represent between 3 percent lower and 22 percent higher (3-Unit Operation) and between 7 percent lower and 17 percent higher (2-Unit Operation) compared to those under the Proposed Action.

The potential differences in pumping costs for CAP water users under the Natural Gas PFR Alternative would result in indirect effects to all CAP users. Energy costs associated with the Natural Gas PFR Alternative could affect the economic feasibility of surplus energy sales, both in terms of the likelihood and value of such energy sales.

Continued low natural gas prices could offer lower rates and result in savings to CAP and its customers including CAP-affected tribes. On the other hand, higher natural gas prices would raise energy costs, further undermining the likelihood for surplus energy sales and surplus revenues to the Development Fund. Conceivably, the loss of surplus revenue sales and impacts of curtailment costs associated with higher levels of replacement energy could raise costs to the point that would render the energy economically unjustifiable for the CAP.

3.20.4.4.6 Project Impact Summary – All Project Components

Navajo Nation and Hopi Tribe Indian trust assets that potentially would be affected by NGS under the Natural Gas PFR Alternative include land and water. The effects on these Indian trust assets resulting from implementation of the Natural Gas PFR Alternative would be substantially the same as those associated with the Proposed Action under the respective 3-Unit Operation and 2-Unit Operation. No negative impacts on Navajo Nation water or land trust assets would be anticipated for NGS from implementation of the Natural Gas PFR Alternative, and the beneficial effects of higher NGS-related payments to the Navajo Nation would be substantial.

Navajo Nation and Hopi Tribe Indian trust assets that would be affected by operations of the proposed KMC include water, land, minerals, and hunting. Annual coal requirements for the Natural Gas PFR Alternative would be between 0.4 million and 1.0 million tpy lower than those for the Proposed Action. Approximately 5 to 18 percent less surface disturbance could occur within the proposed KMC because less coal would be mined. The lower coal production would reduce future lease, royalty, bonus, and water payments to the Navajo Nation and Hopi Tribe, although the revenues would remain substantial.

Water use and groundwater pumping effects at the proposed KMC essentially would be the same as those associated with the Proposed Action, with the exception that impacts to groundwater levels and quality in shallow aquifers on the leasehold would be the same or slightly less than in the Proposed Action due to a reduction in new disturbance and potential changes in mine configurations. Consequently, negligible to moderate impacts would be anticipated on Navajo Nation and Hopi Tribe water trust assets from KMC operations under the Natural Gas PFR Alternative.

Effects on Navajo Nation and Hopi Tribe land trust assets essentially would be the same as under the Proposed Action with the exception that less surface disturbance could occur. This could change the number of residents that would require relocation and the amount of grazing land withdrawn. The mitigation and compensation strategies that would be provided and the steps taken as part of decommissioning and reclamation would result in negligible to minor impacts to Navajo Nation and Hopi Tribe land trust assets under the Natural Gas PFR Alternative.

Annual coal requirements for the Natural Gas PFR Alternative would be between 0.4 million and 1.0 million tons lower than those for the Proposed Action. Over the period of extended operations from 2020 to 2044, royalty, bonus, and water payments to the Navajo Nation and Hopi Tribe would total between $1.14 billion and $682 million. Negative impacts to Navajo Nation and Hopi Tribe mineral trust assets would be negligible under the Natural Gas PFR Alternative and beneficial effects of continued coal royalties to the Hopi Tribe would be substantial.

Effects on Navajo Nation and Hopi Tribe hunting trust assets would be similar to those associated with the Proposed Action. As with the Proposed Action, the vegetation mix on reclaimed lands would be different than predisturbance conditions in some cases, which would result in negligible to minor impacts to Navajo Nation and Hopi Tribe hunting trust assets under the Natural Gas PFR Alternative.

Effects on Kaibab Band of Paiute Indians and Moapa Band of Paiute Indians trust land assets associated with the WTS transmission system and communication site would be limited to ongoing use of the land, for which the respective tribes are compensated by lease agreements. There would be no

change in either the WTS or communication site easement use or in ongoing operation, maintenance and repair activities; consequently, impacts to Indian trust assets would be negligible.

Implementation of the Natural Gas PFR Alternative would not affect water rights held by tribes who received CAP water through water settlements that are held in trust by the federal government and are considered Indian trust assets.

Users of CAP water including CAP-affected tribes, would experience indirect effects associated with the range of somewhat lower to substantially higher pumping costs related to energy costs under the Natural Gas PFR Alternative compared to those under the Proposed Action. Continued low natural gas prices could offer lower rates and result in savings to CAP. Higher natural gas prices would raise energy costs, further undermining the likelihood for surplus energy sales and surplus revenues to the Development Fund. Conceivably, the loss of surplus revenue sales and impacts of curtailment costs associated with higher levels of replacement energy could raise costs to the point that would render this alternative's energy economically unjustifiable for CAP. To the degree that increases in the cost of generating NGS power would reduce the marketability of surplus NGS power, revenues to the Development Fund could decrease. Increases in the cost of CAP water and reductions in the availability of revenues for the Development Fund could affect the Tribes' decisions regarding whether or not it would be economically viable to utilize their CAP water rights and contracted CAP water entitlements.

3.20.4.4.7 Cumulative Impacts

3.20.4.4.7.1 Navajo Generating Station

Cumulative effects on Navajo Nation water and land trust assets resulting from operations, decommissioning, and reclamation of NGS and past, present, or reasonably foreseeable future activities under the Natural Gas PFR Alternative would be the same as those associated with the Proposed Action.

3.20.4.4.7.2 Proposed Kayenta Mine Complex

Cumulative effects on Navajo Nation and Hopi Tribe water, land, and mineral trust assets resulting from implementation of the Natural Gas PFR Alternative related to the proposed KMC would be similar to those associated with the Proposed Action. Minor differences would be associated with the lesser amounts of coal mined at KMC due to the replacement of power generation at NGS under the Natural Gas PFR Alternative. Impacts to groundwater levels and quality in shallow aquifers on the leasehold would be the same or slightly less than under the Proposed Action due to a reduction in new mining disturbance and the potential for corresponding changes in mine configurations. Cumulative land use effects would be the same as the Proposed Action, except that 5 to 18 percent less coal would be mined potentially reducing the amount of surface disturbance that would occur on the proposed KMC. This could result in fewer resident relocations and fewer grazing lands withdrawn for mining. Fewer Navajo Nation and Hopi Tribe lands vould be withdrawn from hunting access under the Natural Gas PFR Alternative because less coal would be mined. Over the period of extended operations from 2020 to 2044, royalty and bonus payments to the Navajo Nation and Hopi Tribe would be lower under the Natural Gas PFR Alternative than under the Proposed Action; however, they would remain substantial and account for large portions of the budgets of both the Navajo Nation and the Hopi Tribe.

3.20.4.4.7.3 Transmission Systems and Communication Sites

Cumulative effects on Kaibab Band of Paiute Indians or Moapa Band of Paiute Indians land trust assets would be the same under the Natural Gas PFR Alternative as under the Proposed Action, and no impacts to these Indian trust assets would be anticipated.

3.20.4.4.7.4 Central Arizona Project

Cumulative effects on water rights of tribes that have received CAP water entitlements would be the same for the Natural Gas PFR Alternative as under the Proposed Action. Cumulative effects of CAP pumping costs and reductions in contributions to the Development Fund associated with Colorado River water shortages could be greater or lesser than those associated with the Proposed Action, depending on natural gas prices at the time shortages were to occur.

3.20.4.5 Renewable Partial Federal Replacement Alternative

The following summarizes the impacts to Indian trust assets if a selected quantity of firm power between 100 MW and 250 MW would be contracted for delivery under a long-term power purchase agreement from existing renewable generation sources, with energy supplied to the CAP during a defined time period (e.g., 14 hours per day). The net result would be replacement power providing the equivalent of between 58.3 MW hours and 145.8 MW hours over the course of a typical 24-hour period. Implementation of the Renewable PFR Alternative assumes NGS output would be curtailed to lower the federal share of NGS energy by an amount corresponding to the amount of energy purchased. Generation from two or more sources, possibly involving different technologies, would be required to supply the necessary level of power for the defined duration. For this assessment, it is assumed that the source(s) would already exist, rather than a new project built specifically to meet Central Arizona Water Conservation District demand. The location of the facility or facilities that would provide the renewable energy is not know, nor is it known if the facility would be located on trust land of a federally recognized Indian tribe. Therefore, prior and future impacts to Indian trust assets were not evaluated. However, because the replacement power would be purchased from an existing facility, future impacts to Indian trust assets likely would be negligible if the facility were located on tribal trust lands.

3.20.4.5.1 Navajo Nation

3.20.4.5.1.1 Water

Under the Renewable PFR Alternative, the effects of NGS operations on groundwater would be the same as those associated with the Proposed Action. Implementation of the NGS Groundwater Protection Plan, Perched Water Dewatering Plan, the Phase I and II Environmental Site Assessments (and remediation as required), and compliance with USEPA's Coal Combustion Residuals rule would be protective of groundwater at NGS during operations, decommissioning, and reclamation. Consequently, no impacts on Navajo Nation water trust assets from NGS operations under the Renewable PFR Alternative would be anticipated.

Water use at the proposed KMC would be the same as under the Proposed Action for the Renewable PFR Alternative; therefore, mine-related N-Aquifer impacts at the proposed KMC would be the same as those from the Proposed Action. Impacts to groundwater levels and quality in shallow aquifers on the leasehold would be the same or slightly less than in a comparable Proposed Action due to a reduction in new mining disturbance and the potential for corresponding changes in mine configurations. Consequently, negligible to moderate impacts on Navajo Nation water trust assets from KMC operations under the Renewable PFR Alternative would be anticipated. The Navajo Nation would be compensated for use of Navajo Nation water, and the increased fee rates for use of water from the N-Aquifer would substantially increase revenues over those that have been historically have been received by the Navajo Nation. Consequently, no impacts on Navajo Nation water trust assets from proposed KMC operations under the Renewable PFR Alternative would be anticipated.

3.20.4.5.1.2 Land

Land use effects on NGS resulting from implementation of Renewable PFR Alternative would be the same as those associated with the Proposed Action. Land disturbed at NGS would be restored as closely as possible to original condition where the surface of any leased land has been modified or improved, as required by the 1969 Lease and Lease Amendment No. 1 (or a leasing agreement with the

Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1. Total NGS-related payments to the Navajo Nation would be the same for the Renewable PFR Alternative as for the Proposed Action. No negative impacts to Navajo Nation land trust assets would be anticipated under the Renewable PRF Alternative and the beneficial effects of higher NGS-related payments to the Navajo Nation would be substantial.

Land use impacts on the proposed KMC would be the same as the Proposed Action except that 3 to 10 percent less surface disturbance could occur because less coal would be mined. This could change the number of residents that would require relocation. Land mined at the proposed KMC would be reclaimed pursuant to the approved reclamation plan and existing lease agreements. The Navajo Nation would be compensated for use of its land through the payment of coal royalties as described in the following minerals subsection. Mitigation and compensation strategies that would be provided and the steps that would be taken as part of decommissioning and reclamation would result in negligible to minor impacts to Navajo Nation land trust assets would be anticipated.

3.20.4.5.1.3 Minerals

Annual coal requirements for the Renewable PFR Alternative would be between 0.2 million and 0.6 million tpy lower than those under the Proposed Action. The differences would be in addition to the 2.6 million tpy reduction associated with retirement of one unit under the 2-Unit Operation The lower coal production would reduce future royalty and bonus payments to the Navajo Nation and Hopi Tribe, although the revenues would remain substantial. Over the period of extended operations from 2020 to 2044, royalty and bonus payments to the Navajo Nation and Hopi Tribe would total between $1.16 billion and $739 million. Approximately 67 percent of those revenues would accrue to the Navajo Nation. The compensation, existing lease agreements, permits, and ROWs were negotiated between PWCC and the Navajo Nation with BIA oversight; therefore, they would be consistent with the U.S. Department of the Interior's trust responsibilities for Indian trust assets. BLM also would monitor mining operations and review production reports and payments and royalty payments to ensure compliance with lease provisions. Negative impacts to Navajo Nation mineral trust assets would be negligible, and beneficial effects of continued coal royalties for the Navajo Nation would be substantial.

3.20.4.5.1.4 Hunting

As with the Proposed Action, the Navajo Nation would have rights to continue hunting on lands outside the leased area for NGS, and outside active mining areas on the proposed KMC under the Renewable PFR Alternative. Fewer lands could be withdrawn from hunting access because 3 to 10 percent less coal would be mined under the Proposed Action. Although active mining areas would be withdrawn from hunting, reclaimed mining areas would be available for these uses. In some cases, the vegetation mix on reclaimed lands would be different than predisturbance conditions, resulting in negligible to minor impacts to Navajo Nation hunting trust assets.

3.20.4.5.2 Hopi Tribe

3.20.4.5.2.1 Water

Water use at the proposed KMC would be the same as under the Proposed Action for the Renewable PFR Alternative; therefore, mine-related N-Aquifer impacts at the proposed KMC also would be the same. Impacts to groundwater levels and quality in shallow aquifers on the leasehold would be the same or slightly less than the Proposed Action, due to reductions in new mining disturbance and the potential for corresponding changes in mine configurations. The Hopi Tribe would be compensated for use of N-Aquifer water, and the increased water fee rates would increase revenues substantially over those that historically have been received by the Hopi Tribe. Consequently, moderate to negligible negative impacts on Hopi Tribe water trust assets from the proposed KMC would be anticipated under the Renewable PFR Alternative, and the effects of higher water payments to the Hopi Tribe would be beneficial.

3.20.4.5.2.2 Land

Impacts on Hopi land trust assets at the proposed KMC would be the same as the Proposed Action except that 3 to 10 percent less surface disturbance could occur because less coal would be mined. Land mined at the proposed KMC would be reclaimed pursuant to the approved reclamation plan and existing lease agreements. The Hopi Tribe would be compensated for use of its land through the payment of coal royalties as described in the following minerals subsection. Because of the mitigation and compensation strategies that would be provided and the steps that would be taken as part of decommissioning and reclamation, negligible to minor impacts to Navajo Nation land trust assets would be anticipated.

3.20.4.5.2.3 Minerals

Annual coal requirements for the Renewable PFR Alternative would be between 0.2 million and 0.6 million tpy lower than those with the Proposed Action. The differences would be in addition to the 2.6 million tpy reduction associated with retirement of one unit under the 2-Unit Operation. The lower coal production would reduce future royalty and bonus payments to the Navajo Nation and Hopi Tribe, although the revenues would remain substantial. Over the period of extended operations from 2020 to 2044, royalty and bonus payments to the Navajo Nation and Hopi Tribe would total between $1.16 billion and $739 million. Approximately 33 percent of those revenues would accrue to the Hopi Tribe. Compensation, existing lease agreements, permits, and ROWs were negotiated between PWCC and the Hopi Tribe with BIA oversight; therefore, they would be consistent with the U.S. Department of the Interior's trust responsibilities for Indian trust assets. BLM also would monitor mining operations and review production reports and payments and royalty payments to ensure compliance with lease provisions. Negative impacts to Hopi Tribe mineral trust assets would be negligible, and beneficial effects of continued coal royalties to the Hopi Tribe would be substantial.

3.20.4.5.2.4 Hunting

As with the Proposed Action, the Hopi Tribe would have rights to continue hunting on its lands outside active mining areas on the proposed KMC under the Renewable PFR Alternative. Fewer lands could be withdrawn from hunting access under the Renewable PFR Alternative because 3 to 10 percent less coal would be mined than under the Proposed Action. Although active mining areas would be withdrawn from hunting, reclaimed mining areas would be available for these uses. In some cases the vegetation mix on reclaimed lands would be different than predisturbance conditions, resulting in negligible to minor impacts to Hopi Tribe hunting trust assets.

3.20.4.5.3 Kaibab Band of Paiute Indians

Effects of the Renewable PFR Alternative on Kaibab Band of Paiute Indians trust land assets would be the same as those described for the Proposed Action. There would be no change in either the WTS or communication site easement use or in ongoing operation, maintenance and repair activities. Consequently, there would be no impacts to Kaibab Band of Paiute Indians land trust assets.

3.20.4.5.4 Moapa Band of Paiute Indians

Effects of the Renewable PFR Alternative on Moapa Band of Paiute Indians land trust assets would be the same as those described for the Proposed Action. There would be no change in the easement's use or in ongoing operation, maintenance, and repair activities. Consequently, there would be no impacts to Moapa Band of Paiute Indians trust land assets.

3.20.4.5.5 CAP-affected Tribes

As with the Proposed Action, implementation of the Renewable PFR Alternative would not affect water rights held by tribes who received CAP water through water settlements, which are held in trust by the federal government and are considered Indian trust assets.

Pumping energy costs for the CAP would increase under the Renewable PFR Alternative, with energy costs potentially much higher with 250 MW of replacement energy. Total pumping energy costs over the 2020 to 2044 time period would be between $3,779 million and $4,126 million under a 3-Unit Operation and between $3,875 million and $4,199 million under a 2-Unit Operation (**Table 3.18-60** and **Technical Supplement 3.18-A**). Those costs represent increases of 8 and 18 percent (3-Unit Operation) and between 7 and 16 percent (2-Unit Operation) compared to those under the Proposed Action.

The unavoidable costs associated with SCR installation, Lease Amendment No. 1, and basic operating costs would account for a portion of the increase, but costs associated with curtailment and firming would account for the majority of the increases, particularly as the amount of energy provided by the Renewable PFR rises.

The effects of the differences would be most pronounced for entities that use CAP-delivered water for agricultural purposes (including the agricultural uses of CAP-affected tribes) as pumping costs are essentially all or the majority of their costs. The higher energy costs under this alternative could negatively affect the economic feasibility of future sales of surplus energy yielding revenues to support to the Development Fund, making it economically unjustifiable to purchase energy and power from NGS to operate the CAP.

3.20.4.5.6 Project Impact Summary – All Project Components

Navajo Nation trust assets potentially affected by NGS under the Renewable PFR Alternative include land and water. The effects on these Indian trust assets resulting from implementation of the Renewable PFR Alternative essentially would be the same as those associated with the Proposed Action. No negative impacts on Navajo Nation water or land trust assets would be anticipated for NGS from implementation of the Renewable PFR Alternative, and the beneficial effects of higher NGS-related payments to the Navajo Nation would be substantial.

Navajo Nation and Hopi Tribe trust assets affected by operations of the proposed KMC include water, land, minerals, and hunting. Annual coal requirements for the Renewable PFR Alaternative would be between 0.2 million and 0.6 million tons lower than those for the Proposed Action. The difference would be in addition to the 2.6 million tpy reduction associated with retirement of one unit with the 2-Unit Operation. Approximately 3 to 10 percent less surface disturbance could occur within the proposed KMC because less coal would be mined than under the Proposed Action. The lower coal production would reduce future royalty and bonus payments to the Navajo Nation and Hopi Tribe, although the revenues would remain substantial.

Water use and groundwater pumping effects at the proposed KMC essentially would be the same as those associated with the Proposed Action, with the exception that impacts to groundwater levels and quality in shallow aquifers on the leasehold would be the same or slightly less than in a Proposed Action due to a reduction in new mining disturbance and the potential for corresponding changes in mine configurations. Consequently, negligible to moderate impacts would be anticipated on Navajo Nation and Hopi Tribe water trust assets from KMC operations under the Renewable PFR Alternative.

Effects on Navajo and Hopi land trust assets essentially would be essentially the same as under the Proposed Action with the exception that approximately 5 to 18 percent less surface disturbance could occur because less coal would be mined. This could change the number of residents that would require relocation and the amount of grazing land that would be withdrawn. The mitigation and compensation strategies that would be provided and the steps that would be taken as part of decommissioning and reclamation would result in negligible to minor impacts to Navajo Nation and Hopi Tribe land trust assets under the Renewable PFR Alternative.

