

BLACK MESA PROJECT

DRAFT ENVIRONMENTAL IMPACT STATEMENT

DOI DES 06-48

OSM-EIS-33



U.S. Department of the Interior
Office of Surface Mining
Reclamation and Enforcement

November 2006

DEPARTMENT OF THE INTERIOR

Mission: As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people.

OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT

Our mission is to carry out the requirements of the Surface Mining Control and Reclamation Act in cooperation with States and Tribes. Our primary objectives are to ensure that coal mines are operated in a manner that protects citizens and the environment during mining and assures that the land is restored to beneficial use following mining, and to mitigate the effects of past mining by aggressively pursuing reclamation of abandoned coal mines.

Cover photographs (from left to right):

- (1) dragline removing overburden from coal at Peabody Western Coal Company's Black Mesa Complex
- (2) drilling of test well for Coconino aquifer water-supply system
- (3) sheepherder and flock on reclaimed land at Peabody Western Coal Company's Black Mesa Complex
- (4) Black Mesa Pipeline, Incorporated's coal-slurry preparation plant
- (5) Black Mesa Pipeline, Incorporated's coal-slurry pipeline Pump Station Number 2



IN REPLY REFER TO:

United States Department of the Interior

OFFICE OF SURFACE MINING
Reclamation and Enforcement
P.O. Box 46667
Denver, Colorado 80201-6667

November 22, 2006

Dear Reader:

Enclosed for your review and comment is the Draft Environmental Impact Statement (EIS) for the Black Mesa Project in northern Arizona. This document provides description and analysis of alternative actions for continuing the supply of coal from the Black Mesa Complex; that is, from the Kayenta mining operation to the Navajo Generating Station near Page, Arizona, and from the Black Mesa mining operation to the Mohave Generating Station in Laughlin, Nevada. The project includes proposed revision of the life-of-mine plan, permitting of the coal-slurry preparation plant, reconstruction of the coal-slurry pipeline, and construction and operation of a new water-supply system.

The purpose of this document is to help the Office of Surface Mining Reclamation and Enforcement (OSM) and the cooperating agencies in their decision-making processes. As the lead Federal agency for this EIS, OSM welcomes your comments. Comments on this document may be submitted orally or in writing at the scheduled public meetings or in writing by letter or e-mail to this office.

Written comments sent by first-class or priority U.S. Postal Service mail should be sent to:

Dennis Winterringer, Leader
Black Mesa Project EIS
Office of Surface Mining Reclamation and Enforcement
Western Regional Coordinating Center
P.O. Box 46667
Denver, Colorado 80201-6667

Written comments sent by U.S. Postal Service express mail or by courier service should be sent to:

Dennis Winterringer, Leader
Black Mesa Project EIS
Office of Surface Mining Reclamation and Enforcement
Western Regional Coordinating Center
1999 Broadway, Suite 3320
Denver, Colorado 80202-5733

Comments sent by e-mail should be sent to BMKEIS@osmre.gov. Electronically mailed comments must indicate in the subject line that they are "BMP Draft EIS Comments."



To ensure consideration in the Final EIS, **all written comments must be received by January 22, 2007**. Where possible, include in your comments references to the pages and paragraphs on which you are commenting.

The public meetings will be held on the Hopi, Hualapai, and Navajo Indian Reservations; in Mohave, Navajo, and Coconino Counties, Arizona; and in Clark County, Nevada. Dates and addresses for these meetings will be announced in the Federal Register, advertised in the local news media, and listed on the OSM Website: www.wrcc.osmre.gov/WR/BlackMesaEIS.htm. During the meetings, information will be displayed to explain the environmental process and the document. Oral comments will be transcribed for consideration in the Final EIS.

Our practice is to make comments, including names and home addresses, home phone numbers, and e-mail addresses of respondents, available for public review. Individual respondents may request that we withhold their names and/or home addresses, etc., but, if you wish us to consider withholding this information, you must state this prominently at the beginning of your comments. In addition, you must present a rationale for withholding this information. This rationale must demonstrate that disclosure would constitute an unwarranted invasion of privacy. Unsupported assertions will not meet this burden. In the absence of exceptional, documentable circumstances, this information will be released. We will always make submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public inspection in their entirety.

Oral comments received at the meetings and **written comments received by January 22, 2007**, will be considered fully and evaluated in preparing the Final EIS.

Sincerely,

A handwritten signature in black ink, appearing to read 'Peter A. Rutledge', with a long horizontal line extending to the right from the end of the signature.