As noted above, annual coal requirements for the Renewable PFR Alternative would be between 0.2 million and 0.6 million tons lower than those with the Proposed Action. Over the period of extended

operations from 2020 to 2044, royalty and bonus payments to the Navajo Nation and Hopi Tribe would total between $1.16 billion and $739 million. Negative impacts to Navajo Nation and Hopi Tribe mineral trust assets would be negligible under the Renewable PFR Alternative, and beneficial effects of continued coal royalties to the Hopi Tribe would be substantial.

Effects on Navajo Nation and Hopi Tribe hunting trust assets would be similar to those associated with the Proposed Action, except approximately 3 to 10 percent fewer hunting lands could be withdrawn during active mining. As with the Proposed Action, the vegetation mix on reclaimed lands would be different than predisturbance conditions in some cases, resulting in negligible to minor impacts to Navajo Nation and Hopi Tribe hunting trust assets under the Renewable PFR Alternative.

Operation of the WTS and STS would continue for the life of the project. The timing of decommissioning and final reclamation requirements for the WTS and STS ROWs ultimately would be determined by the authorities with responsibility for ROW issuance.

Effects on Kaibab Band of Paiute Indians and Moapa Band of Paiute Indians trust land assets associated with the WTS transmission system and communication site would be limited to ongoing use of the land, for which the respective tribes are compensated by lease agreements. There would be no change in either the WTS or communication site easement use or in ongoing operation, maintenance and repair activities. Consequently, impacts to Indian trust assets would be negligible.

As with the Proposed Action, implementation of the Renewable PFR Alternative would not affect water rights held by tribes who received CAP water through water settlements, which are held in trust by the federal government, and are considered Indian trust assets. However, users of CAP water, including CAP-affected tribes, would experience indirect effects associated with substantially higher pumping costs related to energy costs under the Renewable PFR Alternative compared to those under the Proposed Action. Continued low renewable energy prices could offer lower rates and result in savings to CAP. On the other hand, higher renewable energy prices would raise this alternative's energy costs, further undermining the likelihood for surplus energy sales and surplus revenues. Conceivably, the loss of surplus revenue sales and impacts of curtailment costs associated with higher levels of replacement energy could raise costs to the point that would render the energy economically unjustifiable for CAP. To the degree that increases in the cost of generating NGS power would reduce the marketability of surplus NGS power, revenues to the Development Fund could decrease. Increases in the cost of CAP water and reductions in the availability of revenues to the Development Fund could affect the tribes' decisions regarding whether or not it would be economically viable to utilize their CAP water rights and contracted CAP water entitlements.

3.20.4.5.7 Cumulative Impacts

3.20.4.5.7.1 Navajo Generating Station

Cumulative effects on Navajo Nation water and land trust assets resulting from operations, decommissioning, and reclamation of NGS and past, present, or reasonably foreseeable future activities under the Renewable PFR Alternative would be the same as those associated with the Proposed Action.

3.20.4.5.7.2 Proposed Kayenta Mine Complex

Cumulative effects on Navajo Nation and Hopi Tribe water, land, and mineral trust assets resulting from implementation of the Renewable PFR Alternative for the proposed KMC would be similar to those associated with the Proposed Action. Minor differences would be associated with the lesser amounts of coal mined at the proposed KMC due to replacement of the equivalent of between 58.3 MW hours and 145.8 MW hours over the course of a typical 24-hour period. Impacts to groundwater levels and quality in shallow aquifers on the leasehold would be the same or slightly less than the Proposed Action, due to a reduction in new mining disturbance and the potential for corresponding changes in mine configurations. Land use impacts on the proposed KMC would be the same as the Proposed Action except that 3 to

10 percent less surface disturbance could occur because less coal would be mined. This could result in fewer resident relocations and fewer grazing lands withdrawn for mining. Fewer Navajo Nation and Hopi Tribe trust lands would be withdrawn from hunting access under the Renewable PFR Alternative because a lesser amount of surface disturbance could occur. Over the period of extended operations from 2020 to 2044, royalty, bonus, and water payments to the Navajo Nation and Hopi Tribe would be lower under the Renewable PFR Alternative than under the Proposed Action but would remain substantial and account for large portions of the budgets of both the Navajo Nation and the Hopi Tribe.

3.20.4.5.7.3 Transmission Systems and Communication Sites

Cumulative effects on Kaibab Band of Paiute Indians or Moapa Band of Paiute Indians trust land assets would be the same under the Renewable PFR Alternative as under the Proposed Action.

3.20.4.5.7.4 Central Arizona Project

Cumulative effects on water rights of tribes that have received CAP water entitlements would be the same for the Renewable PFR Alternative as under the Proposed Action. Cumulative effects of CAP pumping costs and reductions in contributions to the Development Fund associated with Colorado River water shortages would be greater than those associated with the Proposed Action.

3.20.4.6 Tribal Partial Federal Replacement Alternative

Under the Tribal PFR Alternative, power and energy would be obtained through a power purchase agreement(s) from renewable sources (assumed to be photovoltaic solar facility[ies] located on the lands of the Navajo Nation, Hopi Tribe, or one or more tribes with CAP water allocations). Energy from the solar facility(ies) would be dedicated to meet a portion of CAP demands during daylight hours (e.g., 12 hours a day). The net result would be between 0.33 terrawatt hours and 0.84 terrawatt hours of energy would be sourced from the tribal facility annually, with the replacement solar power providing an average of between 38 MW hours and 94.9 MW hours per hour over a typical 24-hour period. It is assumed that between 1,200 and 3,000 acres would be required for construction and operations of the photovoltaic solar facility, but no lands have been designated for the construction of the facility. Water, land, and hunting most likely would be affected during construction and operations of a facility on tribal lands. Under the assumptions used for this analysis, lease payments to a host tribe could range between $1.4 and $3.5 million, depending on the size of the facility (**Table 3.18-65**). Indian trust assets associated with the affected tribal lands would be subject to U.S. trust responsibilities, and the effects on those Indian trust assets would be assessed in a subsequent NEPA document.

3.20.4.6.1 Navajo Nation

3.20.4.6.1.1 Water

Under the Tribal PFR Alternative, the effects of NGS operations on groundwater would be the same as those associated with the Proposed Action. Implementation of the NGS Groundwater Protection Plan, Perched Water Dewatering Plan, the Phase I and II Environmental Site Assessments (and remediation as required), and compliance with USEPA's Coal Combustion Residuals rule would be protective of groundwater at NGS during operations, decommissioning, and reclamation. Consequently, no impacts on Navajo Nation water trust assets from NGS operations under the Tribal PFR Alternative would be anticipated.

Water use at the proposed KMC would be the same as under the Proposed Action for the Tribal PFR Alternative; therefore, mine-related N-Aquifer impacts at the proposed KMC would be the same as those from the Proposed Action. Impacts to groundwater levels and quality in shallow aquifers on the leasehold would be the same or slightly less than for the Proposed Action due to a reduction in new mining disturbance and the potential for corresponding changes in mine configurations. Consequently, negligible to moderate impacts on Navajo Nation water trust assets from proposed KMC operations under the Tribal PFR Alternative would be anticipated. The Navajo Nation would be compensated for

use of Navajo Nation water, and the increased fee rates for use of water from the N-Aquifer would substantially increase revenues over those that historically have been received by the Navajo Nation. No impacts on Navajo Nation trust water assets from proposed KMC operations under the Tribal PFR Alternative would be anticipated.

3.20.4.6.1.2 Land

Land use effects on NGS resulting from implementation of Tribal PFR Alternative would be the same as those associated with the Proposed Action. Land disturbed at NGS would be restored as closely as possible to original condition where the surface of any leased land has been modified or improved, as required by the 1969 Lease and Lease Amendment No. 1 (or a leasing agreement with the Navajo Nation having similar terms as the 1969 Lease and Lease Amendment No. 1. Total NGS-related payments to the Navajo Nation would be the same for the Tribal PFR Alternative as for the Proposed Action: $1.07 billion and $792.5 billion. The lease amendment was negotiated between NGS and the Navajo Nation. If approved by the Secretary of the Interior, it would be consistent with the U.S. Department of the Interior's trust responsibilities for Indian trust assets. No negative impacts to Navajo Nation land trust assets would be anticipated under the Tribal PRF Alternative, and the beneficial effects of higher NGS-related payments to the Navajo Nation would be substantial.

Land use impacts on the proposed KMC would be the same as the Proposed Action except that 2 to 7 percent less surface disturbance could occur because less coal would be mined. This could change the number of residents that would require relocation and reduce the amount of grazing land that would be withdrawn during active mining. Land mined at the proposed KMC would be reclaimed pursuant to the approved reclamation plan and existing lease agreements. The Navajo Nation would be compensated for use of its land through the payment of coal royalties as described in the following minerals subsection. The mitigation and compensation strategies that would be provided, and the steps that would be taken as part of decommissioning and reclamation would result in negligible to minor impacts to Navajo land trust assets would be anticipated.

3.20.4.6.1.3 Minerals

Annual coal requirements for the Tribal PFR Alternative would be between 0.2 million and 0.4 million tons lower than those for the Proposed Action. The differences would be in addition to the 2.6 million tpy reduction associated with retirement of one unit with the 2-Unit Operation. The lower coal production would reduce future royalty and bonus payments to the Navajo Nation and Hopi Tribe, although the revenues would remain substantial. Over the period of extended operations from 2020 to 2044, royalty and bonus payments to the Navajo Nation and Hopi Tribe would total between $1.169 billion and $763 million. Approximately 67 percent of those revenues would accrue to the Navajo Nation. The compensation, existing lease agreements, permits, and ROWs were negotiated between PWCC and the Navajo Nation with BIA oversight, therefore, they would be considered consistent with Interior's trust responsibilities for Indian trust assets. BLM would monitor mining operations and review production, royalty, and bonus payments to ensure compliance with lease provisions. Negative impacts to Navajo Nation mineral trust assets would be negligible, and beneficial effects of continued coal royalties for the Navajo Nation would be substantial.

3.20.4.6.1.4 Hunting

As with the Proposed Action, the Navajo Nation would have rights to continue hunting, grazing, and traditional uses of its lands outside the leased area for NGS and outside active mining areas on the proposed KMC under the Tribal PFR Alternative. Fewer lands could be withdrawn from hunting access because 2 to 7 percent less coal would be mined than under the Proposed Action. Although active mining areas would be withdrawn from hunting, reclaimed mining areas would be available for these uses. The vegetation mix on reclaimed lands would be different than predisturbance conditions in some cases, resulting in negligible to minor impacts to Navajo Nation hunting trust assets.

3.20.4.6.2 Hopi Tribe

3.20.4.6.2.1 Water

Water use at the proposed KMC under the Tribal PFR Alternative would be the same as under the Proposed Action; therefore, mine-related N-Aquifer impacts at the proposed KMC would be the same as those from the Proposed Action. Impacts to groundwater levels and quality in shallow aquifers on the leasehold would be the same or slightly less than under the Proposed Action due to reductions in new mining disturbance and the potential for corresponding changes in mine configurations. The Hopi Tribe would be compensated for use of N-Aquifer water, and the increased water fee rates would substantially increase revenues over those that historically have been received by the Hopi Tribe. Consequently, moderate to negligible negative impacts on Hopi Tribe water trust assets from proposed KMC operations would be anticipated under the Tribal PFR Alternative, and the effects of higher water payments to the Hopi Tribe would be beneficial.

3.20.4.6.2.2 Land

Impacts on Hopi land trust assets at the proposed KMC would be the same as the Proposed Action except that 2 to 7 percent less surface disturbance could occur because less coal would be mined. Land mined at the proposed KMC would be reclaimed pursuant to the approved reclamation plan and existing lease agreements. The Hopi Tribe would be compensated for use of its land through the payment of coal royalties as described in the following minerals subsection. The mitigation and compensation strategies that would be provided and the steps that would be taken as part of decommissioning and reclamation would result in negligible to minor impacts to Navajo Nation land trust assets.

3.20.4.6.2.3 Minerals

Annual coal requirements for the Tribal PFR Alternative would be between 0.2 million and 0.4 million tons lower than those under the Proposed Action. The differences would be in addition to the 2.6 million tpy reduction associated with retirement of one unit with the 2-Unit Operation. The lower coal production would reduce future royalty and bonus payments to the Navajo Nation and Hopi Tribe, although the revenues would remain substantial. Over the period of extended operations from 2020 to 2044, royalty and bonus payments to the Navajo Nation and Hopi Tribe would total between $1.169 billion and $763 million. Approximately 33 percent of those revenues would accrue to the Hopi Tribe. Compensation, existing lease agreements, permits, and ROWs were negotiated between PWCC and the Hopi Tribe with BIA oversight; therefore, they would be consistent with the U.S. Department of the Interior's trust responsibilities for Indian trust assets. BLM also would monitor mining operations and review production reports and payments and royalty payments to ensure compliance with lease provisions. Negative impacts to Hopi Tribe mineral trust assets would be negligible, and beneficial effects of continued coal royalties to the Hopi Tribe would be substantial.

3.20.4.6.2.4 Hunting

As with the Proposed Action, the Hopi Tribe would have rights to continue hunting on its lands outside active mining areas on the proposed KMC under the Tribal PFR Alternative. Fewer lands could be withdrawn from hunting access under the Tribal PFR Alternative because 2 to 7 percent less coal would be mined than under the Proposed Action. Although active mining areas would be withdrawn from hunting, reclaimed mining areas would be available for these uses. The vegetation mix on reclaimed lands would be different than predisturbance conditions in some cases, resulting in negligible to minor impacts to Hopi Tribe hunting trust assets.

3.20.4.6.3 Kaibab Band of Paiute Indians

Effects of the Tribal PFR Alternative on Kaibab Band of Paiute Indians trust land assets would be the same as those described for the Proposed Action. Operation of the WTS and STS would continue for the life of the project. The timing of decommissioning and final reclamation requirements for the WTS and STS ROWs ultimately would be determined by the authorities with responsibility for ROW issuance.

There would be no change in either the WTS or communication site easement use or in ongoing operation, maintenance and repair activities. Consequently, there would be no impacts to Kaibab Band of Paiute Indians trust land assets.

3.20.4.6.4 Moapa Band of Paiute Indians

Effects of the Tribal PFR Alternative on Moapa Band of Paiute Indians trust land assets would be the same as those described for the Proposed Action. There would be no change in the easement's use or in ongoing operation, maintenance and repair activitiesl. Consequently, there would be no impacts to Moapa Band of Paiute Indians trust land assets.

3.20.4.6.5 CAP-affected Tribes

As with the Proposed Action, implementation of the Tribal PFR Alternative would not affect water rights held by tribes who received CAP water through water settlements, which are held in trust by the federal government and are considered Indian trust assets.

Pumping energy costs for the CAP would increase under the Tribal PFR operation, with energy costs potentially much higher with 250 MW of replacement energy. Total pumping energy costs over the 2020 to 2044 time period would be between $3,678 million and $3,922 million under a 3-Unit Operation and between $3,790 million and $3,998 million under a 2-Unit Operation (**Table 3.18-71** and **Technical Supplement 3.18-A**). Those costs represent increases of 5 and 12 percent (3-Unit Operation) and between 5 and 10 percent (2-Unit Operation) as compared to those under the Proposed Action. The unavoidable costs associated with SCR installation, Lease Amendment No. 1, and basic operating costs would account for a portion of the increase, but costs associated with curtailment and firming would account for the majority of the increases, particularly as the amount of energy provided by the Tribal PFR rises.

The effects of those differences would be most pronounced for entities that use CAP-delivered water for agricultural purposes (including the agricultural uses of CAP-affected tribes) as pumping costs are a major component of their costs. The likely impacts of those increases would comprise a minor to major impact for users. The higher energy costs under this alternative could negatively affect the economic feasibility of future sales of surplus energy yielding revenues to support the Development Fund. This could make it economically unjustifiable to purchase energy and power from NGS for the CAP.

3.20.4.6.6 Project Impact Summary – All Project Components

Navajo Nation and Hopi Tribe trust assets potentially affected by NGS under the Tribal PFR Alternative would include land and water. The effects on these Indian trust assets resulting from implementation of the Tribal PFR Alternative essentially would be the same as those associated with the Proposed Action. No negative impacts on Navajo Nation water or land trust assets would be anticipated for NGS from implementation of the Tribal PFR Alternative, and the beneficial effects of higher NGS-related payments to the Navajo Nation would be substantial.

Navajo Nation and Hopi Tribe trust assets affected by operations of the proposed KMC would include water, land, minerals, and hunting. Annual coal requirements for the Tribal PFR Alternative would be between 0.2 million and 0.4 million tons lower than those for the Proposed Action. The difference would be in addition to the 2.6 million tpy reduction associated with retirement of one unit with the 2-Unit Operation. Approximately 2 to 7 percent less surface disturbance could occur within the proposed KMC because less coal would be mined than under the Proposed Action. The lower coal production would reduce future royalty and bonus payments to the Navajo Nation and Hopi Tribe, although the revenues would remain substantial.

Water use and groundwater pumping effects at the proposed KMC essentially would be the same as those associated with the Proposed Action with the exception that impacts to groundwater levels and

quality in shallow aquifers on the leasehold would be the same or slightly less than in a comparable Proposed Action due to a reduction in new mining disturbance and the potential for corresponding changes in mine configurations. Consequently, negligible to moderate impacts on Navajo Nation and Hopi Tribe water trust assets from KMC operations under the Tribal PFR Alternative would be anticipated.

Effects on Navajo and Hopi land trust assets essentially would be the same as under the Proposed Action with the exception that up to 7 percent less surface disturbance would occur because less coal would be mined. This could change the number of residents that would require relocation and the amount of grazing land that would be withdrawn. The mitigation and compensation strategies that would be provided and the steps that would be taken as part of decommissioning and reclamation would result in negligible to minor impacts to Navajo Nation and Hopi Tribe land trust assets under the Tribal PFR Alternative.

As noted above, annual coal requirements for the Tribal PFR Alternative would be between 0.2 million and 0.6 million tons lower than those for the Proposed Action. Over the period of extended operations between 2020 and 2044, royalty and bonus payments to the Navajo Nation and Hopi Tribe would total between $1.169 billion and $763 million. Negative impacts to Navajo Nation and Hopi Tribe mineral trust assets would be negligible under the Tribal PFR Alternative, and beneficial effects of continued coal royalties to the Hopi Tribe would be substantial.

Effects on Navajo Nation and Hopi Tribe hunting trust assets would be similar to those associated with the Proposed Action, except approximately 2 to 7 percent fewer hunting lands could be withdrawn during active mining. As with the Proposed Action, the vegetation mix on reclaimed lands would, be different than predisturbance conditions in some cases, resulting in negligible to minor impacts to Navajo Nation and Hopi Tribe hunting trust assets under the Tribal PFR Alternative.

Effects on Kaibab Band of Paiute Indians and Moapa Band of Paiute Indians trust land assets associated with the WTS transmission system and communication site would be limited to ongoing use of the land, for which the respective tribes are compensated by lease agreements. There would be no change in either the WTS or communication site easement use or in ongoing operation, maintenance, and repair activities; consequently, impacts to Indian trust assets would be negligible.

Although implementation of the Tribal PFR Alternative would not affect CAP-affected Tribes water rights trust assets, increases in the cost of CAP water and reductions in the availability of revenues for deposit to the Development Fund could affect the tribes' decisions regarding whether or not it would be economically viable to utilize their CAP water rights and contracted CAP water entitlements.

3.20.4.6.7 Cumulative Impacts

3.20.4.6.7.1 NGS and Associated Facilities

Cumulative effects on Navajo Nation water and land trust assets resulting from operations, decommissioning, and reclamation of NGS and past, present, or reasonably foreseeable future activities under the Tribal PFR Alternative would be the same as those associated with the Proposed Action.

3.20.4.6.7.2 Proposed Kayenta Mine Complex

Cumulative effects on Navajo Nation and Hopi Tribe water, land, and mineral trust assets resulting from implementation of the Tribal PFR Alternative for the proposed KMC would be similar to those associated with the Proposed Action. Minor differences would be associated with the lesser amounts of coal mined at the proposed KMC due to the replacement of an average of between 38 MW hours and 94.9 MW hours per hour over a typical 24-hour period under the Tribal PFR Alternative. Impacts to groundwater levels and quality in shallow aquifers on the leasehold would be the same or slightly less than under the Proposed Action due to a reduction in new mining disturbance and the potential for corresponding

changes in mine configurations. Cumulative land use impacts on the proposed KMC would be the same as the Proposed Action except that 2 to 7 percent less surface disturbance could occur because less coal would be mined. This could result in fewer resident relocations and fewer grazing lands withdrawn for mining. Fewer Navajo and Hopi lands would be withdrawn from hunting access under the Tribal PFR Alternative, because a lesser amount of surface disturbance would occur. Over the period of extended operations from 2020 to 2044, royalty, bonus, and water payments to the Navajo Nation and Hopi Tribe would be lower under the Tribal PFR Alternative than under the Proposed Action. However, it would remain substantial and account for large portions of the budgets of both the Navajo Nation and the Hopi Tribe.

3.20.4.6.7.3 Transmission Systems and Communication Sites

Cumulative effects on Kaibab Band of Paiute Indians or Moapa Band of Paiute Indians land trust assets would be the same under the Tribal PFR Alternative as under the Proposed Action.

3.20.4.6.8 Central Arizona Project

Cumulative effects on water rights of tribes that have received CAP water entitlements would be the same for the Tribal PFR Alternative as under the Proposed Action. Cumulative effects of CAP pumping costs and reductions in contributions to the Development Fund associated with Colorado River water shortages would be greater than those associated with the Proposed Action.

3.20.4.7 No Action

3.20.4.7.1 Navajo Nation

3.20.4.7.1.1 Water

Under the No Action Alternative, NGS decommissioning activities would begin in 2018 conclude no later than December 22, 2019. The 1969 Lease requires that the “surface of any Reservation Lands modified or improved by the Lessees by the construction of access roads, dams, rail transportation facilities, surface pipelines, or other facilities constructed pursuant to this Lease or the 323 Grant for the plant site” be restored as closely as possible to their original condition.

A professional engineer would develop an industry-recognized and generally accepted good engineering practices closure plan. The USEPA regulations at the time of closure and lease requirements would be used as the basis for plant decommissioning and environmental demolition requirements.

Prior to decommissioning NGS, measures would be implemented consistent with the Groundwater Protection Plan, Perched Water Dewatering Plan, and Resource Conservation and Recovery Act requirements, including Phase I and II Environmental Site Assessments (and remediation as required), to ensure the groundwater quality has not been impaired. A long-term monitoring plan for groundwater quality, consistent with the USEPA’s Coal Combustion Residuals rule, also would be implemented (Section 3.7 and **Appendix 1B**). Based on the findings of the water assessment conducted for the EIS (Section 3.7.4.2), no impacts to Navajo Nation trust water assets are anticipated to result from decommissioning and reclamation activities at NGS.

As described for No Action in Chapter 2.0, PWCC has indicated it would cease mining operations at the Kayenta Mine in 2019 and proceed to final reclamation of the Kayenta Mine, the former Black Mesa Mine, and all support facilities not otherwise approved as permanent facilities. Mine closure and reclamation would take place according to applicable permit documentation and provisions.

As noted in the No Action subsection of Section 3.7.4, N-Aquifer pumping would decline in 2019 from its current withdrawal rate of approximately 1,200 to 1,400 acre-feet per year. Pumping would continue for decommissioning operations, reclamation, local water supplies, and dust suppression. During the period 2020 through 2022, N-Aquifer pumping would decline to approximately 500 acre-feet per year.

Subsequent rates would be approximately 100 acre-feet per year during reclamation, which would be completed in approximately 2033. The Navajo Nation would continue to receive payment for water used during closure and reclamation.

The maximum predicted N-Aquifer drawdown under the No Action would be similar to, but less than, that depicted for the maximum predicted drawdown under the Proposed Action 3-Unit Operation. Maximum drawdown and percentage increases in pumping lift at key community wells would be similar to, but less than, those identified for the Proposed Action 3-Unit Operation (**Appendix WR-9**). Impacts to springs and stream baseflows also would be the same or less than those identified for the Proposed Action 3-Unit Operation. There would be no change in 2019 stream baseflows from mine-related pumping activities under the No Action or Proposed Action alternatives.

The net difference between Wepo Formation water availability and quality for existing uses under the No Action and Proposed Action alternatives would be negligible. No impacts to alluvial groundwater levels or quality would result from implementation of the No Action Alternative.

Consequently, no unmitigated or uncompensated negative impacts to Navajo Nation water trust assets would be anticipated under No Action. The Navajo Nation would forego the water fee revenues associated with the proposed KMC under the Proposed Action and other action alternatives.

3.20.4.7.1.2 Land

Section 2.3.1.3 describes the decommissioning and reclamation process for NGS. The operating and support facilities at the plant site would be dismantled and demolished to ground level over a multi-year period. The water supply facilities and certain buildings and equipment would remain, in accordance with the terms of the existing NGS Lease between the NGS Participants and the Navajo Nation. Except for hazardous materials and parts, and material salvaged, recycled, or sold for scrap, demolished structural material would be placed in a landfill area within the plant site and covered with soil. Hazardous materials would be transported and disposed of in compliance with Resource Conservation and Recovery Act and other applicable federal requirements. As required in the 1969 Lease, the land would be restored as closely as possible to original conditions on the surface of any trust lands modified or improved. The areas that do not contain permanent facilities would have all nonindigenous material removed from the surface, and the area would be filled and graded to provide proper drainage. No attempt would be made to return the leased lands or the ROWs to the preconstruction elevations. All restored land would be covered with topsoil indigenous to the area and revegetated as specified in the lease requirements.

Decommissioning and reclamation of the BM&LP Railroad would occur within or immediately adjacent to the existing ROW, the latter involving removal of fencing. Consequently, negligible impacts to Indian trust assets would be anticipated. In addition, decommissioning and reclamation would occur under the provisions of the existing 1969 Lease and 323 grants; therefore, negligible impacts to Indian trust assets within the remainder of the NGS lease area would be anticipated.

Under the No Action Alternative, the Navajo Nation would not receive lease or other payments for the use of land for NGS post-2019. Compared to the Proposed Action 3-Unit Operation, the No Action Alternative would result in foregone payments to the Navajo Nation totaling over $1.075 billion. Foregone revenues would total $793 million under the Proposed Action 2-Unit Operation.

Under the No Action Alternative, the Kayenta Mine would cease operations by the end of 2019. Mined land would be reclaimed pursuant to the approved reclamation plan and existing lease agreements. PWCC would restore the land with equal or greater forage productivity than pre-mining conditions (Section 3.14) or for other approved uses including wildlife habitat and cultural plants. After OSMRE and BIA have deteremined reclamation conditions are satisfactory, and following the release of bonds,

control of the surface use would revert to the Navajo Nation. No homes would require relocation under the No Action Alternative and no grazing lands would be withdrawn for mining.

Site reclamation would be expected to take 2 to 3 years after cessation of mining. Mine facilities with economic value would be decommissioned and the materials removed for salvage. Non-salvageable facilities would be buried. Concrete foundations and sub-bases would be removed or buried in place if approved by OSMRE and the Navajo Nation. If the foundations were buried in place, the cover over these structures would be a minimum of 4 feet.

Disposition of mine facilities and lands affected by mining is expected to take approximately 10 to 15 years after mining ends to allow for the reclamation and bond release period (a minimum of 10 years after reclamation pursuant to Surface Mining Control and Reclamation Act requirements). Additional time could be required to meet revegetation standards and ensure long-term stability of reclaimed areas. Grading, topsoil replacement, and seeding would occur for facility areas as described in the approved permit application package. A reclamation bond would be maintained for the lands affected under the permanent program until final release.

Because decommissioning and reclamation would occur under OSMRE and tribal guidelines and the provisions of the existing lease for the Kayenta and former Black Mesa mines, no unmitigated impacts to Navajo Nation land trust assets within the lease area would be anticipated. The primary post-closure land uses would be livestock grazing and wildlife habitat, which would represent a restoration of pre-mining land uses.

3.20.4.7.1.3 Minerals

No additional coal would be mined under the No Action Alternative post 2019, and the Navajo Nation and Hopi Tribe would not receive royalty or bonus payments. Compared to the Proposed Action 3-Unit Operation, the No Action Alternative would result in foregone royalty and bonus payments to the Navajo Nation ranging from their 67 percent share of a total of $1.16 billion over the 25-year period from 2020 to 2044, under the 3-Unit Operation. Under the 2-Unit Operation, estimated total payments foregone would be $787 million.

3.20.4.7.1.4 Hunting

Reclaimed land would be returned to the Navajo Nation. Hunting, gathering, and other traditional land uses would resume at the discretion of the tribal government; consequently, negligible impacts to these Indian trust assets would be anticipated.

3.20.4.7.2 Hopi Tribe

3.20.4.7.2.1 Water

As described above, PWCC has indicated it would cease mining operations at the Kayenta Mine in 2019 and proceed to final reclamation of the Kayenta Mine, the former Black Mesa Mine, and all support facilities not otherwise approved as permanent facilities. Mine closure and reclamation would take place according to applicable permit documentation and provisions.

During the period 2020 through 2022, N-Aquifer pumping would decline to approximately 500 acre-feet per year. Subsequent rates would be approximately 100 acre-feet per year during reclamation, which would be completed in approximately 2033. The Hopi Tribe would continue to receive payment for water used during closure and reclamation.

The maximum predicted N-Aquifer drawdown under the No Action would be similar to, but less than, that depicted for the maximum predicted drawdown under the Proposed Action 3-Unit Operation. Maximum drawdown and percentage increases in pumping lift at key community wells would be similar to, but less than those identified for the Proposed Action 3-Unit Operation (**Appendix WR-9**). Impacts to springs and

stream baseflows also would be the same or less than those identified for the Proposed Action 3-Unit Operation. There would be no change in 2019 stream baseflows from mine-related pumping activities under the No Action or Proposed Action alternatives.

The net difference between Wepo Formation water availability and quality for existing uses under the No Action and Proposed Action alternatives would be negligible. No impacts to alluvial groundwater levels or quality would result from implementation of the No Action Alternative.

Consequently, no unmitigated or uncompensated negative impacts to Hopi Tribe water trust assets would be anticipated under No Action. The Hopi Tribe would forego the water fee revenues associated with the proposed KMC under the Proposed Action and other action alternatives.

3.20.4.7.2.2 Land

As described above, the Kayenta Mine would cease operations by the end of 2019 under the No Action Alternative. Mined land would be reclaimed pursuant to the approved reclamation plan and existing lease agreements. PWCC would restore the land with equal or greater forage productivity than pre-mining conditions (Section 3.14) or for other approved uses including wildlife habitat and cultural plants. After the OSMRE and BIA determines reclamation to be satisfactory, and following the release of bonds, control of the surface use would revert to the Hopi Tribe.

Because decommissioning and reclamation would occur under OSMRE and tribal guidelines and the provisions of the existing lease for the Kayenta and former Black Mesa mines, no unmitigated impacts to Hopi Tribe land trust assets within the lease area would be anticipated. The primary post-closure land uses would be livestock grazing and wildlife habitat, which would represent a restoration of pre-mining land uses.

3.20.4.7.2.3 Minerals

No additional coal would be mined under the No Action Alternative, and the Navajo Nation and Hopi Tribe would not receive royalty or bonus payments. Compared to the Proposed Action 3-Unit Operation, the No Action Alternative would result in foregone royalty and bonus payments to the Hopi Tribe for its 33 percent share ranging from a total of $1.16 billion over the period from 2020 to 2044 under the 3-Unit Operation. Under the 2-Unit Operation, estimated total payments foregone would be $787 million.

3.20.4.7.2.4 Hunting

Reclaimed land would be returned to the Hopi Tribe. Hunting would resume at the discretion of the tribal government; consequently, negligible impacts to these Indian trust assets would be anticipated.

3.20.4.7.3 Kaibab Band of Paiute Indians

The NGS transmission system is an established part of the western U.S. transmission grid and supports reliability and delivery of power throughout the region, well beyond the power generated by the NGS. Therefore, under the No Action Alternative it is likely that that one, several, or all of the land owners/managers of the transmission line ROWs and communication site leases would renew some portion of the facilities to keep the power grid performing as expected.

In the event it is determined that some or all of the transmission systems and communication site ROWs are not renewed, a lengthy study and permitting process would need to occur before any decommissioning is initiated due to the essential and integral nature of these facilities with the western electric grid. As noted in Section 2.3.3, up to 4,826 acres within and alongside the transmission system corridors could be temporarily disturbed if the entirety of the transmission systems and communication sites were decommissioned and removed.

If, however, the segment of the WTS that crosses the Kaibab Band of Paiute Indians' trust lands is abandoned, the easement would revert to the Kaibab Band of Paiute Indians. If the communications site is decommissioned, the Kaibab Band of Paiutes would no longer receive an annual payment for the site.

3.20.4.7.4 Moapa Band of Paiute Indians

The NGS transmission system is an established part of the western U.S. transmission grid and supports reliability and delivery of power throughout the region, well beyond the power generated by the NGS. Therefore, under the No Action Alternative it is likely that that one, several, or all of the land owners/managers of the transmission line ROWs and communication site leases would renew some portion of the facilities to keep the power grid performing as expected.

In the event it is determined that some or all of the transmission systems and communication site ROWs are not renewed, a lengthy study and permitting process would need to occur before any decommissioning is initiated due to the essential and integral nature of these facilities with the western electric grid. As noted in Section 2.3.3, up to 4,826 acres within and alongside the transmission system corridors could be temporarily disturbed if the entirety of the transmission systems and communication sites were decommissioned and removed.

If, however, the segment of the WTS that crosses the Moapa River Indian Reservation is decommissioned, the Moapa Band of Paiute Indians would no longer receive annual compensation for its use.

3.20.4.7.5 CAP-affected Tribes

Implementation of the No Action Alternative would not affect water rights held by tribes who received CAP water through water settlements, which are held in trust by the federal government and are considered Indian trust assets.

Under the No Action Alternative, NGS power and energy would no longer be available to operate the CAP pumps. As system operator, Central Arizona Water Conservation District would continue to be responsible for obtaining the power necessary to deliver CAP water. Depending on market conditions and future prices of natural gas, CAP pumping energy costs under No Action could be between 23 percent less costly and 21 percent more costly compared to energy pumping costs under the Proposed Action. Due to the uncertainty regarding natural gas prices, future energy rates under No Action may be more variable over time than under the Proposed Action (**Table 3.18-78**).

Lower costs could benefit all users, in particular agricultural users and those tribes with CAP water allocations that devote most of their allocations to agriculture. Conversely, higher pumping energy costs effectively would raise the cost of water for users, including most of the tribes with CAP water allocations, and could affect water use. Surplus energy sales and revenues to support the Development Fund would cease under the No Action Alternative, regardless of whether pumping energy costs were higher or lower than those under the Proposed Action. Compensating for those reductions venues would require adjustments by CAP to fund debt service. The loss of surplus revenue sales could increase pumping energy rates on the order of $10 to $15 per acre-foot.

3.20.4.7.6 No Action Impact Summary – All Project Components

The provisions of the NGS and the Kayenta Mine lease agreements would ensure that decommissioning and reclamation occurred in compliance with applicable regulatory standards. Based on the lease agreements and the findings of the relevant EIS resource sections, no negative impacts to Navajo Nation or Hopi Tribe trust assets would be anticipated to result from closure, decommissioning, or reclamation activities. However, closure of NGS under the No Action Alternative would result in foregone payments to the Navajo Nation of over $1.075 billion under the Proposed Action 3-Unit Operation or $793 million under the Proposed Action 2-Unit Operation. Combined foregone revenues to the Navajo Nation and

Hopi Tribe associated with the proposed KMC under the No Action Alternative would total $1.16 billion over the period from 2020 to 2044 under the 3-Unit Operation and $787 million under the 2-Unit Operation.

If the WTS and communications sites were decommissioned on Kaibab Band of Paiute Indians or Moapa Band of Paiute Indians lands under the No Action Alternative, the tribes would. no longer receive annual compensation for use of those ROW segments.

Indian trust assets for tribes with CAP water allocations potentially affected by the No Action would be limited to existing water entitlements, which are held in trust by the federal government. Neither water entitlements nor the CAP's physical ability to deliver water to CAP-affected tribes would be affected by the No Action Alternative.

Future water costs would change under the No Action Alternative. Assuming replacement of NGS power with natural gas-generated power, CAP pumping energy costs under No Action could be between 23 percent less costly and 21 percent more costly compared to energy pumping costs under the Proposed Action. Due to the uncertainty regarding natural gas prices, future energy rates under No Action may be more variable over time than under the Proposed Action. Surplus energy sales and revenues to support the Development Fund would cease under No Action, which could increase CAP pumping energy rates on the order of $10 to $15 per acre-foot.

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Chapter 4.0

Mitigation and Voluntary Commitments

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Acronyms and Abbreviations

1969 Lease	Navajo Project Indenture of Lease
BART	Best Available Retrofit Technology
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BM&LP Railroad	Black Mesa & Lake Powell Railroad
BO	Biological Opinion
CAP	Central Arizona Project
CEQ	Council on Environmental Quality
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
CO_2	carbon dioxide
Co-tenants	Salt River Project, Arizona Public Service Company, NV Energy, and Tucson Electric Power Company
Development Fund	Lower Colorado River Basin Development Fund
EIS	Environmental Impact Statement
ERA	Ecological Risk Assessment
ESA	Endangered Species Act of 1973
HHRA	Human Health Risk Assessment
km	kilometer
KMC	Kayenta Mine Complex
kV	kilovolt
kW	kilowatt
MW	megawatt
N-Aquifer	Navajo Aquifer
NEPA	National Environmental Policy Act of 1969, as amended
NGO	non-government organization
NGS	Navajo Generating Station
NGS Participants	U.S. (Reclamation), Salt River Project, Arizona Public Service Company, NV Energy, and Tucson Electric Power Company
NHPA	National Historic Preservation Act
NNEPA	Navajo Nation Environmental Protection Agency
NO_2	nitrogen dioxide
NO_X	nitrogen oxide
OSMRE	Office of Surface Mining Reclamation and Enforcement
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PFR	Partial Federal Replacement
PWCC	Peabody Western Coal Company
Reclamation	U.S. Bureau of Reclamation
ROW	Right-of-way
SO_2	sulfur dioxide

SRP	Salt River Project Agricultural Improvement and Power District
STS	Southern Transmission System
U.S.	United States
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WTS	Western Transmission System

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4.0 Mitigation and Voluntary Commitments

4.1 Introduction

The Council on Environmental Quality (CEQ) (2011) states that "mitigation is an important mechanism Federal agencies can use to minimize the potential adverse environmental impacts associated with their actions. As described in the CEQ regulation, agencies can use mitigation to reduce environmental impacts in several ways. Mitigation includes:

- Avoiding an impact by not taking a certain action or parts of an action;
- Minimizing an impact by limiting the degree or magnitude of the action and its implementation;
- Rectifying an impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating an impact over time, through preservation and maintenance operations during the life of the action; and
- Compensating for an impact by replacing or providing substitute resources or environments."