Peter A. Rutledge, Chief
Program Support Division

Enclosures



Black Mesa Project

Draft Environmental Impact Statement

DOI DES 06-48

OSM-EIS-33

November 2006

Type of Action: Administrative

Prepared by the
Office of Surface Mining Reclamation and Enforcement

In cooperation with the:

U.S. Department of the Interior
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Reclamation
U.S. Department of Agriculture
Forest Service
U.S. Environmental Protection Agency

Tribes
Hopi Tribe
Hualapai Tribe
Navajo Nation
City of Kingman, Arizona
County of Mohave, Arizona

Allen D. Klein
Regional Director, Western Region
Office of Surface Mining Reclamation and Enforcement

COVER SHEET

PROPOSED ACTIONS:

Approval of revisions to the life-of-mine operation and reclamation plans for the Kayenta and Black Mesa surface-coal mining operations at the Black Mesa Complex; approval of a coal-slurry preparation plant permit application; granting of rights-of-way, leases and/or permits for reconstruction of the coal-slurry pipeline from the Black Mesa mining operation to the Mohave Generating Station in Laughlin, Nevada; and granting of rights-of-way, leases, and/or permits for construction of a water-supply system and associated facilities to convey water from a well field in the Coconino aquifer near Leupp, Arizona, to and for use at the Black Mesa Complex.

LEAD AGENCY:

Office of Surface Mining Reclamation and Enforcement

COOPERATING AGENCIES:

Department of the Interior	Environmental Protection Agency (USEPA)
Bureau of Reclamation (Reclamation)	Tribes Hopi Tribe
Bureau of Indian Affairs (BIA)	Hualapai Tribe
Bureau of Land Management (BLM)	Navajo Nation
Department of Agriculture	County and City
Forest Service	Mohave County
	City of Kingman

FOR FURTHER INFORMATION:

Peter A. Rutledge
Attn: Dennis Winterringer
Office of Surface Mining Reclamation and Enforcement
Western Regional Coordinating Center
P.O. Box 46667
Denver, Colorado 80201-6667
Telephone: (303) 844-1400, extension 1440

ABSTRACT:

This Draft Environmental Impact Statement (EIS) has been prepared to analyze and disclose the potential impacts resulting from approval of a permit application from Peabody Western Coal Company (Peabody) proposing numerous revisions to the life-of-mine (LOM) operation and reclamation plan for the Kayenta and Black Mesa surface-coal mining operations at the Black Mesa Complex in northern Arizona as well as the infrastructure to deliver coal from the Black Mesa mining operation to the Mohave Generating Station. The Kayenta mining operation has provided coal to the Navajo Generating Station near Page, Arizona, since 1973, and, until December 2005, the Black Mesa mining operation provided coal to the Mohave Generating Station in Laughlin, Nevada, since 1970. Currently, Peabody is authorized to mine at the Kayenta mining operation through 2026 and to mine at the Black Mesa mining operation until such time that the Office of Surface Mining Reclamation and Enforcement (OSM) makes a decision on the LOM permit application that Peabody submitted to OSM.

Three alternatives have been considered. Alternative A, the applicants' and agencies' preferred alternative, would involve the approval of the LOM revision and all associated components (e.g., approve the permit for the coal-slurry preparation plant, reconstruct the Black Mesa coal-slurry pipeline, and construct and operate the Coconino aquifer water-supply system) of the Black Mesa Project. Alternative B would be the conditional approval of the Kayenta mining operation part of the LOM revision and disapproval of the Black Mesa mining operation part of the LOM revision. Alternative C would be the disapproval of the entire LOM revision.

The following actions would occur: The BLM Arizona State Director (or designee), in consultation with the BIA, Hopi Tribe, and Navajo Nation, would approve, conditionally approve, or disapprove the LOM mining plan. The OSM Director (or designee) would approve, conditionally approve, or disapprove Peabody's permit application package and in the case of an approval or conditional approval issue a Federal permit to conduct surface coal mining and reclamation operations, with conditions, as necessary, to comply with applicable Federal laws and regulations. The OSM Director (or designee) would approve, conditionally approve, or disapprove the permit application submitted by Black Mesa Pipeline, Inc. to operate the coal-slurry preparation plant. The BIA, Hopi Tribe, Navajo Nation, Forest Service, and BLM would approve, disapprove, and/or amend rights-of-way, leases, and/or permits for reconstruction of the Black Mesa coal-slurry pipeline. The BIA, Hopi Tribe, and Navajo Nation would approve or disapprove rights-of-way, leases, and permits for the Coconino aquifer water-supply system (i.e., well field, pipeline, and associated facilities).

EXECUTIVE SUMMARY



EXECUTIVE SUMMARY

PURPOSE AND NEED

The Black Mesa Project Environmental Impact Statement (EIS) is being prepared to analyze and disclose potential impacts that could result from the Black Mesa Project; the majority of the project is in northern Arizona. The Black Mesa Project consists of several proposed actions, the purpose of and need for which would (1) continue supplying coal from the Kayenta mining operation to the Navajo Generating Station near Page, Arizona, and (2) continue supplying coal from the Black Mesa mining operation to the Mohave Generating Station in Laughlin, Nevada. The Kayenta and Black Mesa mining operations comprise all mining at the Black Mesa Complex. The actions proposed by three applicants are as follows:

- Peabody Western Coal Company (Peabody) proposes revisions to the life-of-mine (LOM) operation and reclamation plan for the Kayenta and Black Mesa surface coal-mining operations. Peabody proposes to incorporate into the permanent program LOM permit (1) currently unpermitted parts of the Hopi Tribe and Navajo Nation lease areas (and all associated structures and facilities) and (2) new, proposed rights-of-way and easements. The revisions include, but are not limited to, construction of a coal-washing facility, an increase in coal produced from the Black Mesa mining operation, and increased need for water for slurry and coal washing.
- Black Mesa Pipeline, Inc. (BMPI) proposes to operate the Black Mesa coal-slurry preparation plant.
- BMPI also proposes to reconstruct the 273-mile-long coal-delivery slurry pipeline, which has reached its 35-year design life, from the Black Mesa mining operation to the Mohave Generating Station in Laughlin, Nevada.
- Salt River Project (SRP)¹ proposes to construct and operate a new water-supply system, including a proposed well field near Leupp, Arizona, and a 108-mile-long water-supply pipeline to convey the water from the Coconino aquifer (C aquifer) to the Black Mesa Complex for use in the coal slurry and other mining-related purposes. C-aquifer water would be used to replace much of the water that has been used from the Navajo aquifer (N aquifer) for those purposes.

Also, the Hopi Tribe and Navajo Nation have proposed that the C aquifer water-supply system could be expanded to provide an additional 5,600 acre-feet per year (af/yr) of water from tribal domestic, municipal, industrial, and commercial uses. Although not a part of the applicants' proposed project to meet the purpose and need, both tribes have indicated that upsizing the pipeline and expanding the well

¹ Southern California Edison Company (SCE) is currently the operator and majority owner of the Mohave Generating Station. The other co-owners include SRP, Nevada Power Company, and Los Angeles Department of Water and Power. In response to a lawsuit concerning air quality, the Mohave Generating Station co-owners entered into a consent decree with several environmental organizations, under which the co-owners would need to install new air-pollution-control technology on the plant in order to operate the Mohave Generating Station beyond December 2005. After a comprehensive reassessment of efforts required to return the power plant to operation, SCE announced on June 19, 2006, that it would not continue to pursue resumed operation of the power plant. Nevada Power Company and Los Angeles Department of Water and Power made similar announcements. SRP announced that it was continuing to assess the situation and might pursue resumed operation of the power plant with new partners, but not as sole owner. In September 2006, SRP announced that it was accelerating efforts to return the plant to service, and requested that the EIS process resume while it attempts to form a new ownership group. With SCE's concurrence, SRP committed to replace SCE as the principal applicant for those aspects of the Black Mesa Project that SCE had initiated.

field of the system is an alternative that would fulfill needs of both tribes to significantly expand and improve tribal water supplies at a relatively modest cost. The construction of the tribal water-distribution systems is not currently proposed and, accordingly, is not analyzed in this EIS, and would be the subject of future NEPA review processes, if and when appropriate. The tribes' potential future withdrawals of C-aquifer water from the proposed well field, which is interrelated with the sizing of the currently proposed water-supply pipeline and well field, and the total amount of C-aquifer water withdrawal from the well field, is analyzed in the EIS.

The preparation of the EIS is required because of Federal government approvals required for various project components. The United States Department of the Interior, Office of Surface Mining Reclamation and Enforcement (OSM), is the lead agency responsible for preparing this EIS. Other Federal agencies and tribal and local governments cooperating with OSM in the preparation of the EIS include the Bureau of Indian Affairs (BIA), Bureau of Reclamation, Bureau of Land Management (BLM), U.S. Forest Service (Forest Service), U.S. Environmental Protection Agency (USEPA), Hopi Tribe, Hualapai Tribe, Navajo Nation, Mohave County, and City of Kingman.