This Environmental Impact Statement (EIS) includes Best Management Practices (BMPs) and proposed mitigation measures under the general category of mitigation. BMPs are existing policies, practices, and measures required by law, regulation, and voluntary NGS-participants and PWCC commitments that reduce the environmental impacts of designated activities, functions, or processes. BMPs are distinguished from mitigation measures because BMPs are existing requirements for the proposed action, and are ongoing, regularly occurring practices.

4.2 Best Management Practices

BMP descriptions are provided in this EIS by project component in appendices, or by reference to applicable federal regulations. The following is a summary of the BMPs that were considered as part of the impact assessment process.

<u>NGS and BM&LP Railroad</u>. The following BMP-related documents are included in **Appendix 1B** of this EIS:

- Navajo Project Operation and Maintenance Plan (April 2016). This document provides a summary of environmental management programs, and compliance activities that are required by federal agencies, and other agreements. The Environmental Regulations Requiring Compliance at NGS are summarized on Table 10. This table lists the agency regulation or permit, the regulated constituents, permit approval and renewal dates, and reporting requirements. BMPs and Mitigation Measures for the Navajo Project, which includes Navajo Generating Station (NGS) and the Black Mesa and Lake Powell (BM&LP) Railroad, are summarized in Appendix E to the Navajo Project Operation and Maintenance Plan (**Appendix 1B**). Measures are included for air quality; wildlife; threatened, endangered, and sensitive species; vegetation; noxious weeds; water quality; soil loss and erosion; cultural resources; health and safety; waste management; and recreation.
- Navajo Generating Station: Coal Combustion Residuals Ash Disposal Landfill Requirements. (July 2015). This document provides details for complying with the final rule to regulate Coal Combustion Residuals under Subtitle D of the Resource Conservation and Recovery Act. The primary component of this document is the Groundwater Protection Plan. The Plan describes the facilities that involve waste water containment, ditches, and landfills. The Plan then describes the shallow and deep groundwater monitoring wells, inspection and monitoring

programs, emergency contingency plans, and reporting. A Groundwater Monitoring Program Report (1978 to present) is an attachment to the Groundwater Protection Plan.

Kayenta Mine. The Office of Surface Mining Reclamation and Enforcement (OSMRE) administers the 1977 Surface Mining Controls and Reclamation Act (SMCRA) on all lands and coal leased from the Navajo Nation and Hopi Tribe on Black Mesa. The SMCRA legislation outlines the Permanent Program Standards (Code of Federal Regulations [CFR] Title 30 Mineral Resources, Subchapter K Permanent Program Standards, Parts 816.1 through 816.200). These standards include definitions of post-mining land use, and provide guidelines for soils and overburden management; use of explosives; surface water and groundwater management; revegetation suitability for soils and overburden; and revegetation success standards. PWCC provides annual reports to OSMRE that summarize reclamation progress across the mine, mine spoil monitoring for revegetation suitability, and surface water and groundwater quality monitoring at various locations within the lease area. In addition to the annual reports, PWCC provides air and groundwater monitoring reports on a quarterly basis. PWCC also maintains an air quality sampling network (**Appendix 1D** for sampling locations) which provide data for existing permits and permit renewals.

The USGS is engaged in a long-term groundwater, surface water, and water chemistry program on Black Mesa that was initiated in 1971. The program includes measurements of groundwater withdrawals, groundwater levels, spring discharges, surface-water discharges, and groundwater chemistry (Macy and Truini 2016). The results of this monitoring are summarized in periodic open-file reports.

STS and WTS Transmission Lines. BMPs for operation and maintenance activities (vegetation management, facility repairs) have been developed for both transmission line systems. Arizona Public Service Company, which operates the STS, has developed vegetation management plans (Appendix D to the Navajo Operation and Maintenance Plan, located in EIS **Appendix 1B**) that address the requirements of the Arizona State Land Department, BLM, U.S. Forest Service, the Navajo Nation and Hopi Tribe. Procedures for salvaging cacti, and protecting sensitive plants and animals and cultural resources are included for each land management jurisdiction. Best Management Practices and Mitigation Measures for the Navajo Project, which includes the STS and WTS, are summarized in Appendix E of the Navajo Project Operation and Maintenance Plan (**Appendix 1B**), as described above for the NGS and the BM&LP Railroad.

4.3 Proposed Mitigation Measures

For the purpose of this EIS, mitigation measures are additional, project specific measures proposed as a result of the NEPA environmental review process. Mitigation measures may specify resource protection actions, or may require monitoring, followed by a decision to take, or not take a protection action. Mitigation measures that are included in any Record of Decision (ROD) would become an integral part of the Proposed Action or alternative approved for implementation by the Secretary of the Interior. A Post-ROD Mitigation Monitoring Plan would be developed in conjunction with the ROD to track mitigation measure implementation.

Mitigation (Conservation Measures) for USFWS listed or candidate plant and animal species are contained in the Biological Assessment published concurrently with the Draft EIS. The same Conservation Measures are included in the applicable resource sections, and in **Appendix 4A**. It is anticipated that these Biological Assessment Conservation Measures, or Measures as modified, will be included in the USFWS Biological Opinion, which will be attached to the ROD. USFWS Biological Opinion is the definitive mitigation document for the affected species.

The NHPA Programmatic Agreements are treated as mitigation measures in this EIS; the details of cultural resources protection measures are included in the draft Programmatic Agreements located on (website). . The final Programmatic Agreements signed by the required parties are the definitive mitigation documents for cultural resources.

Table 4-1 provides a list of the proposed mitigation measures that have been included in the various EIS resource sections, with references to the chapter location where the measure text can be found.

Table 4-1 Summary of Proposed Mitigation Measures for the NGS and KMC Project EIS

NGS	Proposed KMC	WTS	STS	Mitigation Measure	Location in EIS
Paleontology					
	X			P-1 Identification and recovery of important fossils	3.5.4.3.2.3, 3.5,4.3.3.3
Wildlife – Special Status Species					
	X			AS-1 Mexican Spotted Owl Nesting Period Protection	3.11.4.3.2.3, **Appendix 4A**
		X	X	AS-2 Southwestern Willow Flycatcher Breeding and Nesting Protection	3.11.4.3.3.2, **Appendix 4A**
		X	X	AS-3 Western Yellow-billed Cuckoo Breeding and Nesting Protection	3.11.4.3.3.2, **Appendix 4A**
		X		RS-1 Mojave Desert Tortoise Individual and Habitat Protection	3.11.4.3.3.2, **Appendix 4A**
			X	RS-2 Sonoran Desert Tortoise Individual and Habitat Protection	3.11.4.3.3.2, **Appendix 4A**
Aquatic Biology – Special Status Fish Species					
X				FS-1 Non-native Fish Management in the Colorado River Grand Canyon Area	3.13.4.3.1.1, **Appendix 4A**
X				FS-2 Razorback Sucker Translocations	3.13.4.3.1.1, **Appendix 4A**
X				FS-3 Support Activities at the U.S. Fish and Wildlife Service Southwest Native Aquatics Research and Recovery Center	3.13.4.3.1.1, **Appendix 4A**
X				FS-4 Support Transport of Colorado Pikeminnow and Razorback Sucker above the Waterfall Barrier in the San Juan River	3.13.4.3.1.1, **Appendix 4A**
X				FS-5 Funding Support for a Habitat Improvement Project in the San Juan River	3.13.4.3.1.1, **Appendix 4A**
Cultural Resources					
X		X	X	Programmatic Agreement for the Navajo Generating Station, BM&LP Railroad, WTS and STS	**NGS PA**[1]
	X			Programmatic Agreement for the Kayenta Mine Complex	**KMC PA**[1]

[1] Posted on Project website (NGSKMC-EIS.net) when Draft EIS is released.

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Chapter 5.0

Short-term Uses versus Long-term Productivity

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Acronyms and Abbreviations

1969 Lease	Navajo Project Indenture of Lease
BART	Best Available Retrofit Technology
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BM&LP Railroad	Black Mesa & Lake Powell Railroad
BO	Biological Opinion
CAP	Central Arizona Project
CEQ	Council on Environmental Quality
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
CO_2	carbon dioxide
Co-tenants	Salt River Project, Arizona Public Service Company, NV Energy, and Tucson Electric Power Company
Development Fund	Lower Colorado River Basin Development Fund
EIS	Environmental Impact Statement
ERA	Ecological Risk Assessment
ESA	Endangered Species Act of 1973
HHRA	Human Health Risk Assessment
km	kilometer
KMC	Kayenta Mine Complex
kV	kilovolt
kW	kilowatt
MW	megawatt
N-Aquifer	Navajo Aquifer
NEPA	National Environmental Policy Act of 1969, as amended
NGO	non-government organization
NGS	Navajo Generating Station
NGS Participants	U.S. (Reclamation), Salt River Project, Arizona Public Service Company, NV Energy, and Tucson Electric Power Company
NHPA	National Historic Preservation Act
NNEPA	Navajo Nation Environmental Protection Agency
NO_2	nitrogen dioxide
NO_X	nitrogen oxide
OSMRE	Office of Surface Mining Reclamation and Enforcement
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PFR	Partial Federal Replacement
PWCC	Peabody Western Coal Company
Reclamation	U.S. Bureau of Reclamation
ROW	Right-of-way
SO_2	sulfur dioxide

SRP	Salt River Project Agricultural Improvement and Power District
STS	Southern Transmission System
U.S.	United States
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WTS	Western Transmission System

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5.0 Short-term Uses versus Long-term Productivity

5.1 Introduction

The National Environmental Policy Act requires that an Environmental Impact Statement (EIS) include a discussion of the relationship between short-term uses of man's environment and maintenance and enhancement of long-term productivity (40 Code of Federal Regulations 1502.16). The following are definitions, or assumptions used to conduct this analysis.

- The primary resource-related activities at Kayenta Mining include coal extraction and follow-on reclamation, and withdrawal of groundwater for dust control and other uses. The primary resource-related activities at Navajo Generating Station (NGS) include withdrawal of cooling water from Lake Powell, coal combustion to generate electricity, disposal of coal combustion residuals in a landfill, and evaporation of waste water in cooling towers and in ponds. The workforces that operate both facilities represent the primary human resource activities.
- Natural and human resource impacts from implementation of the Proposed Action and the Alternatives are described in Chapter 3.0.
- Short-term for this EIS is defined as period of 2 years or less, which generally corresponds to the time required to stabilize disturbed soils and initiate revegetation.
- Long-term for this EIS is defined as the operating period for NGS-Kayenta Mine Complex (KMC) Project components, and the additional time required for project impacts to be reduced to levels similar to background conditions. Both NGS and the Kayenta Mine represent long-term operations.
- For renewable resources (e.g., biological resources), productivity means the rate at which quantities of a resource (for example, the weight of new plant growth or biomass) are added (input) to an ecosystem. In economic terms, productivity is a measure of how efficiently inputs, such as labor and natural resources, are being used in an economy to produce a given output of goods and services.
- The Western Transmission System, Southern Transmission System, and associated communication sites would continue to operate through 2044, and likely beyond. No new modifications to this system would occur; only operation and maintenance activities would occur along the rights-of-way on an infrequent basis. As a consequence, the influence of short-term uses on long-term productivity is not relevant for these project components.

For purposes of evaluating project effects on long-term productivity, all the action alternatives are evaluated together because of the operational differences are small. The No Action Alternative is discussed separately. The following resources are discussed in this section because long-term productivity impacts are expected.

5.2 Air Quality and Climate

5.2.1 Proposed Action and Action Alternatives

NGS and the Kayenta Mine would continue to generate emissions of various air pollutants over the remaining life of both facilities. As described in Section 3.1, Air Quality, both components currently operate, and are expected to operate within regulatory limits for emissions and consequent atmospheric concentrations of criteria and hazardous air pollutants. These emissions are not expected to reduce long term productivity because air quality standards were developed to be protective of natural resource and human health.

As described in Chapter 3.2, Climate Change, the project would emit greenhouse gases at a maximum rate of approximately 18.3 million metric tons of carbon dioxide equivalent annually through 2044. Greenhouse gas emissions would be slightly lower under the partial replacement alternatives than under the Proposed Action. These emissions are predicted to contribute to climate change, indicated by increases in global temperature and greater variability in precipitation at various geographic scales. The aquatic and terrestrial ecosystems, and agricultural crops and livestock forage may respond to climate changes in different ways as described in Section 3.2, which could result in both increased and decreased productivity.

5.2.2 No Action Alternative

The operational emissions from NGS and Kayenta Mine would cease in 2018, thereby eliminating more than 25 years of greenhouse gas emissions from these facilities. Global, regional, and local increases in greenhouse gases from other sources are predicted to continue (Section 3.2), with consequent productivity changes in natural and agricultural systems.

5.3 Water and Water-Dependent Resources

5.3.1 Proposed Action and Action Alternatives

NGS would continue to use up to 40,000 acre feet of water per year from Lake Powell, and the proposed KMC would require approximately 1,200 acre feet of groundwater per year through 2044. Based on the analysis provided in Section 3.7, Water Resources, and Section 3.12, Aquatic Resources, the NGS withdrawals would not reduce the productivity of aquatic resources within Lake Powell. At the proposed KMC, the retention and maintenance of impoundments over the long term would provide reliable water for wildlife and livestock, a productivity benefit. Based on the analysis provided in Section 3.7, the project withdrawal of groundwater would result in no or negligible reductions in spring flows and base flows in channels that drain Black Mesa, and therefore the productivity of water dependent resources (riparian vegetation and wildlife habitat) would be maintained. Cumulative reductions in channel base flows are predicted (**Appendix WR-9**) when past pumping (community and mine), future KMC, and future community pumping are considered together, and therefore there may be a slight decline in riparian vegetation productivity within the major Black Mesa drainages. See Section 5.6 for a discussion of community well drawdown impacts from mine pumping.

5.3.2 No Action Alternative

NGS water demands from Lake Powell would cease after decommissioning is completed in 2020, and groundwater withdrawals at proposed KMC would decline to 500 acre-feet per year during a reclamation period extending for 10 to 15 years after 2018. Future cumulative reductions in Black Mesa channel base flows are predicted (**Appendix WR-9**) in the absence of proposed KMC pumping because the continuing aquifer drawdown impacts of past pumping, combined with foreseeable community pumping, would result in slight declines in riparian vegetation productivity.

5.4 Soil and Biological Resources

5.4.1 Proposed Action and Action Alternatives

Land productivity on approximately 3,724 acres at the NGS plant site and railroad right-of-way would be restored as the result of decommissioning and revegetation after 2044. The time required for vegetation recovery to a level similar to background conditions would be long-term because of low and variable annual precipitation.

Areas disturbed by proposed KMC mining would be progressively revegetated. At the completion of mining in 2044, surface facilities such as conveyors, buildings, and roads, would be decommissioned and removed. A total of 10,123 acres of previously disturbed land would remain to be revegetated after

2044, requiring 10 to 15 years before control of the land is returned to the Navajo Nation or Hopi Tribe. The long-term productivity of revegetated land is expected to match or be higher than that for pre-existing vegetation communities because soil and overburden would be mixed to provide suitable growing medium for revegetation species.

Wildlife habitat would be predominantly suitable for grassland species, with an increasing shrubland habitat component over the long-term. Restoration of woodlands (pinyon pine-juniper) would be very long term (greater than 50 years). In summary, the productivity of wildlife habitats would be maintained or increased, but the support functions would be different (less overall ground cover by woody vegetation).

Based on the ecological risk analysis conducted for wildlife and aquatic communities, and special status species (Sections 3.8 through 3.13), the long-term productivity of the terrestrial and aquatic communities receiving trace metal deposition from NGS stack emissions through 2044 would be maintained. When cumulative sources of trace metal deposition and baseline water quality conditions are considered, reductions in the productivity of special status fish species are predicted in segments of the Lower Colorado River (humpback chub and razorback sucker) and San Juan River (Colorado pikeminnow and razorback sucker). Mitigation measures have been proposed to improve survival and reproduction for these species (Section 3.13).

5.4.2 No Action Alternative

Under the No Action Alternative, decommissioning activities at NGS and proposed KMC would occur in 2018 to 2019, and previously disturbed areas would be revegetated. Less time would be required for vegetation productivity to recover as compared to the Proposed Action and Action Alternatives. Trace metal deposition from NGS stacks would cease, but cumulative impacts to the productivity of special status fish in the Colorado River system would continue, based on trace metal deposition rates from other regional and global sources.

5.5 Land Use

5.5.1 Proposed Action and Action Alternatives

The industrial land use would continue, largely unchanged at NGS through 2044. As described above under Soils and Biological Resources, proposed KMC mining would progressively remove native vegetation communities, followed by reclamation of disturbed areas. Access for grazing to areas undergoing reclamation would be restricted. Over the long-term, revegetated land would be returned to the Navajo Nation or Hopi Tribe. The appropriate tribal agency in turn would allocate the revegetated land to community members for the purpose of livestock grazing and other uses. In summary, economic productivity related to natural resources uses (grazing land) by community members on the proposed KMC would be reduced during the 2020 to 2044 period to accommodate continued mining, and ongoing land reclamation. It is expected that economic productivity based on livestock grazing would increase after community members gain full access to reclaimed lands.

5.5.2 No Action Alternative

Industrial land uses at NGS and proposed KMC would cease in 2018 to 2019, with decommissioning and reclamation as described above. The effect on natural productivity would be less time required to meet reclamation productivity goals, and less time for the land to be suitable for intended future uses (primarily livestock grazing).

5.6 Socioeconomics

5.6.1 Proposed Action and Action Alternatives

The socioeconomic benefits of power plant and mine related employment would extend through 2044, and then would substantially decline during decommissioning and the final reclamation period. No comparable source(s) of employment and income for power plant and mine workers currently exist or are anticipated to develop in the region. Lease fees, mine royalties and other payments to the tribes and local counties would cease after 2044. Other costs to the Navajo Nation, Hopi Tribe, and affected counties are expected to increase, including costs for employee assistance and education programs, and greater demands for social and medical services as the result of increased unemployment. The overall impact would be an overall reduction in economic productivity because of lowered economic outputs (payrolls and payments), and increased costs to support unemployed workers and their families.

Mine-related pumping would result in long-term groundwater drawdown of less than 50 feet in community wells near the proposed KMC, which would slightly increase pumping costs over the next 50 years.

Proposed Action Central Arizona Project (CAP) pumping cost increases from 2020 levels would range from $12 to $14 per acre-foot in 2044 due to the Proposed Action; implementation of the most expensive alternative would increase the acre foot pumping cost in 2044 by $45 per acre-foot relative to the Proposed Action. Changes in the cost of water could alter decisions on CAP water distribution among agricultural, industrial, municipal, and groundwater recharge uses.

5.6.2 No Action Alternative

Production at NGS and proposed KMC would cease in 2018, with decommissioning and reclamation as described above. The socioeconomic impacts on employment, income, unemployment and support for tribal and local government operations would occur earlier in time, with the impacts of unemployment also occurring earlier. Community pumping costs are anticipated to increase in the future because the continued community N-Aquifer drawdowns would offset the aquifer recovery associated with cessation of mine pumping.

Alternative energy sources for CAP pumping would need to be acquired or constructed, or contracts signed for power purchases. Assuming a power purchase agreement for the equivalent of NGS power, the cost per acre-foot is projected to be from $10 less to $17 more relative to the Proposed Action in 2020, depending on future prices of natural gas (**Table 3.18-83**). In summary, the impacts on economic productivity for the Navajo Nation and Hopi Tribe would occur earlier in time; the economic productivity related to CAP pumping costs may be influenced by a wide range of future natural gas market costs. Changes in the cost of water could alter future use of CAP water among agricultural, industrial, municipal and groundwater recharge.