The approvals required include (1) OSM approval of Peabody's LOM revision and BMPI's coal-slurry preparation-plant permit application; (2) BLM approval of changes to Peabody's mine plans; (3) BIA approval for various rights-of-way and leases for the well field, and BIA actions associated with tribal approval of the use of tribal waters on tribal lands, (4) Federal approvals for granting rights-of-way across Federal lands (BLM and Forest Service), and may include (5) USEPA approval of a new National Pollutant Discharge Elimination System permit. This EIS is being prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), Council on Environmental Quality regulations for implementing NEPA (Title 40 Code of Federal Regulations Parts 1500-1508), and other applicable regulations including the Surface Mining Control and Reclamation Act (SMCRA) of 1977.

BACKGROUND

The Black Mesa Project facilities are located in Navajo, Coconino, Yavapai, and Mohave Counties in northern Arizona, and in the extreme southern tip of Nevada in Clark County. The Black Mesa Complex, which includes the Kayenta and Black Mesa mining operations, is located on land leased from the Hopi Tribe and Navajo Nation within the boundaries of the Hopi and Navajo Indian Reservations near Kayenta in Navajo County, Arizona (about 125 miles northeast of Flagstaff, Arizona).

The Black Mesa Complex, which Peabody has operated since the early 1970s, is an area composed of three contiguous leases, and surface rights-of-way and easements granted from the Hopi Tribe and Navajo Nation. The Black Mesa Complex comprises approximately 24,858 acres of land where the surface and mineral interests are held exclusively by the Navajo Nation and approximately 40,000 acres of land in the former Hopi and Navajo Joint Minerals Ownership Lease Areas. The tribes have joint and equal interest in the minerals that underlie the Joint Use Area; however, the surface has been partitioned. The portion of the leasehold that lies in the former Joint Use Area consists of approximately 6,137 acres partitioned to the Hopi Tribe and 33,863 acres partitioned to the Navajo Nation. The coal-mining leases with the Hopi Tribe and Navajo Nation provide that Peabody may produce up to 290 million tons of coal from the Navajo Lease Area (Lease 14-20-0603-8580) and up to 380 million tons of coal from the Hopi and Navajo Joint Mineral Ownership Lease Area (Leases 14-20-0603-9910 and 14-20-0450-5743) for a combined total of 670 million tons.

A complete coal-removal, preparation, and transportation system is in place and, though separate operations, the Kayenta and Black Mesa mining operations share some facilities and structures. Peabody has been supplying coal from the Kayenta mining operation to the Navajo Generating Station since 1973.

The Black Mesa mining operation supplied coal to the Mohave Generating Station from 1970 until December 2005, when the Black Mesa mining operation ceased delivering coal due to suspension of Mohave Generating Station operations.

On February 17, 2004, Peabody filed with OSM a permit revision application proposing revisions to the LOM plans (LOM revision) for both the Kayenta and Black Mesa mining operations. Currently, the Kayenta operation is permitted to mine coal reserves that would last into 2026 at current production rates. Peabody is authorized to mine coal at the Black Mesa mining operation until such time that OSM makes a decision on the LOM revision permit application Peabody submitted to OSM. Approval of the LOM revision would allow the continued Kayenta and Black Mesa mining operations into 2026.

PROJECT COMPONENTS

The components of the Black Mesa Project are described below.

LOM Revision

Peabody's permit application proposes revisions to the LOM operation and reclamation plans for the Black Mesa Complex. The Kayenta mining operation, which is within the current permit area of 44,073 acres, is currently authorized under a permanent Indian Lands Program permit. The operation produces 8.5 million tons of coal per year. The LOM revision would allow changes to the operation and reclamation plan for the Kayenta mining operation, but would not change the mining methods or the average annual production rate at the Kayenta mining operation.