Chapter 6.0

Irretrievable and Irreversible Commitment of Resources

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Acronyms and Abbreviations

1969 Lease	Navajo Project Indenture of Lease
BART	Best Available Retrofit Technology
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BM&LP Railroad	Black Mesa & Lake Powell Railroad
BO	Biological Opinion
CAP	Central Arizona Project
CEQ	Council on Environmental Quality
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
CO_2	carbon dioxide
Co-tenants	Salt River Project, Arizona Public Service Company, NV Energy, and Tucson Electric Power Company
Development Fund	Lower Colorado River Basin Development Fund
EIS	Environmental Impact Statement
ERA	Ecological Risk Assessment
ESA	Endangered Species Act of 1973
HHRA	Human Health Risk Assessment
km	kilometer
KMC	Kayenta Mine Complex
kV	kilovolt
kW	kilowatt
MW	megawatt
N-Aquifer	Navajo Aquifer
NEPA	National Environmental Policy Act of 1969, as amended
NGO	non-government organization
NGS	Navajo Generating Station
NGS Participants	U.S. (Reclamation), Salt River Project, Arizona Public Service Company, NV Energy, and Tucson Electric Power Company
NHPA	National Historic Preservation Act
NNEPA	Navajo Nation Environmental Protection Agency
NO_2	nitrogen dioxide
NO_X	nitrogen oxide
OSMRE	Office of Surface Mining Reclamation and Enforcement
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PFR	Partial Federal Replacement
PWCC	Peabody Western Coal Company
Reclamation	U.S. Bureau of Reclamation
ROW	Right-of-way
SO_2	sulfur dioxide

SRP	Salt River Project Agricultural Improvement and Power District
STS	Southern Transmission System
U.S.	United States
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WTS	Western Transmission System

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6.0 Irretrievable and Irreversible Commitment of Resources

Irretrievable and irreversible resource commitments are related to the use of nonrenewable and renewable resources, and the effects that the uses of these resources would have on availability for future generations. Irretrievable commitments apply primarily to the use of nonrenewable resources that cannot be replenished such as fossil fuels, paleontological and cultural resources. Irreversible commitments primarily result from the use or loss of a specific resource that cannot be replaced within a reasonable time. Irreversible commitments are represented by potential losses of future options for resource development or management. An example would be protection of high value surface resources (such as cultural resources) that preclude access to underlying minerals.

The irretrievable and irreversible commitments of resources for the Proposed Action and alternatives are considered similar in scale, and are discussed together.

Table 6-1 provides a summary of irretrievable and irreversible commitments of resources

Table 6-1 NGS-KMC Project Irretrievable and Irreversible Commitment of Resources for the Proposed Action and Alternatives.

Resource	Irretrievable	Irreversible	Interpretation
Air Quality	Yes	Yes	The constituent gases of the atmosphere are considered nonrenewable resources. NGS combustion emissions represent irretrievable additions to regional and global atmospheric concentrations of various criteria pollutants and greenhouse gases. These additions are irreversible because they become permanent constituents of the atmosphere, or are removed very slowly by natural processes.
Geological and Mineral Resources	Yes	Yes	Mining and combustion of coal would be both irretrievable and irreversible commitments of resources because coal is a nonrenewable fossil fuel.
Paleontological Resources	Yes	Yes	Paleontological resources removed by surface disturbance would be both irretrievable and irreversible commitments of resources because fossil bearing formations are nonrenewable.
Water Resources	No	No	The storage and release of surface water originating from annual rainfall does not represent a irretrievable or irreversible commitment of resources. Groundwater withdrawal in an arid climate may be irretrievable if recharge is non-existent or extremely slow. There is evidence of aquifer recovery from past and present pumping on Black Mesa, and therefore groundwater commitments are not irreversible, but recovery rates are long-term.
Soil Resources	Yes	No	Soil removal and mixing from surface disturbance is an irretrievable resource commitment because soil cannot be replaced in its original form. However, the productivity of soil can be maintained and enhanced from proper soil storage and reapplication over disturbed areas.

Table 6-1 NGS-KMC Project Irretrievable and Irreversible Commitment of Resources for the Proposed Action and Alternatives.

Resource	Irretrievable	Irreversible	Interpretation
Vegetation Resources	Yes	No	Vegetation removal from surface disturbance is an irretrievable resource commitment because all elements of the existing vegetation community cannot be replaced because of intolerance of some species to soil disturbance. The productivity and diversity of vegetation communities over the long term may be restored with proper management, even though the species composition of these communities may be different from the pre-existing community.
Wildlife Resources	Yes	No	Wildlife habitat removal is an irretrievable resource commitment because the pre-existing components of habitat and structure cannot be comprehensively replaced. Restored vegetation communities may provide suitable habitat over the long term for a variety wildlife species, but the wildlife species composition and abundance may be different from the pre-existing habitat areas.
Aquatic Resources	No	No	The operation of project components are not expected to measurably change the composition and abundance of aquatic resources in Lake Powell and on Black Mesa, and therefore irretrievable and irreversible resource commitments are not anticipated.
Cultural Resources	Yes	Yes	Damage and loss of cultural resources are irretrievable and irreversible resource commitments because cultural resources are not replaceable.
Socioeconomics	Yes	Yes	Operation of the two facilities would require the commitment of natural, human, engineered, and monetary resources. Once completed, most of the resource investments would be irretrievable and their use/application for this project would preclude or foreclose their use for other purposes. Other economic enterprises that would be able to utilize these human and infrastructural resources are lacking in the project area; without other economic opportunities, community members would see employment opportunities elsewhere and would not be available as a labor source, resulting in an irreversible commitment.

Chapter 7.0

Consultation and Coordination

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Acronyms and Abbreviations

1969 Lease	Navajo Project Indenture of Lease
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BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BM&LP Railroad	Black Mesa & Lake Powell Railroad
BO	Biological Opinion
CAP	Central Arizona Project
CEQ	Council on Environmental Quality
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
CO_2	Carbon dioxide
Co-tenants	Salt River Project, Los Angeles Department of Water and Power, Arizona Public Service, NV Energy, and Tucson Electric Power Company
Development Fund	Lower Colorado River Basin Development Fund
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ROW	Right-of-way

SO_2	Sulfur dioxide
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7.0 Consultation and Coordination

During the scoping process, and consultation and coordination throughout the preparation of this Environmental Impact Statement (EIS), formal and informal efforts were made by the U.S. Bureau of (Reclamation) to involve other federal agencies, state, and local governments, tribes, and the public. Consultation and coordination with federal and intergovernmental agencies, organizations, Native American tribes, and interested groups and individuals is important to (1) ensure the most appropriate data have been gathered and employed for analyses and (2) ensure that agency and public interests and values are considered by decision makers. The sections of this chapter describe the consultation and coordination efforts for this EIS including informal consultation and coordination, required formal consultation, and public participation activities other than Public Scoping. Public outreach activities conducted during the scoping period are summarized in Section 1.10; Public Scoping. Additional information is available in the Scoping Summary Report, available at http://ngskmc-eis.net/scoping-summary-report-files/.

7.1 Consultation and Coordination

Coordination and collaboration on the EIS were accomplished through written and telephone communication, meetings, and other cooperative efforts between Reclamation and interested federal, state, and local government agencies, tribes, organizations, other interest groups, and the public.

7.1.1 Cooperating Agencies

Federal, state, and local agencies, and Native American tribes that may have an interest in the Navajo Generating Station (NGS)-Kayenta Mine Complex (KMC) Project EIS were invited to participate in the preparation of the EIS as cooperating agencies. A cooperating agency is any federal, state, or local government agency or Native American tribe that has either jurisdiction by law or special expertise regarding environmental impacts of a proposal or a reasonable alternative for a major federal action affecting the quality of the human environment. The benefits of cooperating agency participation in the analyses for and preparation of this EIS include (1) disclosure of relevant information early in the analytical process; (2) application of available technical expertise and staff support; (3) avoidance of duplication of other federal, tribal, state, and local procedures; and (4) establishment of a mechanism for addressing intergovernmental issues.

Due to the substantial jurisdictional responsibilities of both Office of Surface Mining Reclamation and Enforcement's (OSMRE's) Western Region and Bureau of Indian Affairs' (BIA's) Navajo Region, these two agencies were defined as key cooperating agencies.

As detailed in **Table 7-1**, in February and March of 2013, Reclamation sent formal letters inviting 10 federal entities to participate as cooperating agencies in the preparation of the NGS-KMC Project EIS and received 7 positive responses.

In January of 2014, Reclamation sent formal letters inviting the Hopi Tribe and Navajo Nation, and in April of 2014 invited the 10 tribes with Central Arizona Project (CAP) water allocations (Ak Chin Indian Community, Fort McDowell Yavapai Nation, Gila River Indian Community, Pascua Yaqui Tribe, Salt River Pima-Maricopa Indian Community, San Carlos Apache Tribe, Tohono O'odham Nation, Tonto Apache Tribe, White Mountain Apache Tribe, and Yavapai-Apache Nation) to participate as cooperating agencies. In March and June of 2014, the Navajo Nation, and the Gila River Indian Community, respectively, accepted the invitation to become cooperating agencies.

In April of 2014, Reclamation sent a formal letter inviting the Central Arizona Water Conservation District to participate as a cooperating agency and received a positive response in May 2014. In addition, the Arizona Department of Game and Fish requested cooperating agency status in April of 2014.

Reclamation sent a formal letter acknowledging the Arizona Department of Game and Fish as a cooperating agency in May of 2014.

Table 7-1 Cooperating Agency Interaction

Agency	Invitation Date	Acceptance Date	Cooperating Agency Status	Jurisdiction/Special Expertise for this EIS
OSMRE–Western Region	03/06/2013	03/13/2013	Key Cooperating Agency	Act as key cooperating agency per Memorandum of Understanding among Reclamation, OSMRE, BIA, and the project proponents. Review EIS regarding compliance with OSMRE requirements; ensure all information is adequate to issue a Record of Decision based on the Final EIS analysis.
Bureau of Indian Affairs - Navajo Region	03/06/2013	03/18/2014	Key Cooperating Agency	Act as key cooperating agency per Memorandum of Understanding among Reclamation, OSMRE, BIA, and the project proponents. Review EIS regarding compliance with BIA requirements; ensure all information is adequate to issue a Record of Decision based on the Final EIS analysis.
Bureau of Land Management	02/12/2014	04/14/2014	Cooperating Agency	Act as cooperating agency per Memorandum of Understanding between Reclamation and Bureau of Land Management.
BIA Western Region	02/12/2014	05/12/2014	Cooperating Agency	Act as cooperating agency per Memorandum of Understanding between Reclamation and BIA – Western Region.
U.S. Fish and Wildlife Service (USFWS)	02/12/2014	03/06/2014	Cooperating Agency	Act as cooperating agency per Memorandum of Understanding between Reclamation and USFWS.
National Park Service	02/12/2014	04/07/2014	Cooperating Agency	Act as cooperating agency per Memorandum of Understanding between Reclamation and National Park Service.
U.S. Department of Labor Mine Safety and Health Administration	02/12/14	—	No Response	N/A
U.S. Environmental Protection Agency	02/12/2014	04/02/2014	Cooperating Agency	Act as cooperating agency per letter dated May 28, 2014. Review EIS for compliance with applicable federal environmental regulations.
Department of Energy – Western Area Power Administration	02/12/2014	Declined - 04/02/2014	Declined Cooperating Agency Status	N/A
Department of Agriculture - U. S. Forest Service	02/12/2014	04/07/2014	Cooperating Agency	Act as cooperating agency per Memorandum of Understanding between Reclamation and U.S. Forest Service.

Table 7-1 Cooperating Agency Interaction

Agency	Invitation Date	Acceptance Date	Cooperating Agency Status	Jurisdiction/Special Expertise for this EIS
Navajo Nation	01/30/2014	03/31/2014	Cooperating Agency	Act as cooperating agency per Memorandum of Understanding between Reclamation and the Navajo Nation.
Hopi Tribe	01/30/2014	None	No Response	Invited to act as cooperating agency per Memorandum of Understanding between Reclamation and the Hopi Tribe.
Ak Chin Indian Community	05/23/2014	—	No Response	CAP-affected Tribe
Fort McDowell Yavapai Nation	05/23/2014	—	No Response	CAP-affected Tribe
Gila River Indian Community	05/23/2014	06/03/2014	Cooperating Agency	Act as cooperating agency per Memorandum of Understanding between Reclamation and Gila River Indian Community.
Pascua Yaqui Tribe	05/23/2014	—	No Response	CAP-affected Tribe
Salt River Pima-Maricopa Indian Community	05/23/2014	—	No Response	CAP-affected Tribe
San Carlos Apache Tribe	05/23/2014	—	No Response	CAP-affected Tribe
Tohono O'odham Nation	05/23/2014	—	No Response	CAP-affected Tribe
Tonto Apache Tribe	05/23/2014	—	No Response	CAP-affected Tribe
White Mountain Apache Tribe	05/23/2014	—	No Response	CAP-affected Tribe
Yavapai-Apache Nation	05/23/2014	—	No Response	CAP-affected Tribe
Pueblo of Zuni	03/23/2016	04/07/2016	Cooperating Agency	Act as cooperating agency per Memorandum of Understanding between Reclamation and the Pueblo of Zuni.
Arizona Game and Fish Department	10/02/2014	01/20/15	Cooperating Agency	Act as cooperating agency per Memorandum of Understanding between Reclamation and the Arizona Game and Fish Department.
Central Arizona Water Conservation District	4/10/2014	05/29/14	Cooperating Agency	Act as cooperating agency per Memorandum of Understanding between Reclamation and the Central Arizona Water Conservation District.

An initial cooperating agencies' meeting was held on June 13, 2013, to outline the EIS process and provide background on the Proposed Action, including a preview of the EIS issues. The project team was introduced and an initial project schedule was presented. In addition:

- Information was provided to federal agencies and tribes to assist in their decision whether to become Cooperating Agencies;
- The Technical Work Group process was initiated; and
- A plan for periodic project communications was established.

A second cooperating agency meeting was held on October 29, 2014 to update the agencies on the project process and schedule and to provide additional information on subgroup processes and other occurrences.

A third cooperating agency meeting was held on May 26, 2016 to provide information on the preliminary draft EIS released for cooperating agency review on that day. The meeting kicked-off a 30-day review period with an update of the project progress and a question and answer session.

7.1.2 Government-to-Government Consultation

The United States (U.S.) has a unique legal relationship with Native American tribal governments as set forth in the Constitution of the U.S., treaties, Executive Orders, federal statues, federal policy, and tribal requirements, which establish the interaction that must take place between federal and tribal governments. The most important basis for this relationship is the trust responsibility of the U.S. to protect tribal sovereignty, self-determination, tribal lands, tribal assets and resources, and treaty and other federally recognized and reserved rights. Federal agencies work with tribes, government-to-government, to address issues concerning Indian tribal self-government, tribal trust resources, and Indian tribal treaty and other rights. Government-to-government consultation is the process of seeking, discussing, and considering views on environmental and cultural resource management issues. The Department of the Interior Policy on Consultation with Indian Tribes (U.S. Department of the Interior 2011) and Reclamation's Protocol Guidelines: Consulting with Indian Tribal Governments (Reclamation 2012) contain consultation and coordination procedures to guide Reclamation's interaction with the tribes.

In addition to status as cooperating agencies, Reclamation requested formal government-to-government consultation with the Navajo Nation, Hopi Tribe, Zuni Tribe, and 10 tribes that have Central Arizona Project water allocations (CAP-affected tribes)).

Reclamation has conducted government-to-government tribal consultation as detailed in **Table 7-2**. Additional government-to-government tribal consultations and informal tribal consultations will occur at key project stages and as requested by tribal governments.

Table 7-2 Government–to–Government Tribal Consultations to Date

Tribe	Date	Location	Agencies Represented
Navajo	March 31, 2014	Window Rock, Arizona	Reclamation, OSMRE, BIA-Navajo Region
	July 21, 2015	Window Rock, Arizona	Reclamation, OSMRE, BIA-Navajo Region
	July 19, 2016	Window Rock, Arizona	Reclamation, OSMRE, BIA- Navajo Region
Hopi	May 16, 2014	Kykotsmovi, Arizona	Reclamation, OSMRE
	May 15, 2015	Kykotsmovi, Arizona	Reclamation, OSMRE
	March 7, 2016	Kykotsmovi, Arizona	Reclamation, OSMRE
	June 22, 2016	Kykotsmovi, Arizona	Reclamation, OSMRE, BIA-Western Region

Table 7-2 Government–to–Government Tribal Consultations to Date

Tribe	Date	Location	Agencies Represented
CAP-affected Tribes	May 15, 2014	Phoenix, Arizona	Reclamation, BIA-Western Region
	April 14, 2015	Phoenix, Arizona	Reclamation
Kaibab Band of Paiute Indians	July 3, 2014	Pipe Spring, Arizona	Reclamation, OSMRE, BIA-Western Region
	April 16, 2015	Pipe Spring, Arizona	Reclamation
	February 18, 2016	Pipe Spring, Arizona	Reclamation
Hualapai	March 4, 2016	Peach Springs, Arizona	Reclamation
Pueblo of Zuni	February 16, 2016	Zuni, New Mexico	Reclamation, OSMRE

7.1.3 Formal Consultation

Reclamation is required to prepare EISs in coordination with any studies or analyses required by the Fish and Wildlife Coordination Act (16 United States Code [USC] Sec 661 et seq. [16 USC 661]), Endangered Species Act of 1973 (16 USC Sec 1531 et seq. [16 USC 1531]), and the National Historic Preservation Act of 1966, as amended (16 USC Sec 470 et seq. [16 USC 470]). Early in the preparation of the EIS, the cooperating agencies suggested and agreed to work collaboratively in the consultations for Section 7 of the Endangered Species Act and Section 106 of the National Historic Preservation Act. The following sections are summaries of the activities associated with the consultation processes to date for threatened and endangered species and cultural resources.

7.1.3.1 Biological Resources

In accordance with the Endangered Species Act of 1973, as amended, 16 USC 1531 et seq., formal consultation is required when the action agency determines that the proposed action may affect a listed species or designated critical habitat. The consultation process determines whether the proposed action is likely to jeopardize the continued existence of a species or destroy or adversely modify critical habitat. The process begins with Reclamation's written request and a submittal of a completed biological assessment (BA), and concludes with the issuance of a biological opinion from the USFWS, which may include an incidental take statement or a letter of concurrence from USFWS (if USFWS agrees that the proposed project would have no effect or would not adversely affect a threatened or endangered species or their critical habitat). On February 12, 2015, Reclamation sent a letter to the USFWS Arizona Ecological Services Office requesting confirmation of a draft list of federally listed species that may be affected by the NGS-KMC Project. Reclamation also contacted the following agencies regarding the occurrence of special status species in the NGS-KMC Project areas: USFS (Kaibab National Forest, Prescott National Forest), BLM, Navajo Nation, Hopi Tribe, Kaibab Band of Paiute Indians, Moapa Band of Paiute Indians, and Arizona Game and Fish Department. Species occurrence information also was obtained from Arizona Game and Fish Department Project Evaluation Program, Utah Division of Wildlife Resources Natural Heritage Program, and Nevada Natural Heritage Program. Responses and accompanying information received are summarized in **Table 7-3**.