The Black Mesa mining operation is conducted in accordance with OSM's Initial Program under an administrative delay of OSM's permanent Indian Lands Program permitting decision instituted in 1990 by the Secretary of the Interior. The administrative delay was imposed because of concerns of the Hopi Tribe and Navajo Nation regarding the use of N-aquifer water for coal slurry and mine-related purposes. Until its suspension in December 2005, the Black Mesa mining operation produced 4.8 million tons of coal annually. With the LOM revision, OSM's existing Indian Lands Program permit area (the 44,073 acres associated with the Kayenta mining operation) would be expanded to incorporate the unpermitted parts of the existing lease area and existing and proposed rights-of-way (the 18,984 acres associated with the current Black Mesa mining operation including 127 acres on the Hopi Reservation for the proposed 2-mile-long and 500-foot-wide coal-haul road). The revision would change or add coal-reserve areas to be mined within the existing lease area, and add associated facilities (sedimentation ponds, roads, etc.). Annual production would increase from 4.8 to 6.35 million tons. A new coal-washing facility would be constructed near the existing coal-slurry preparation plant and operated to remove about 0.95 million tons per year of coal-processing waste (earth material) before transporting the coal via slurry. Washing the coal is needed to meet anticipated future coal-quality requirements of the Mohave Generating Station. The waste from washing the coal would be hauled by truck for disposal in a mine pit as the pit is backfilled. Approximately 5.4 million tons of coal per year would be transported via slurry. The slurry is a mixture of about 50 percent pulverized coal (5.4 million tons per year) and 50 percent water (3,700 af/yr). (This equates to about 1,360 tons of coal per acre-foot of water, or 8.95 pounds of coal per gallon of water.)

If approved, the permit and permit area would not distinguish geographically between the Kayenta mining operation and the Black Mesa mining operation; they would be considered one operation for the purpose of regulation by OSM. Both the Kayenta mining operation and the Black Mesa mining operation would continue into 2026.

Coal-Slurry Preparation Plant

BMPI filed an application for operation of the coal-slurry preparation plant. OSM's permanent program permitting decision on the preparation plant has been administratively delayed for the same reasons as is the Black Mesa mining operation. Only minor modifications to the existing plant would need to occur; no ground-disturbing activities would result.

Coal-Slurry Pipeline

The reconstruction of the 273-mile-long coal-delivery slurry pipeline proposed by BMPI, which crosses Federal, tribal, State, and private lands, between the Black Mesa mining operation and Mohave Generating Station would involve burying a new pipeline adjacent and parallel to the existing pipeline for the majority of its length. BMPI is proposing localized realignments along the existing alignment. In the Moenkopi Wash, the pipeline would be shifted about 200 feet on one side or the other of the existing pipeline to move it out of the active channel (which may or may not require new right-of-way). In the vicinity of Kingman, Arizona, approximately 28.5 miles of the pipeline would be rerouted to the south of Kingman to avoid areas in major residential or commercial developments. The reroute would require new right-of-way; however, the reroute would parallel other linear utilities and/or roads for the majority of the reroute.

C Aquifer Water-Supply System

Until December 2005, approximately 4,400 af/yr of water were drawn from the N aquifer within Peabody's lease. Use of C-aquifer water would replace the majority of N-aquifer water use. Proposed future use of C-aquifer water for the Black Mesa Complex and coal slurry would total an average of 6,000 af/yr (Table S-1).

Table S-1 Proposed Project Use of C-Aquifer Water

Use	Acre-Feet per Year
Coal slurry	3,700
Coal washing	500
Mine-related and domestic purposes	1,600
Contingency	200
Total	6,000

The water from the C aquifer would be supplied from a well field to be located near Leupp, Arizona, and conveyed via pipeline to the Black Mesa Complex. The N aquifer would be a contingency standby source that would be used in case of interruptions or curtailments of the C-aquifer water supply.

The components of the C aquifer water-supply system, as proposed for the Black Mesa Project, are described below.

- A well field in the southwestern part of the Navajo Reservation (south of Leupp, Arizona) including 12 wells and associated facilities (e.g., well yards, collector pipelines, access roads, electrical power lines).
- An approximately 108-mile-long pipeline with a capacity of 6,000 af/yr from the well field north-northeast to the Black Mesa Complex following, to the extent practicable, existing roads.
- An estimated two pump stations and associated facilities (e.g., access roads, electrical transmission lines)

ALTERNATIVE DECISIONS

Under the SMCRA, OSM must make decisions on the LOM revision for the Black Mesa Complex. The primary decision options available to OSM are (1) approval of the LOM revision, (2) conditional approval of the LOM revisions without approval of the Black Mesa mining operation, and (3) disapproval of the LOM revision. In making the decisions, OSM will consider issues associated with the use of water from the N aquifer as required by the Secretary of the Interior prior to issuance of the permanent LOM permit for the Black Mesa mining operation. Several other Federal agencies as well as the Hopi Tribe and Navajo Nation have authority and/or actions (decisions) to perform for the various proposals, addressed in this EIS, related to the mining operation or coal-delivery system from the Black Mesa mining operation to the Mohave Generating Station. The three alternative decisions addressed in this Draft EIS are described below.

Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

Under Alternative A, the lead and cooperating agencies' preferred alternative, Peabody's LOM revision would be approved as described above and a Federal permit would be issued to continue surface-coal mining and reclamation operations at the Black Mesa Complex with conditions necessary to meet the requirements of SMCRA. The currently unpermitted 18,984 acres where the Black Mesa mining operation has been conducted would be added to the 44,073 acres in the existing OSM permit area and 127 acres for the proposed coal-haul road right-of-way to form a permit area totaling 63,184 acres for the Black Mesa Complex, and the Kayenta and Black Mesa mining operations would continue into 2026.

The decision to approve the LOM revision would result in the other project components being approved and implemented to achieve the purposes of the Black Mesa Project. The other project components include the coal-slurry preparation plant, reconstruction of the coal-slurry pipeline, and construction of a C aquifer water-supply system.

The coal-slurry pipeline would be reconstructed as proposed by BMPI by burying a new pipeline adjacent and parallel to the centerline of the existing pipeline in the existing right-of-way for the majority of its length. Segments of the pipeline in Moenkopi Wash would be realigned, and the pipeline would be rerouted to the south of the Kingman area. The existing coal-slurry pipeline route is 273 miles long, and the existing route with realignments is slightly longer.

Water for the project is proposed to come primarily from the C aquifer with some supplemental use of water from the N aquifer. Additionally, the development of a water-supply system from the C aquifer provides an opportunity to enhance water availability to the Hopi Tribe and Navajo Nation for municipal, industrial, and commercial uses by expanding the system capacity. Two water-withdrawal scenarios and pipeline capacities are considered.

C-Aquifer Water Withdrawal and Supply: 6,000 af/yr. Under this alternative, up to 6,000 af/yr would be withdrawn from the C aquifer and delivered to the Black Mesa Complex for the life of the project (i.e., 2010 through mid 2026). This is the amount of water that would be needed annually for the coal slurry, coal-washing facility, other mine-related and domestic uses, and a contingency. After 2026, the water would no longer be needed for the project and pumping from the C aquifer would cease. Water for reclamation would be provided from the existing N-aquifer wells.

C-Aquifer Water Withdrawal and Supply: 11,600 af/yr. Under this alternative, the Hopi Tribe and Navajo Nation would have an option to pay the incremental costs of increasing the water production from the C aquifer and increasing the size of the water-supply pipeline in anticipation of potential future use of the system from tribal purposes. The total maximum amount of water that could be delivered would be

11,600 af/yr—6,000 af/yr for project-related purposes and an additional 5,600 af/yr for tribal use. Under this alternative, 2,000 af/yr and 3,600 af/yr would be available for use by the Hopi Tribe and Navajo Nation, respectively. In addition, 6,000 af/yr of water used for project-related purposes would be used by the Navajo Nation when it is no longer needed for project-related purposes (until 2026), and pumping C-aquifer water up to 11,600 af/yr would continue for the estimated 50-year life of the pipeline. In order to deliver the system’s additional capacity to Hopi and Navajo communities, lateral pipelines would have to be constructed; however, the details of the delivery spur pipelines, timing of construction, and ultimate use of the water are not known at this time.

The proposed well field is near Leupp, Arizona. To produce 6,000 af/yr of water, a minimum of 12 wells would be developed; to produce 11,600 af/yr of water 21 wells would be developed. For the 11,600 af/yr alternative, the section of the well field proposed to produce the 6,000 af/yr for the Black Mesa Complex (12 wells) and 3,600 af/yr for the Navajo Nation (5 wells) would be located on the Navajo Reservation in a triangular area bounded by State Route 99, Canyon Diablo, and the Burlington Northern Santa Fe (BNSF) Railroad just north of Red Gap and Interstate 40 (I-40). To provide 2,000 af/yr of water to the Hopi Tribe, four wells would be developed in the section of the well field that is within the Hart Ranch (owned in fee by the Hopi Tribe), a triangular area bounded by the BNSF Railroad, Canyon Diablo, and I-40. Proposed use of C-aquifer water under Alternative A is shown in Table S-2. When the 6,000 af/yr of C-aquifer water is no longer needed for the project (in 2026), the use of the 6,000 af/yr and associated wells would be transferred to the Navajo Nation.