Table 7-3 Information Provided by Tribe or Agency Regarding Listed Species in the Project Area

Tribe/Agency	Date of Response	Information Provided
U.S. Fish and Wildlife Service	March 11, 2015	Confirmation, with revisions, of list of threatened, endangered, proposed, candidate, and conservation agreement species to be analyzed in the NGS-KMC BA.
U.S. Forest Service	April 25, 2014	Meeting with the Kaibab and Prescott National Forests to receive input on special status and management indicator species (MIS) known or with potential to occur along the STS.
Bureau of Land Management	November 19, 2015 December 2, 2015	BLM Field Office-specific lists of BLM-designated sensitive species with potential to occur on BLM-administered lands along the WTS and STS.
Navajo Nation	March 25 and October 29, 2014	Received special status species occurrence information in a letter and meeting for the proposed KMC and STS study areas.
Hopi Tribe	May 19, 2014	Input (received during meeting) on sensitive species with potential to occur in the KMC analysis area.
Kaibab Band of Paiute Indians	No response	None
Moapa Band of Paiute Indians	No response	None

Considerable efforts have been made by all participants to determine major issues and concerns and potential effects the Proposed Action may have on federally listed threatened, endangered, proposed, and candidate species. At the project kickoff meeting for the cooperating agencies, a Biological Resources Working Group (later renamed the ESA Section 7/Biological Resources [ESA/Bio] Subgroup) was formed with representatives from Reclamation, OSMRE, BIA, U.S. Environmental Protection Agency, USFWS, Hopi Tribe, Navajo Nation, and AECOM. The project applicants and their contractors including EPRI, Environ, and Logan Simpson, also participated in the ESA/Bio Subgroup by contributing expertise and background data and analyses to assist in evaluation of impacts including air quality monitoring and risk assessments. Other agencies added to the ESA/Bio Subgroup over time included the U.S. Geological Survey, National Park Service, and BLM.

Informal consultation with the USFWS has been ongoing. This process has helped (1) identify which species and habitats may be in the action area, (2) determine the effects that the Proposed Action may have on listed species, (3) discuss ways the effects can be eliminated or reduced through modification of the Proposed Action, (4) discuss the need to enter into formal consultation, and (5) discuss ways the Proposed Action can contribute to the conservation of selected listed species. ESA/Bio Subgroup meetings were held frequently during the period of time leading up to submitting the Draft EIS and Draft BA.

In total, 27 meetings/conference calls of the ESA/Bio Subgroup (including meetings of the closely related and overlapping Ecological Risk Assessment [ERA] Subgroup) were held between June 2013 and January 2016. The purpose of these meetings included requests for information on special status

species in the project area, updates on agency activities related to the BA and biological resource sections of the EIS, interagency review of the final species list and outline for the BA, presentation of Mojave and Sonoran desert tortoise habitat assessments, review of ERA planning efforts and background data, and presentation of ERA field sampling results and the preliminary results of the ERAs for baseline conditions and the action alternatives. Additional agency coordination meetings and calls were held with the Navajo Nation, Hopi Tribe, USFS, and BLM to discuss issues and exchange information specific to those tribes and agencies. Several meetings among subsets of the ESA/Bio Subgroup were held to discuss specific aspects of the ESA section 7 consultation process. For instance, there were five meetings/calls among agency fish biologists to identify and refine fish conservation measures to be carried forward in the EIS and BA as part of the Proposed Action.

All data collected from the federal agencies, the tribes, and state and local government agencies, as described in **Table 7-3**, have been incorporated into this EIS and/or the BA, as appropriate. The BA has been completed and submitted to the USFWS. Formal consultation will begin with the USFWS determines the consultation package (i.e., the BA and supporting documentation) to be complete. In addition to the BA, a Biological Evaluation is being prepared for the Navajo Nation to address Navajo Nation-listed endangered species not covered in the BA.

7.1.3.2 Cultural Resources

Section 106 of the NHPA requires Reclamation and the cooperating federal agencies to consider the effects of the agencies' undertakings on properties listed in or eligible for the National Register of Historic Places (which can include a diversity of archaeological, historical, and traditional cultural resources). Regulations for Protection of Historic Properties (36 Code of Federal Regulations Part 800) implement Section 106 and define a process for federal agencies to use in consulting with State Historic Preservation Officers, Tribal Historic Preservation Officers, and other interested parties as they assess the effects of their undertakings. Pursuant to those regulations, Reclamation initiated Section 106 consultations with the Navajo Tribal Historic Preservation Officer and the Arizona, Nevada, and Utah State Historic Preservation Officers in May 2013. A formal letter inviting Tribes and state preservation offices to participate in the Section 106 process and the development of a proposed KMC PA were sent in July and August 2013. On July 24, 2015, Reclamation sent letters to 26 tribes (including the Navajo, Hopi, and Zuni) to provide them information about the project area and to ask if they wanted to participate in the Section 106 consultations and development of the NGS PA.

Reclamation has coordinated closely with the Navajo Nation, Hopi Tribe, and Pueblo of Zuni about various aspects of the Proposed Action, including potential impacts on cultural resources. Informational meetings were held with representatives of the Navajo Nation and Hopi Tribe as early as May 2013 and have continued regularly through the present. Information meeting were held with representatives of the Pueblo of Zuni as early as December 2013 and have continued regularly through the present.

Reclamation invited representatives from 10 Non-governmental Organizations to listening sessions on November 19 and 20, 2014, where they could provide a statement; a court reporter was available to record the statements word-for-word. Over the course of two days, 15 individuals provided comments.

Two listening sessions were held on Black Mesa at the Kayenta Mine on July 16, 2015 and August 28, 2015 for residents within and adjacent to the proposed KMC. Topics discussed included cultural resources.

A Cultural Resources Subgroup was created to share information project progress and consultation activities. Participants included the Office of Surface Mining Reclamation and Enforcement, Bureau of Indian Affairs, AECOM and Statistical Research, Inc., SRI Foundation, SRP, PWCC, and specific subcontractors conducting archaeological and ethnographic studies (HDR, Inc.; Anthropological Research, LLC; Logan Simpson). The group was organized to coordinate compliance with NHPA Section 106, and other laws, regulations, and ordinances protecting cultural resources; to facilitate

completion of Ethnographic Assessments for the NGS-KMC Project EIS, and manage data collection activities. The subcommittee members reviewed the cultural resources study plan and technical reports. Cultural Resources Subgroup meetings were generally held monthly to update participants on project activities and progress.

7.1.3.2.1 Cultural Resources Update Meeting (CRUM):

Three public meetings were held to provide agency staff and the interested public regarding progress in preparing Programmatic Agreements in compliance with Section 106 of the NHPA. **Table 7-4** presents a summary of the CRUM meetings.

Table 7-4 Summary of Cultural Resources Update Meetings

Date	Agencies/Entities represented
October 30, 2013	Bureau of Reclamation, OSMRE, BIA, BLM, USFS, NPS, Arizona SHPO, SRP, PWCC, APS, Navajo Nation, Hopi Tribe, Pueblo of Zuni, Museum of Northern Arizona, Statistical Research, Inc., SRI Foundation, plus 25 public members including representatives of Black Mesa Trust.
May 15, 2014	Bureau of Reclamation, OSMRE, BIA, USFS, ACHP, NPS, Arizona SHPO, Utah SHPO, APS, SRP, PWCC, Navajo Nation, Hopi Tribe, Pueblo of Zuni, Statistical Research, Inc., SRI Foundation, plus 4 public members including a representative of Black Mesa Conservancy.
December 2, 2014	Reclamation, OSMRE, BIA, ACHP, Arizona SHPO, Utah SHPO, SRP, PWCC, APS, Hopi Tribe, Pueblo of Zuni, Hualapai Tribe, Statistical Research, Inc., SRI Foundation, HDR, plus public members including representatives of Black Mesa Conservancy Black Mesa Trust, Black Mesa Water Coalition, Forgotten Navajo People.

7.1.4 Air Quality Subgroup

Activities focused on air quality-related components of the proposed action and alternatives, including emissions, ambient impacts, and other air quality-related topics. The group also reviewed the atmospheric deposition components of trace metals and acid compounds that were used for the Ecological Risk Assessment and Human Health Risk Assessment prepared to support the EIS.

Air quality subgroup participants included federal agency staff from Reclamation, the Office of Surface Mining Reclamation and Enforcement, Bureau of Indian Affairs, Environmental Protection Agency, National Park Service, Fish and Wildlife Service, Forest Service, and Bureau of Land Management; AECOM; Salt River Project; and Peabody Western Coal Company. At times, specific contractors who supported technical work prepared to support the EIS process participated in the interactions, related to review of their technical work products.

Interactions by the Air Quality Subgroup included conference calls, meetings, and webinars where data and reports were presented and discussed; technical documentation and modeling results were reviewed; and discussions occurred related to how the data were to be integrated into the EIS process. The subgroup activities, scheduled and coordinated on an as-needed basis, continued through the preparation of the Preliminary Draft EIS.

7.2 Public Review of the Draft EIS

A Notice of Availability and Notice of Public Meetings for the Draft Environmental Impact Statement for the Navajo Generating Station-Kayenta Mine Complex Project, Arizona was published in the Federal Register on September 30, 2016, by the Bureau of Reclamation, Interior. Written comments on the Draft EIS should be submitted on or before Tuesday, November 29, 2016.

7.2.1 Distribution List of the Draft EIS

Federal Agencies

Advisory Council on Historic Preservation, Washington, DC
Bureau of Indian Affairs, Washington, DC
Bureau of Indian Affairs - Trust Services, Washington, DC
Bureau of Indian Affairs - Navajo Regional Office, Gallup, NM (Cooperating Agency)
Bureau of Indian Affairs - Western Regional Office, Phoenix, AZ (Cooperating Agency)
Bureau of Indian Affairs - Western Regional Office, Phoenix, AZ
Bureau of Indian Affairs - Western Regional Office, Phoenix, AZ
Bureau of Indian Affairs - Hopi Agency, Keams Canyon, AZ
Bureau of Indian Affairs - Hopi Agency, Hotevilla, AZ
Bureau of Indian Affairs - Pima Agency, Sacaton, AZ
Bureau of Indian Affairs - Salt River Agency, Scottsdale, AZ
Bureau of Land Management, Washington, DC (Cooperating Agency)
Bureau of Land Management, Arizona State Office, Phoenix, AZ
Bureau of Land Management - Nevada State Office, Reno, NV
Bureau of Land Management - Utah State Office, Salt Lake City, UT
Bureau of Land Management - Phoenix District Office, Phoenix, AZ
Bureau of Reclamation, Office of the Commissioner, Washington, DC
Bureau of Reclamation - Lower Colorado Regional Office, Boulder City, NV
Bureau of Reclamation - Upper Colorado Regional Office, Salt Lake City, UT
Council on Environmental Quality, Washington, DC
Indian Health Service, Navajo Area, Window Rock, AZ
Indian Health Service, Rockville, MD
National Park Service - Glen Canyon, Page, AZ (Cooperating Agency)
National Park Service, Grand Canyon National Park, Grand Canyon, AZ
National Park Service, Mesa Verde, CO
National Park Service, Intermountain Regional Office, Denver, CO
National Park Service, Intermountain Regional Office, Lakewood CO
National Park Service, Phoenix, AZ
Office of Surface Mining Reclamation and Enforcement, Denver, CO (Cooperating Agency)
U.S. Fish and Wildlife Service, Washington, DC
U.S. Fish and Wildlife Service, Southwest Region 2, Albuquerque, NM
U.S. Fish and Wildlife Service - Arizona Ecological Services, Phoenix, AZ (Cooperating Agency)*
U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, Albuquerque, NM
U.S. Geological Survey - Environmental Affairs Program Office, Denver, CO
U.S. Geological Survey - Rocky Mountain Area, Flagstaff, AZ
U.S. Geological Survey - Arizona Water Science Center Tucson, AZ
U.S. Department of the Interior, Office of Environmental Policy and Compliance, Washington, DC
U.S. Department of the Interior, Office of Environmental Policy and Compliance, Denver, CO
U.S. Department of the Interior, Office of Environmental Policy and Compliance, San Francisco, CA
U.S. Department of the Interior, Office of the Solicitor, Albuquerque, NM
U.S. Department of the Interior, Office of the Solicitor, Lakewood, CO

U.S. Department of the Interior, Office of the Solicitor, Salt Lake City, UT
U.S. Department of the Interior, Office of the Solicitor, Phoenix Field Office, Phoenix, AZ
U.S. Army Corps of Engineers, Los Angeles District, Regulatory Division, Los Angeles, CA
U.S. Army Corps of Engineers, Arizona Regulatory Branch, Phoenix, AZ
U.S. Department of Commerce, Washington, DC
U.S. Department of Energy, Washington, DC
U.S. Department of Justice, U.S. Attorneys' Office, District of Arizona, Phoenix, AZ
U.S. Department of Labor, Mine Safety and Health Administration, Denver, CO
U.S. Environmental Protection Agency - Federal Activities Office, Washington, DC
U.S. Environmental Protection Agency, Region 9, San Francisco, CA (Cooperating Agency)*
USDA Forest Service - Southwest Region, Albuquerque, NM (Cooperating Agency)
USDA Forest Service - Kaibab National Forest, Cameron, AZ
USDA Forest Service - Kaibab National Forest, Williams, AZ
USDA Forest Service - Prescott National Forest, Prescott, AZ
USDA Natural Resource Conservation Service, Washington, DC
Western Area Power Administration - Desert Southwest Region, Phoenix, AZ

Elected Officials - Federal (Arizona)

Farrington, Shari, Office of Congressman Trent Franks, Glendale, AZ
Flake, Jeff, U.S. Congress, Phoenix, AZ
Franks, Trent, U.S. House of Representatives, 8th District, Glendale, AZ
Gallego, Ruben, U.S. House of Representatives, 7th District, Phoenix, AZ
Gosar, Paul, U.S. House of Representatives, 4th District, Prescott, AZ
Grijalva, Raul, U.S. House of Representatives, 3rd District, Tucson, AZ
Kirkpatrick, Ann, U.S. House of Representatives, 1st District, Flagstaff, AZ
Knight, Kevin, Office of Congressman David Schweikert, Scottsdale, AZ
McCain, John, U.S. Congress, Phoenix, AZ
McSally, Martha, U.S. House of Representatives, 2nd District, Tucson, AZ
Salmon, Matt, U.S. House of Representatives, 5th District, Gilbert, AZ
Schweikert, David, U.S. House of Representatives, 6th District, Scottsdale, AZ
Sinema, Kyrsten, U.S. House of Representatives, 9th District, Phoenix, AZ

Elected Officials - Federal (Utah)

Chaffetz, Jason, U.S. House of Representatives, 3rd District, Provo, UT
Hatch, Orrin, U.S. Congress, Salt Lake City, UT
Lee, Mike, U.S. Congress, Salt Lake City, UT

Native American Tribes

Andrews, Malinda, Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ
Bahnimptewa, Anita, Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ
Bates, Lorenzo, Navajo Nation Council, Window Rock, AZ
Beauty, Thomas, Yavapai Apache Nation of Camp Verde Indian Reservation, Arizona, Camp Verde, AZ

Begay, Jr., Kee Allen, Navajo Nation Council, Window Rock, AZ
Begay, Norman M., Navajo Nation Council, Window Rock, AZ
BeGaye, Nelson S., Navajo Nation Council, Window Rock, AZ
Begaye, Russell, President, Navajo Nation, Window Rock, AZ (Cooperating Agency)
Bennett, Benjamin, Navajo Nation Council, Window Rock, AZ
Bow, Corrina, Paiute Indian Tribe of Utah (Cedar, Kanosh, Koosharem, Indian Peaks, and Shivwits Bands), Cedar City, UT
Brown, Nathaniel, Navajo Nation Council, Window Rock, AZ
Burdette, Vivian, Tonto Apache Tribe of Arizona, Payson, AZ
Burnette, Bernadine, Fort McDowell Yavapai Nation, Arizona, Fountain Hills, AZ
Chee, Tom, Navajo Nation Council - Shiprock Chapter, Window Rock, AZ
Counts, Sherry J., Hualapai Indian Tribe of the Hualapai Indian Reservation, Arizona, Peach Springs, AZ
Crotty, Amber Kanazbah, Navajo Nation Council, Window Rock, AZ
Damon, Seth, Navajo Nation Council, Window Rock, AZ
Daniels, Jr., Herman, Navajo Nation Council, Window Rock, AZ
Dongoske, Kurt, Pueblo of Zuni - Zuni Heritage and Historic Preservation Department Office, Zuni, NM
Elmer, Michael, Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ
Filfred, Davis, Navajo Nation Council, Window Rock, AZ
Fredericks, Bruce, Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ
Frost, Clement, Southern Ute Indian Tribe, Ignacio, CO
Gillon, Robert*, Pascua Yaqui Tribe, Attorney General's Office, Tucson, AZ
Glassco, Greg, Yavapai Prescott Indian Tribe, Prescott, AZ
Hale, Jonathan, Navajo Nation Council, Window Rock, AZ
Hart, Manuel, Ute Mountain Ute Tribe, Towaoc, CO
Honani, Rosa, Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ
Honanie, Antone, Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ
Honanie, Herman*, Chairman, Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ
Honanie, Norman, Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ
Hopi Department of Natural Resources, Kykotsmovi, AZ
Hopi Tribe of Arizona, Hopi Cultural Preservation Office, Kykotsmovi, AZ
Hopi Tribe of Arizona, Office of Mining and Minerals, Kykotsmovi, AZ
Hopi Tribe of Arizona, Office of Realty Service, Kykotsmovi, AZ
Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ
Hopi Tribe of Arizona, Wildlife and Ecosystems, Kykotsmovi, AZ
Jack, Sr., Lee, Navajo Nation Council, Window Rock, AZ
Jackson-Kelly, Loretta, Hualapai Indian Tribe of the Hualapai Indian Reservation, Arizona, Peach Springs, AZ
Jones, Sr., Ernest, Yavapai Prescott Indian Tribe, Prescott, AZ
Kaping, Miona, Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ
Keevama, Lamar, Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ
Kewanimptewa, Ruth, Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ
Kootswatewa, Norene, Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ

Kuwanhyoima, Wayne, Hopi Tribe of Arizona, Tribal Council, Kykotsmovi, AZ
Lomahquahu, Jr., Alfred, Vice Chairman, Hopi Tribe of Arizona Kykotsmovi, AZ
Lupe, Ronnie, White Mountain Apache Tribe of the Fort Apache Reservation, Arizona, Whiteriver, AZ
Maldonado, Roland, Kaibab Band of Paiute Indians of the Kaibab Indian Reservation, Arizona, Fredonia, AZ
Manuel, Edward, Tohono O'odham Nation - Schuk Toak District, Sells, AZ
Miguel, Robert, Ak-Chin Indian Community, Maricopa, AZ
Navajo Nation Aneth Chapter, Montezuma Creek, UT
Navajo Nation Beclabito Chapter, Shiprock, NM
Navajo Nation Birdsprings Chapter, Winslow, AZ
Navajo Nation Black Mesa Chapter, Pinon, AZ
Navajo Nation Blue Gap/Tachee Chapter, Blue Gap, AZ
Navajo Nation Bodaway-Gap Chapter, Gap, AZ
Navajo Nation Cameron Chapter, Cameron, AZ
Navajo Nation Chilchinbeto Chapter, Kayenta, AZ
Navajo Nation Chinle Chapter, Chinle, AZ
Navajo Nation Coalmine Canyon Chapter, Tuba City, AZ
Navajo Nation Coppermine Chapter, Page, AZ
Navajo Nation Cornfields Chapter, Ganado, AZ
Navajo Nation Cove Chapter, Red Valley, AZ
Navajo Nation Crystal Chapter, Navajo, NM
Navajo Nation Dennehotso Chapter, Dennehotso, AZ
Navajo Nation Department of Agriculture, Window Rock, AZ
Navajo Nation Department of Fish and Wildlife, Window Rock, AZ
Navajo Nation Department of Justice, Window Rock, AZ
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Arizona Water Company, Coolidge System, Coolidge, AZ
AVRA Water Co-op, Inc., Tucson, AZ
Chaparral City Water Company, Fountain Hills, AZ
Community Water Company of Green Valley, Green Valley, AZ
Green Valley Domestic Water Improvement District, Green Valley, AZ
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Metropolitan Domestic Water Improvement District, Tucson, AZ
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Rio Verde Utilities, Inc., Rio Verde, AZ
Salt River Project, Phoenix, AZ
Spanish Trail Water Company, Tucson, AZ
The Carefree Water Company, Carefree, AZ
Tonto Hills Domestic Water Improvement District, Cave Creek, AZ

Tucson Electric Power, Tucson, AZ
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Chapter 8.0

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Glossary

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Glossary

A

Acceleration of Gravity. 32 feet per second squared (9.8 meters per second squared).

Acre-foot/acre-feet. A unit for measuring the volume of water equal to the quantity of water required to cover one acre to a depth of one foot and is equal to 43,560 cubic feet or 325,851 gallons. The term is commonly used in measuring volumes of water used or stored.

Affected Environment. A NEPA term that refers to a description of the environment of the area(s) to be affected or created by the alternatives under consideration. The description must include baseline information to create a basis for assessing or understanding the impacts that would result from implementation of the alternatives. It must contain enough detail to support the impact analyses and highlight environmentally sensitive resources (e.g., floodplains, wetlands, threatened and endangered species, and archeological resources).

Air Model. A mathematical simulation of how air pollutants disperse in the ambient atmosphere.

Air Pollutant. Generally an airborne substance that could, in high enough concentrations, harm living things or cause damage to materials. From a regulatory perspective, an air pollutant is a substance for which emissions or atmospheric concentrations are regulated and for which maximum guideline levels have been established due to potential harmful effects on human health and welfare.

Air Quality. The cleanliness of the air as measured by the levels of pollutants relative to standards or guideline levels established to protect human health and welfare.

Alternative: A NEPA term that refers to a way of achieving the same purpose and need for a project that is different from the recommended proposal; alternatives should be studied, developed, and described to address any proposal which involves unresolved conflicts concerning different uses of available resources. Analysis scenarios presented in a comparative form, to facilitate a sharp definition of the issues resulting in a basis for evaluation among options by the decision maker and the public.

Ambient. The environment as it exists at the point of measurement and against which changes or impacts are measured.

Aquatic Bird. Wading, swimming, and diving birds, such as waterfowl, shorebirds, seabirds, and rails.

Aquatic. Occurring in, or closely associated with, water.

Aquifer. A body of rock that is sufficiently permeable to conduct groundwater and yield economically significant quantities of water to wells, springs, sands, and soils.

Archaeological Resource. “Any material remains of past human life or activities of archaeological interest...” These “include, but are not limited to: pottery, basketry, bottles, weapons, projectiles, tools, structures or portions of structures, pit houses, rock paintings, rock carvings, intaglios, graves, human skeletal materials, or any portion or piece of any of the foregoing items. Non-fossilized and fossilized paleontological specimens, or any portion or piece thereof, shall not be considered archaeological resources unless found in an archaeological context. No item shall be treated as an archaeological resource unless such item is at least 100 years of age.” (Archaeological Resource Protection Act of 1979, as amended, 16 USC 470bb(1))

Archaeological Site. A geographic locale that contains the material remains of prehistoric or historic human activity.

Archaeology. The reconstruction of past cultures through their material remains and the study of how cultures change over time.

Area of Critical Environmental Concern (ACEC). An area approved through a land use plan where special management attention is required to protect and prevent irreparable damage to important biological, cultural, historic, or scenic values, or other natural systems or processes, or to protect humans from natural hazards.

Artesian head. The distance in a well (feet, meters) that groundwater under pressure is able to rise above the level at which it is first encountered when the well taps the aquifer. The pressure in such an aquifer commonly is called artesian pressure, and the formation containing artesian water is an artesian, or confined, aquifer.

Assumptions (for analysis). The basis for framing the analysis. Assumptions often are identified at the beginning of the environmental consequences section of an EA or EIS and, as needed, at the beginning of the program-specific environmental consequences analysis.

Attainment Area. An area that the U.S. Environmental Protection Agency has designated as being in compliance with one or more of the National Ambient Air Quality Standards (NAAQS) for sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and particulate matter. An area may be in attainment for some pollutants but not for others (see National Ambient Air Quality Standards (NAAQS), nonattainment area).

Avian. Relating to birds.

B

Bald and Golden Eagle Protection Act. A law that prohibits the take, possession, selling, purchasing, bartering, or transporting of live or dead bald or golden eagles, or any parts, nests, or eggs of these birds.

Baseline. The existing environmental conditions against which impacts of the proposed action and its alternatives can be compared. For a specific NEPA document, a further statement can be included about the date or conditions that are considered the baseline.

Best Available Control Technology (BACT). Available devices, systems, or techniques for achieving the maximum reduction of air pollutant emissions while considering energy, environmental, and economic impacts. BACT is determined on a case-by-case basis for new sources or major modifications to existing sources in areas that are in attainment of NAAQS. BACT does not permit emissions in excess of those allowed under any Clean Air Act provisions. (See Lowest Achievable Emissions Rate [LAER], Maximum Achievable Control Technology [MACT], Reasonably Achievable Control Technology [RACT], and National Ambient Air Quality Standards [NAAQS].)

Best Available Retrofit Technology (BART). An emission limitation to reduce regional haze, based on the degree of reduction achievable through the application of the best system of continuous emission reduction for each pollutant which is emitted by an existing stationary facility. The emission limitation must be established, on a case-by-case basis, taking into consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology. (40 CFR 51.301)

Best Management Practices (BMPs). A practice or combination of practices that are the most effective and practical means of preventing or reducing the amount of environmental impact, including but not limited to, pollution generated by nonpoint sources to a level compatible with water quality goals.

Big Game. Large animals that may be taken by hunters, pursuant to local government restrictions and regulations.

Bituminous Coal. A rank class of coal defined as having less than 86 percent fixed carbon, more than 14 percent volatile matter on a dry, mineral-matter-free basis, and from 10,500 to 14,00 British thermal units (Btu's) per pound on a moist, mineral-matter-free basis.

C

Candidate Species. An ESA term that refers to a plant or animal species for which the USFWS or NOAA Fisheries has on file sufficient information on biological vulnerability and threats to support a proposal to list as endangered or threatened.

Categorical Exclusion (CE). A NEPA term, referring to a category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a Federal agency pursuant to NEPA.

Chemical of Potential Concern (COPC) or Chemical of Potential Ecological Concern (COPEC). A chemical that is potentially site related and of sufficient quality to quantify risk. Chosen primarily on the basis of an evaluation of the chemical analytical data and relationship of measured levels to background levels. COPC is typically used for human health risk assessments and COPEC is used for ecological risk assessments.

Class I Area. A specifically designated area where the degradation of air quality is stringently restricted (e.g., many national parks, wilderness areas). (See Prevention of Significant Deterioration.)

Climate. The average or prevailing weather conditions of a place over a lengthy period of years (Bureau of Land Management Technical Reference 4400-7).

Colorado River Compact of 1922. Provides for the equitable division and apportionment of the use of the waters of the Colorado River System between the Upper Basin states (Colorado, New Mexico, Utah, and Wyoming) and the Lower Basin states (Arizona, California, and Nevada).

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). A Federal law (also known as Superfund), enacted in 1980 and reauthorized in 1986, that provides the legal authority for emergency response and cleanup of hazardous substances released into the environment and for the cleanup of inactive waste sites.

Conservation Agreement. An ESA term referring to a voluntary agreement between FWS or NOAA Fisheries and other federal or non-federal landowners to identify specific conservation measures that the participants of the agreement will undertake to conserve species covered by the agreement, none of which are listed under the Endangered Species Act, with the intention of preventing any need to list the species.

Consumptive Use. The portion of water withdrawn from a surface water or groundwater source that is consumed for a particular use (i.e., irrigation, domestic needs, and industry), and does not return to its original source or another body of water.

Cooperating Agency. A NEPA term, referring to any Federal agency, other than a lead agency, that has jurisdiction by law or special expertise with respect to any environmental impact involved in a

proposed project or project alternative. A State or local agency of similar qualifications or, when the effects are on lands of tribal interest, a Native American tribe may, by agreement with the lead agencies, also become a cooperating agency

Corona. The electrical breakdown of air into charged particles caused by the electrical field at the surface of conductors, insulators, and hardware of energized high-voltage transmission lines.

Council on Environmental Quality (CEQ). Established under Title II of NEPA to develop Federal agency-wide policy and regulations for implementing the procedural provisions of NEPA, resolve interagency disagreements concerning proposed major Federal actions, and ensure that Federal agency programs and procedures are in compliance with NEPA.

Criteria Pollutant. An air pollutant that is regulated by NAAQS. The Environmental Protection Agency must describe the characteristics and potential health and welfare effects that form the basis for setting, or revising, the standard for each regulated pollutant. Criteria pollutants include sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and two size classes of particulate matter, less than 10 micrometers (0.0004 inch) in diameter, and less than 2.5 micrometers (0.0001 inch) in diameter. Pollutants may be added to, or removed from, the list of criteria pollutants as more information becomes available. (See National Ambient Air Quality Standards.) Note: Sometimes pollutants regulated by state laws also are called criteria pollutants.

Critical Habitat (threatened and endangered species). As used by the ESA, the specific areas within the geographical area occupied by the species that contain those physical or biological features essential to the considerations or protection, and specific areas outside the geographical area occupied by the species, that are essential for the conservation of the species.

Crucial Range. Can describe any particular seasonal range or habitat component (often winter or year-long range in the project area) but describes that component which has been documented as the determining factor in a population's ability to maintain itself at a certain level (theoretically at or above the state wildlife agency population objective) over the long term.

Cultural Property. A definite location of past human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral evidence (BLM Manual 8100).

Cultural Resources. A general term meaning any cultural property and any traditional lifeway value (BLM Manual 8100). It includes prehistoric, historic, ethnographic, tribal heritage, ethnohistoric, engineering, architectural, and technological resources.

<u>Cultural Resources Investigations</u>

Class I (Files Search) Inventory. A file search completed to identify all previously conducted cultural resources investigations and previously recorded cultural resources within a defined distance (typically 1 mile) on either side of proposed rights-of-way, roads, and other project facilities.

Class II Inventory. A reconnaissance-level Inventory typically combined with a Class I Inventory. Class II is usually used as a methodology in large scale projects for locating areas with good or better cultural resources potential to determine whether previously recorded cultural resources exist within the proposed project area, and to determine whether portions of the project area have been adequately surveyed in the recent past.

Class III (Pedestrian) Inventory. A Class III intensive field inventory to locate and record cultural resources and places of traditional, cultural, and religious importance to Native Americans.

Cumulative Effect/Cumulative Impact. As used by NEPA, the impact or impacts that result from identified actions when they are added to other past, present, and reasonably foreseeable future actions regardless of who undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

D

dBA. An “A” weighting is commonly used when sound is measured in decibels. It emphasizes vibrations at middle frequencies where the human ear is most sensitive, and puts less emphasis on higher and lower frequencies to which the ear is not sensitive.

Decommissioning. Removal of project facilities at the end of their operational life.

Desiccation cracks. Cracks that form in clayey soils because of low moisture content.

Designated Wilderness. See Wilderness.

Dispersed Recreation. Passive or active outdoor recreation that occurs outside of developed sites in an unconcentrated manor.

Drawdown. The lowering of the water level in a well, spring, or waterbody as a result of water withdrawal in another area; the reduction in head at a point caused by the withdrawal of water from an aquifer.

Drawdown Contour. A boundary derived from water modeling that depicts a certain reduction in the water level compared to its previous level.

E

Earnings. Wages and salaries, other labor income, and proprietor’s income (including inventory valuation and capital consumption adjustments).

Ecological Resources. Animals, plants, and the habitats in which they live.

Ecological System. All the organisms in a particular region and the environment in which they live. The elements interact with each other in some way, and so depend on each other either directly or indirectly.

Ecology. The science of the interrelationships between organisms and their environment.

Effluent. A waste stream flowing into the atmosphere, surface water, groundwater, or soil. Most frequently the term applies to wastes discharged to surface waters.

Electromagnetic Fields (EMF). A combination of electric and magnetic fields of energy that surround any electrical devise that is plugged in and turned on. EMFs are found near powerlines and other electronic devices.

Endangered Species Act (ESA) of 1973, as amended. Federal legislation intended to provide a means to conserve the ecosystems upon which endangered and threatened species depend, and which provides programs for the conservation of those species, thus preventing extinction of plants and animals.

Endangered Species. Any species defined through the Endangered Species Act of 1973, as amended, as being in danger of extinction throughout all or a significant portion of its range; designations of endangered species are published in the Federal Register.

Endemic Species. Species native to, and restricted to, a particular geographical region, community type, or specific habitat; generally used for species with comparatively restricted distribution.

Environmental Assessment (EA). A NEPA term, which refers to a concise public document that a federal agency prepares under the National Environmental Policy Act to provide sufficient evidence and analysis to determine whether a proposed action requires preparation of an Environmental Impact Statement (EIS) or whether a Finding of No Significant Impact can be issued. An EA must include brief discussions on the need for the proposal, the alternatives, the environmental impacts of the proposed action and alternatives, and a list of agencies and persons consulted.

Environmental Consequences. Environmental effects of project alternatives, including the proposed action, which cannot be avoided; the relationship between short-term uses of the human environment, and any irreversible or irretrievable commitments of resources which would be involved if the proposal should be implemented.

Environmental Impact Statement (EIS). A NEPA term, referring to a formal document that is filed with the U.S. Environmental Protection Agency and that considers significant environmental impacts expected to result from implementation of a major federal action.

Environmental Justice. The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

F

Fault. A fault is a dislocation in the earth whereby there is movement along a fracture with the movement on either side of the fracture parallel to the plane of the fracture. An active fault is a fault that movement has occurred within the last 10,000 years. A Quaternary fault is a fault that that has moved within the last 1.6 million years.

Federal Register. The official daily publication for rules, proposed rules, and notices of federal agencies and organizations, as well as executive orders and other presidential documents.

Firming. A secondary source of energy to compensate for the normal variability and irregularity of renewable energy generation (e.g., if part of a solar array is shaded by cloud cover) in order to assure delivery of a specific quantity of energy during a defined period of time.

Fissures or Earth Fissures. Cracks that form as a result of the lowering of groundwater levels in unconsolidated aquifer materials such as valley fill sediments that occur in parts of Arizona.

Floodplain. A nearly level alluvial plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the stream.

Forage. Plant material consumed by, or available to, grazing animals.

Fragmentation. The breaking up of contiguous areas of vegetation/habitat into smaller patches.

Fugitive Emissions. 1. Emissions that do not pass through a stack, vent, chimney, or similar opening where they could be captured by a control device. 2. Any air pollutant emitted to the atmosphere other than from a stack. Sources of fugitive emissions include pumps; valves; flanges; seals; area sources such as ponds, lagoons, landfills, piles of stored material (e.g., coal); and road construction areas or other areas where earthwork is occurring.

G

Game Species. Species of animals that are hunted or fished, for purposes of sport, recreation, and food capture.

Geographic Information System (GIS). A computer system capable of storing, analyzing, and displaying data and describing places on the earth's surface.

Greenhouse Gas. Gases which absorb outgoing terrestrial radiation, such as water vapor, methane, chlorofluorocarbons, and carbon dioxide.

Groundwater. Subsurface water that is in the zone of saturation. The top surface of the groundwater is the "water table." Source of water for wells, seepage, springs.

H

Habitat Edges. Changes in vegetation and animal communities that are caused by one habitat type being immediately adjacent to a different habitat type. Habitat edges can include changes in temperature, humidity, and plan and wildlife species present in the area.

Habitat. An environment that meets a specific set of physical, biological, temporal, or spatial characteristics that satisfy the requirements of a plant or animal species or group of species for part or all of its life cycle.

Hazardous Air Pollutants (HAPs). Air pollutants not covered by the National Ambient Air Quality Standards but which may present a threat of adverse human health effects or adverse environmental effects. Those specifically listed in 40 CFR 61.01 are asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride. More broadly, HAPs are any of the 189 pollutants listed in or pursuant to section 112(b) of the Clean Air Act. Very generally, HAPs are any air pollutants that may realistically be expected to pose a threat to human health or welfare.

Hazardous Waste. A category of waste regulated under the Resource Conservation and Recovery Act (RCRA). To be considered hazardous, a waste must be a solid waste under RCRA and must exhibit at least one of four characteristics described in 40 CFR 261.20 through 40 CFR 261.24 (i.e., ignitability, corrosivity, reactivity, or toxicity) or be specifically listed by the Environmental Protection Agency in 40 CFR 261.31 through 40 CFR 261.33. Source, special nuclear, or by-product materials as defined by the Atomic Energy Act are not hazardous waste because they are not solid waste under RCRA.

Heavy Metals. Metallic and semimetallic elements that are generally highly toxic to plants and animals and that tend to accumulate in food chains. Heavy metals include lead, mercury, cadmium, chromium, and arsenic. . EPA regulation 40 CFR 258.4 refers to the following monitoring parameters as "heavy metals": antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, thallium, vanadium, and zinc. Note: The term "heavy metals" is deeply embedded in environmental usage and will doubtless continue to be used. However, some of the elements commonly called "heavy metals" are not heavy (e.g., beryllium) or are not true metals (e.g., arsenic). Therefore, "heavy metals" should be avoided whenever more precise wording can be substituted.

Historic Property. "…any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. The term includes, for purposes of these regulations, artifacts, records, and remains that are related to and located within such properties." (36 CFR 800.16 (l)(1))

Human Health Risk Assessment (HHRA). The process used to estimate the nature and probability of adverse health effects in humans who may be exposed to hazards in contaminated environmental media, now or in the future.

Hydrologically Connected. Areas where the groundwater is linked and flow is contiguous.

I

Impact. An impact has both space and time components and can be described as the change in an environmental factor or characteristic over a specific period and within a defined area. The change results from a particular activity compared with the situation which would have occurred had the activity not been initiated. An impact may be beneficial or adverse.

Indian Trust Assets. Lands, natural resources, or other assets held in trust or restricted against alienation by the United States for Native American Tribes or individual Native Americans.

Indian Trust Resources. Those natural resources, either on or off Indian lands, retained by or reserved by or for Indian Tribes through treaties, statutes, judicial decisions, and Executive Orders, which are protected by a fiduciary obligation on the part of the United States.

Indigenous. Living naturally within a given area and part of the area's flora or fauna prior to human settlement of the region.

Indirect Effect. A NEPA term that refers to effects caused by the Federal action that are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Intermittent Stream. A stream which carries water a considerable portion of the time, but which ceases to flow occasionally or seasonally because bed seepage and evapotranspiration exceed the available water supply.

J

Jurisdictional Wetlands. Those wetlands protected by the Clean Water Act. They must have a minimum of one positive wetland indicator from each parameter (i.e., vegetation, soil, and hydrology). The U.S. Army Corps of Engineers requires a permit to fill or dredge jurisdictional wetlands.

K

Key Observation Point. An observer position on a travel route used to determine visible area.

L

Land Use Plan. A land use plan is a public document that sets aside different areas for different uses, and describes what activities are permitted or not, and any limitations or conditions associated with such use.

Lead Agency. The agency or agencies responsible for preparing the environmental impact statement.

Lowest Achievable Emission Rate (LAER). The emissions rate permitted for new sources or major modifications of existing sources in areas that are not in attainment of NAAQS. The LAER is defined on a case-by-case basis, according to the regulations found in 40 CFR 51.165.

Low-Income Population. Low-income populations, defined in terms of Bureau of the Census annual statistical poverty levels (Current Population Reports, Series P-60 on Income and Poverty), may consist of groups or individuals who live in geographic proximity to one another or who are geographically dispersed or transient (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect.

M

Major Federal Action. A NEPA term referring to an action with effects that may be major and which is potentially subject to Federal control and responsibility (40 CFR 1508.18).

Maximum Achievable Control Technology (MACT). Technology for achieving the maximum control of air emissions from major sources of hazardous air pollutants, using particularly stringent control devices, as prescribed in 40 CFR 63.41 for new sources and in 40 CFR 63.51 for existing sources.

Migration Routes. Important areas used by wildlife to connect seasonal habitats.