Table S-2 Proposed Use of C-Aquifer Water: 11,600 af/yr

Use	Acre-Feet per Year
Black Mesa Complex	
Coal slurry	3,700
Coal washing	500
Mine-related and domestic uses	1,600
Contingency	200
<i>Subtotal Black Mesa Complex</i>	<i>6,000</i>
Tribal	
Hopi Tribe	2,000
Navajo Nation	3,600
<i>Subtotal tribal</i>	<i>5,600</i>
Grand total	11,600

The Kayenta and Black Mesa mining operations would cease in 2026, and the mines would be reclaimed. From 2026 to 2028, up to 500 af/yr of N-aquifer water would be used for reclamation and public use and, from 2029 to 2038, up to 444 af/yr of N-aquifer water would be used for post-reclamation maintenance and public uses. Under this alternative, pumping the N aquifer for project-related uses would cease when the water is no longer needed for project-related uses. The leases require N-aquifer wells to be transferred to the tribes in operating condition. The wells would be transferred to the tribes once Peabody completes reclamation and relinquishes the leases.

N-Aquifer Water Supply. Until December of 2005, approximately 4,400 af/yr of water were withdrawn from the N aquifer within Peabody’s lease area—3,100 af/yr of water for slurry of 4.8 million tons of coal and 1,300 af/yr of water for mine-related and domestic purposes. Both mining operations and local residences together accounted for the 1,300 af/yr of water. Under Alternative A, use of N-aquifer water would continue at a reduced rate. Peabody’s N-aquifer well field would be conserved to provide potable water for the public and as an emergency backup supply should the primary C-aquifer source supply be

interrupted for any reason. It is the applicants' intent to no longer use water from the N aquifer for mine-related or slurry use except as noted below.

In order to maintain the N-aquifer well field in an operationally ready state to supply the public and in case of emergencies, the wells must be pumped periodically for extended periods of time. As a worst case, an estimated average of 2,000 af/yr of N-aquifer water would be used for (1) public consumption, (2) withdrawal from the N-aquifer wells to maintain their function, (3) emergencies, and (4) the Kayenta mining operation.

If the N aquifer were to be used as the sole water supply (i.e., the C aquifer water-supply system was not developed); up to 6,000 af/yr of water would be withdrawn from the N aquifer within Peabody's lease area for the life of the project (i.e., 2010 through mid 2026). If the N aquifer were to be used as the sole water supply, concerns of the Hopi Tribe and Navajo Nation regarding use of N-aquifer water for coal slurry leading to the administrative delay of OSM's permanent Indian Lands Program permitting decision for the Black Mesa mining operation would not be resolved.

The C aquifer water-supply pipeline would convey the water from the proposed well field near Leupp, Arizona, along one of two major alternative routes to the Black Mesa Complex. The agencies' preferred alternative, the eastern route, would be about 108 miles long, need two pump stations, and cross both Hopi and Navajo Reservations. Along this eastern alternative, there are two areas where localized routing subalternatives are considered. At the Little Colorado River, the pipeline would cross either (1) under the river using horizontal boring as the method of construction (the applicant's preferred method) or (2) over the river on an abandoned historic road bridge. In the Kykotsmovi area, the pipeline would be buried under a road that passes through the community (the agencies' preferred alternative) or in a road that bypasses the community. The alternative major route, the western route, would be about 137 miles long, need four pump stations, and cross the Navajo Reservation.

Alternative B – Conditional Approval of the LOM Revision Without Approval of the Black Mesa Mining Operations, Coal-Slurry Pipeline, and C Aquifer Water-Supply System

The 18,984 acres associated with the Black Mesa mining operation (including the 127 acres for the coal-haul road) would be incorporated into the expanded permit area; however, the Black Mesa mining operation, coal-slurry preparation plant, and coal-slurry pipeline that supplied coal to the Mohave Generating Station until December 2005 would not resume operations. The coal-washing facility and the C aquifer water-supply system would not be constructed.

Under its current permanent Indian Lands Program permit for the Kayenta mining operation, Peabody already has approved mining, operation, and reclamation plans that allow it to produce all of the coal needed by the Navajo Generating Station into 2026. The Kayenta mining operation would operate through 2026 and use N-aquifer water in amounts averaging 1,236 af/yr from 2006 to 2025. Up to 500 af/yr of N-aquifer water would be used for reclamation and public use from 2026 to 2028, and up to 444 af/yr of N-aquifer water would be used for post-reclamation maintenance and public uses from 2029 to 2038. As is the case under Alternative A, the wells would be transferred to the tribes once Peabody completes reclamation and relinquishes the leases.