Migratory Bird Treaty Act. A law enacted in 1918 that prohibits pursuing, hunting, taking, capturing, killing, possessing, selling, bartering, purchasing, delivering, transporting, and receiving any migratory birds, parts, nests, or eggs.

Migratory Bird. A bird that moves seasonally to different ranges to maximize breeding and feeding opportunities.

Minority Population. Minority populations exist where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than in the general population or other appropriate unit of geographic analysis (such as a governing body's jurisdiction, a neighborhood, census tract, or other similar unit). "Minority" refers to individuals who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. "Minority populations" include either a single minority group or the total of all minority persons in the affected area. They may consist of groups of individuals living in geographic proximity to one another or a geographically dispersed/transient set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect.

Mitigate, Mitigation. 1) Avoiding or reducing possible adverse impacts to a resource by limiting the timing, location, or magnitude of an action and its implementation; 2) rectifying possible adverse impact by repairing, rehabilitating or restoring the affected environment or resource; 3) reducing or eliminating adverse impacts by preservation and maintenance operations during the life of an action.

Mitigation Measure. A measure or action taken to reduce the adverse impacts to the environment from implementation of a project or another action. Such measures may include avoidance, replacement, restoration, relocation, timing of operations, etc.

Monitoring. The periodic observation and orderly collection of data to evaluate: 1) Effects of management actions; and 2) effectiveness of actions in meeting management objectives (43 Code of Federal Regulations 4100.0.5). The orderly collection, analysis, and interpretation of resource data to evaluate progress toward meeting management objectives. (BLM Technical Reference 4400-7).

N

National Ambient Air Quality Standards (NAAQS). The allowable concentrations of air pollutants in the ambient (public outdoor) air. National ambient air quality standards are based on the air quality

criteria and divided into primary standards (allowing an adequate margin of safety to protect the public health) and secondary standards (allowing an adequate margin of safety to protect the public welfare).

National Emissions Standards for Hazardous Air Pollutants (NESHAPs). Emissions standards set by the Environmental Protection Agency for air pollutants which are not covered by NAAQS and which may, at sufficiently high levels, cause increased fatalities, irreversible health effects, or incapacitating illness. These standards are found in 40 CFR Parts 61 and 63. NESHAPs are given for many specific categories of sources (e.g., equipment leaks, industrial process cooling towers, dry cleaning facilities, petroleum *refineries*).

National Environmental Policy Act of 1969 (NEPA). A Federal environmental law that established a U.S. national policy promoting the enhancement of the environment; also established the President's Council on Environmental Quality (CEQ). NEPA's most significant effect was to set up procedural requirements for all federal government agencies to prepare Environmental Assessments (EAs) and Environmental Impact Statements (EISs) containing statements of the environmental effects of proposed federal agency actions.

National Historic Preservation Act (NHPA). A federal law providing that property resources with significant national historic value be placed on the National Register of Historic Places. It does not require permits; rather, it mandates consultation with the proper agencies whenever it is determined that a proposed action might affect a historic property.

National Monument. An area designated to protect objects of scientific and historic interest by public proclamation by the President (under the Antiquities Act of 1906) or by Congress for historic landmarks, historic, and prehistoric structures, or other objects of historic or scientific interest situated upon the public lands and to provide for the management of associated features and/or values.

National Pollutant Discharge Elimination System (NPDES). A program authorized by the Clean Water Act which prohibits discharge of pollutants into waters of the United States unless a special permit is issued by the Environmental Protection Agency, a state, or, where delegated, a tribal government on an Indian reservation. The NPDES permit lists either permissible discharges, the level of cleanup technology required for wastewater, or both.

National Recreation Area. An area designated by Congress in order to assure the conservation and protection of certain natural, scenic, historic, pastoral, and fish and wildlife values and to provide for the enhancement of associated recreational values.

National Register of Historic Places. A register of districts, sites, buildings, structures, and objects, significant in American history, architecture, archaeology and culture, established by the National Historic Preservation Act and maintained by the Secretary of the Interior.

Native American. Of, or relating to, a tribe, people, or culture that is indigenous to the United States.

Native Species. With respect to a particular ecological system, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecological system.

Natural Recharge. Replenishment of groundwater storage from naturally-occurring surface water sources such as rain, snow-melt, or stream flows.

No Action Alternative. A NEPA term that refers to the alternative in which the proposed Federal action is not taken (40 CFR 1502.14(d)). For many Federal actions, the No Action Alternative represents a scenario in which current conditions and trends are projected into the future without another proposed action, such as updating a land management plan. In other cases, the No Action Alternative represents the future in which the Federal action does not take place and the project is not implemented. In the

case of the Navajo Generating Station-Kayenta Mine Complex Project, under the No Action Alternative, the power plant would cease operation, the plant lease would not be renewed, and the Kayenta Mine permit revision application would not be approved.

Nonattainment Area. An area that the U.S. Environmental Protection Agency has designated as not meeting (i.e., not being in attainment of) one or more of the National Ambient Air Quality Standards (NAAQS) for sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and particulate matter. An area may be in attainment for some pollutants, but not for others. (See attainment area, National Ambient Air Quality Standards [NAAQS], and particulate matter.)

Nongame Species. Those wildlife species that are not legally hunted.

Notice of Intent (NOI). A notice published in the *Federal Register* that an environmental impact statement will be prepared and considered.

O

Obligate Phreatophyte. Plants which typically require access to groundwater at shallow soil depths for the majority of the year.

Occupational Safety and Health Administration (OSHA). The main federal agency charged with enforcement of safety and health legislation.

P

Paleontological Resources. Any fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth (P.L. 111-011).

Paleontology. The study of past life on earth through the preservation and classification of fossils (naturally preserved remains or impressions of organisms).

Particulate matter (PM), PM_{10}, $PM_{2.5}$. Any finely divided solid or liquid material, other than uncombined (i.e., pure) water. A subscript denotes the upper limit of the diameter of particles included. Thus, PM_{10} includes only those particles equal to or less than 10 micrometers (0.0004 inch) in diameter; $PM_{2.5}$ includes only those particles equal to or less than 2.5 micrometers (0.0001 inch) in diameter. Note: The applicable regulations express the diameter as the aerodynamic diameter. This is not the true diameter, but is the diameter of a spherical particle of unit density (i.e., 1 gram/cubic centimeter) which behaves the same way as the particle under consideration. Thus, for example, a spherical particle 10 micrometers in diameter with greater than unit density would not be included as PM_{10} because it would fall at the same rate as a particle with unit density and diameter greater than 10 micrometers.

Perennial Springs. A spring in which water is present during all seasons of the year.

Perennial Stream. A stream in which water is present during all seasons of the year.

Perennial Yield (sometimes also referred to as sustainable yield). The amount of usable water from a ground-water aquifer that can be economically withdrawn and consumed each year for an indefinite period of time. It cannot exceed the natural recharge to that aquifer and ultimately is limited to a maximum amount of discharge that can be utilized for beneficial use.

Permeability. The quality of the soil that enables water to move downward through the profile, measured as the number of inches per hour that water moves downward through the saturated soil.

Phase I Environmental Site Assessment (ESA). A Phase I ESA is an inquiry conducted to determine if contamination by hazardous substances as defined by CERCLA is present at a particular property. A Phase I ESA inquiry is conducted under standards developed by the American Society for Testing and Materials (ASTM) and USEPA rules. A Phase I ESA involves site inspection, records review, and interviews with knowledgeable persons to determine whether current and past uses of a property indicate the potential presence of contamination. Phase I ESA's are primarily conducted by prospective buyers or lenders pursuant to transactions or lending involving real property in order to provide the basis of the "innocent landowner" defense under CERCLA. If a Phase I ESA indicates the potential for contamination, a Phase II ESA may be conducted to verify the presence of contamination. The Phase II ESA may involve the sampling and testing of soil, water, and other media.

Piezometric Surface. The imaginary surface to which groundwater rises under hydrostatic pressure in wells. It is an imaginary or hypothetical surface of the pressure (or artesian) head throughout all or part of a confined or semi-confined aquifer; analogous to the water table of an unconfined aquifer.

Plume. The elongated volume of contaminated water or air originating at a pollutant source such as an outlet pipe or a smokestack. A plume eventually diffuses into a larger volume of less contaminated material as it is transported away from the source.

Potential Fossil Yield Classification System (PFYC). A system used by some federal agencies to classify geologic units based on the relative potential of valuable vertebrate fossils or scientifically important invertebrate or plant fossils. PFYC has fossil potential classes that range from one (the lowest potential) to five (the highest potential).

Prevention of Significant Deterioration (of air quality) (PSD). Regulations established to prevent significant deterioration of air quality in areas that already meet NAAQS. Specific details of PSD are found in 40 CFR 51.166. Among other provisions, cumulative increases in sulfur dioxide, nitrogen dioxide, and PM-10 levels after specified baseline dates must not exceed specified maximum allowable amounts. These allowable increases, also known as increments, are especially stringent in areas designated as Class I areas (e.g., national parks, wilderness areas) where the preservation of clean air is particularly important. All areas not designated as Class I are currently designated as Class II. Maximum increments in pollutant levels are also given in 40 CFR 51.166 for Class III areas, if any such areas should be so designated by EPA. Class III increments are less stringent than those for Class I or Class II areas.

Programmatic Agreement. A document that records the terms and conditions agreed upon to resolve the potential adverse effects of a Federal agency program, complex undertaking or other situations in accordance with 36 CFR 800.14(b).

Proponents. The non-Federal sponsors of a proposed project or undertaking that requires a Federal action. For the Navajo Generating Station-Kayenta Mine Complex Project, the proponents are Salt River Project Agricultural Improvement and Power District (SRP), which is the operating agent of the NGS, and Peabody Western Coal Company (PWCC), which is the owner/operator of the Kayenta Mine.

Proposed Action. A NEPA term referring to a plan that contains sufficient details about the intended actions to be taken, or that will result, to allow alternatives to be developed and its environmental impacts analyzed.

Public Health. The science of protecting the safety and improving the health of communities through education, policy making and research for disease and injury prevention.

Public Scoping. A NEPA term referring to discussions with and disclosure to agencies and the public with regard to a project or undertaking wherein areas of concern or issues to be addressed in a NEPA document are determined. (See Scope and Scoping.)

Pumping Effects. Any impact to natural or man-made resources that can be directly attributed to groundwater pumping.

Q

R

Raptor. A bird of prey that feeds upon smaller animals.

Reasonably Achievable Control Technology (RACT). Technology for control of air pollutant emissions from existing sources in areas that are not in attainment of NAAQS. RACT may include devices, systems, process modifications, or other apparatus or techniques that are reasonably achievable taking into account: (1) the necessity of imposing such controls in order to attain and maintain an NAAQS; (2) the social, environmental, and economic impact of such controls; and (3) alternative means of providing for attainment and maintenance of such a standard.

Reclamation. The process by which lands disturbed as a result of human activity are restored by grading, planting, seeding, etc., to stabilize the disturbed area and simulate original conditions.

Record of Decision. A NEPA term which refers to a document separate from but associated with an environmental impact statement (EIS) that publicly and officially discloses the responsible agency's decision on the EIS alternative to be implemented.

Regional Air Quality. The measure in the outdoor atmosphere of one or more contaminants such as dust, fumes, gas, mist, odor, smoke, or vapor.

Regional Haze. Visibility impairment that is caused by the emission of air pollutants from numerous sources located over a wide geographic area. Such sources include, but are not limited to, major and minor stationary sources, mobile sources, and area sources. (40 CFR 51.301)

Reserve Power. The electrical energy required for Central Arizona Project pumping requirements, which is currently approximately two-thirds of the United States' 24.3 percent interest in the power and energy generated at NGS.

Resource Conservation and Recovery Act (RCRA). A law that gives the U.S. Environmental Protection Agency the authority to control hazardous waste from "cradle to grave" (i.e., from the point of generation to the point of ultimate disposal), including its minimization, generation, transportation, treatment, storage, and disposal. RCRA also sets forth a framework for the management of non-hazardous solid wastes.

Resource Management Plan. A Bureau of Land Management multiple-use planning document, prepared in accordance with Section 202 of the Federal Land Policy and Management Act, that:

- Establishes resource conditions goals and objectives to be attained;
- Allocates resources and identifies allowable uses;
- Identifies land area for limited, restrictive, or exclusive uses; and
- Provides guidance for implementation of the decisions made in the plan.

Revegetation. The reestablishment and development of self-sustaining plant cover.

Richter Scale or Richter Magnitude Scale. The Richter scale is used to estimate the magnitude of earthquakes. It is a base-ten logarithmic scale that has largely been replaced with other scales by researchers, but is still used to communicate earthquake magnitudes to the public.

Riparian Communities/Areas. Vegetation communities that occur adjacent to waterways such as streams, rivers, springs, ponds, lakes, or tidewater and that provide habitat for numerous plant and animal species. They generally occupy transitional areas between aquatic and upland habitats and may function as vegetative buffers for aquatic resources.

Runoff. Surface water, from rain, snow melt, or other sources, that flows off the surface of the land without sinking into the soil. The precipitation discharged into stream channels from an area.

S

Sacred Landscapes. Natural places recognized by a cultural group as having spiritual or religious significance.

Sacred Site. Any specific, discrete, narrowly delineated location of federal land that is identified by an Indian tribe, or individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site (Executive Order 13007, Section 7 1[b][iii]).

Scope. The range of actions, alternatives, and impacts to be considered in an EA or EIS.

Scoping. An early and open process for determining the extent and variety of issues to be addressed and for identifying the significant issues related to a proposed action that should be evaluated in an EA or EIS.

Scoria (clinker). Rock that has been baked or melted because of the burning of adjacent coal seams.

Section 7 of the Endangered Species Act. Describes the responsibilities of Federal agencies in conserving threatened and endangered species.

Seep. Wet areas, normally not flowing, arising from an underground water source.

Significant. Use of this term in NEPA requires consideration of both context and intensity (40 CFR 1508.27): Context - significance of an action must be analyzed in its current and proposed short-and long-term effects on the whole of a given resource (e.g.-affected region) Intensity – Refers to the severity of the effect.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. For example, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Small Game. Small animals that may be taken by hunters, pursuant to local government restrictions and regulations.

Socioeconomics. The social and economic conditions in the study area.

Special Status Species. Plant or animal species that are federally listed, proposed, or Bureau of Land Management or USFS sensitive species.

Species. A group of interbreeding individuals not interbreeding with another such group; similar and related species are grouped into a genus.

Spring. Flowing water originating from an underground source.

State Historic Preservation Officer (SHPO). The State official appointed or designated pursuant to section 101(b)(1) of the National Historic Preservation Act to administer the State historic preservation program. (36 CFR 800.16 (v))

Study Area. The physical extent of a resource as related to the area of the proposed project.

Subbituminous Coal. A rank class of coal that has a heating value that ranges from 8,300 to 10,500 Btu's per pound on a moist, mineral-matter-free basis.

Subsidence. Lowering of the land surface that can be caused by natural or anthropogenic-caused processes.

Surface Water. All bodies of water on the surface of the earth and open to the atmosphere, such as rivers, lakes, reservoirs, ponds, seas, and estuaries.

Surplus Power. The electrical energy from the United States' share of NGS power that is excess to that used by the Central Arizona Project. This surplus power is sold at market rates with the revenues being deposited to the Lower Basin Development Fund.

Syncline. A syncline is a geologic fold structure where the strata have been folded downward.

T

Technical Work Group (TWG). A stakeholder group formed by SRP, comprised of DOI, Gila River Indian Community, Navajo Nation, Salt River Project, Environmental Defense Fund, Central Arizona Water Conservation District, and Western Resource Advocates. The TWG developed an alternative to U.S. Environmental Protection Agency's proposed BART for NGS, and submitted it for U.S. Environmental Protection Agency's consideration.

Terrestrial. Relating to land; a land animal.

Threatened Species. Any plant or animal species defined under the Endangered Species Act of 1973 as likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Requirements for declaring a species threatened are contained in the Endangered Species Act of 1973; listings are published in the Federal Register.

Topography. The form and structure of the land surface.

Traditional Cultural Property. A cultural property that derives significance from traditional lifeway values associated with it. A traditional cultural property may qualify for the National Register if it meets the criteria and criteria exceptions at 36 Code of Federal Regulations 60.4.

Traditional Use. A term referring to a category that is applied to any cultural resource known to be perceived by a specified social and/or cultural group as important in maintaining the cultural identity, heritage, or well-being of the group. Cultural properties assigned to this category are to be maintained in ways that recognize the importance ascribed to them and seek to accommodate their continuing traditional use.

Tribal Historic Preservation Officer (THPO). The tribal official appointed by the tribe's chief governing authority or designated by a tribal ordinance or preservation program who has assumed the responsibilities of the SHPO for purposes of section 106 compliance on tribal lands in accordance with section 101(d)(2) of the National Historic Preservation Act. (36 CFR 800.16 (w))

Tribal Lands. In the Native American Graves Protection and Repatriation Act, tribal land is defined as: (a) all lands within the exterior boundaries of any Indian reservation; (b) all dependent Indian communities; and (c) any lands administered for the benefit of Native Hawaiians pursuant to the Hawaiian Homes Commission Act, 1920, and section 4 of Public Law 86-3. In the National Historic Preservation Act, tribal land is defined as: (a) all lands within the exterior boundaries of any Indian reservation; and (b) all dependent Indian communities.

U

Unavoidable Adverse Effects. Effects that cannot be avoided due to constraints in alternatives. These effects do not have to be avoided by the planning agency, but they must be disclosed, discussed, and mitigated, if practicable.

Unconformity. A geological surface that represents missing strata that either was not deposited or was eroded.

U.S. Fish and Wildlife Service (USFWS). 1940 reorganization plan (54 Stat. 1232) in the Department of the Interior consolidated the Bureau of Fisheries and the Bureau of Biological Survey into one agency to be known as the Fish and Wildlife Service. The Bureau of Sport Fisheries and Wildlife was created as a part of the U.S. Fish and Wildlife Service in the Department of the Interior on November 6, 1956, by the Fish and Wildlife Act of 1956 (70 Stat. 1119). That act was amended on July 1, 1974, by Public Law 93-271 (88 Stat. 92) to, among other purposes, abolish the position of Commissioner of Fish and Wildlife and designate the Bureau as the U.S. Fish and Wildlife Service.

V

Vegetation Communities. A combination of dominant plant species that live together in the same region or on the same landform.

Visual Resource Management Classes. A classification of landscapes according to the kinds of structures and changes that are acceptable to meet established visual goals.

Visual Resources. The visible physical features of a landscape (topography, water, vegetation, animals, structures, and other features) that constitute the scenery of an area.

W

Water Right. A legal entitlement of an individual or entity to extract water from a water source (surface water or groundwater) and to use it for a beneficial use (e.g., potable water supply, irrigation, mining, livestock).

Watershed. 1) A total area of land above a given point on a waterway that contributes runoff water to the flow at that point; 2) A major subdivision of a drainage basin.

Wetlands. Areas that are inundated or saturated by surface water 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 soils

Wilderness. An area designated by Congress and defined in Section 2(c) of the Wilderness Act of 1964 as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined as an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which: 1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; 2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; 3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and 4) also may contain ecological, geological, or other features of scientific, educational, scenic, or historical values.

Wind Rose. A circular diagram showing, for a specific location, the percentage of the time the wind is from each compass direction. A wind rose for use in assessing consequences of airborne releases also shows the frequency of different wind speeds for each compass direction.

X

Xeric. An environment or habitat that is extremely dry, lacking humidity and water.

Y

Z

Zone of Saturation. The area in an aquifer, below the water table, in which relatively all pores and fractures are saturated with water. Also called the phreatic zone, it may fluctuate with changes of season and during wet and dry periods. Multiple zones of saturation may occur below any given point on the surface.

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