Alternative C – Disapproval of the LOM Revision (No Action)

Unmined coal-resource areas of the Black Mesa mining operation would not be incorporated in the expanded permit area of the Black Mesa Complex and would not be mined. The infrastructure for the Black Mesa mining operation would be promptly reclaimed. Therefore, the Black Mesa mining operation, coal-slurry preparation plant, and coal-slurry pipeline that supplied coal to the Mohave Generating Station

until December 2005 would not resume operations. The coal-washing facility and the C aquifer water-supply system would not be constructed.

Under its current permanent Indian Lands Program permit for the Kayenta mining operation, Peabody already has approved operation and reclamation plans that allow it to produce all of the coal needed by the Navajo Generating Station into 2026. Similar to Alternative B, the Kayenta mining operation would use N-aquifer water in amounts averaging 1,236 af/yr from 2006 to 2025, would cease operation in 2026, and the mine would be reclaimed. Up to 500 af/yr of N-aquifer water would be used for reclamation and public use from 2026 to 2028, and up to 444 af/yr of N-aquifer water would be used for post-reclamation maintenance and public uses from 2029 to 2038. As is the case under Alternatives A and B, the wells would be transferred to the tribes once Peabody completes reclamation and relinquishes the leases.

AFFECTED ENVIRONMENT

Chapter 3 addresses the existing conditions of the human and natural environment that potentially could be affected by the alternatives. The existing conditions of the environment are described based on the most recent data available—primarily literature, published and unpublished reports, and agency databases. Field reconnaissance and interviews were conducted as necessary to verify specific information (such as land use or traditional cultural resources). The affected environment is characterized for the following general resource concerns.

- Landforms and Topography
- Geology and Mineral Resources
- Soils
- Water Resources (surface and groundwater hydrology)
- Climate
- Air Quality
- Vegetation
- Fish and Wildlife (including threatened and endangered species)
- Land Use
- Cultural Environment
- Social and Economic Conditions
- Environmental Justice
- Indian Trust Assets
- Noise and Vibration
- Visual Resources
- Transportation
- Recreation
- Health and Safety

ENVIRONMENTAL CONSEQUENCES

The information regarding the existing condition of the environment (Chapter 3.0 Affected Environment) was used as a baseline by which to measure and identify the potential impacts that could result from implementing the Black Mesa Project. The EIS team considered and incorporated best management practices, conservation measures, and mitigation (which the applicants commit to implement), where appropriate, before arriving at the impacts described in the EIS.

An impact, or effect, is defined as the modification to the environment brought about by an outside action. Impacts vary from no change, or only slightly discernible change, to a full modification or elimination of the environmental condition. Impacts can be *beneficial* (positive) or *adverse* (negative).

Impacts can be *short-term*, or those changes to the environment during and following ground-disturbing activities that generally revert to predisturbance conditions at or within a few years after the ground disturbance has taken place. *Long-term* impacts are defined as those that substantially would remain beyond short-term ground-disturbing activities.

For the mining operations, the local short-term impacts are those that would occur from the beginning of mining of a unit through reclamation of that unit when vegetation is re-established (i.e., through regrading, replacement of topsoil, reseeding, and initial revegetation). The mining operation continually advances with contemporaneous reclamation. That is, earth material excavated from a coal-producing unit is deposited to backfill the adjacent previously mined unit. When the unit has been backfilled, the area is reclaimed. This sequence continues until all of the coal has been removed from a given coal resource area. Long-term impacts are defined as the period when vegetation is established and controlled grazing is permitted, through and beyond release of the property by Peabody.

For the coal-slurry pipeline and water-supply system, local short-term impacts of the project are those that would occur during construction of the pipelines (and water-supply well field) plus a reasonable period for reclamation (i.e., a total of about 5 years). Mining and reclamation of a given coal resource area generally spans between 20 and 25 years. Long-term impacts are those that would persist beyond or occur after the 5-year construction and reclamation period.

An action can have direct or indirect effects, and it can contribute to cumulative effects. *Direct effects* generally occur at the same time and place. *Indirect effects* are later in time or farther in distance, but still reasonably foreseeable. *Cumulative effects* result from the proposed action's incremental impacts when these impacts are added to the impacts of other past, present, and reasonably foreseeable future actions, regardless of the agency or person who undertakes them (Federal or non-Federal).

Also in identifying impacts, the vulnerability of resources is considered. The status of a resource, resource use, or related issue in this regard is evaluated against the following:

- *Resource significance*: a measure of formal concern for a resource through legal protection or by designation of special status.
- *Resource sensitivity*: the probable response of a particular resource to project-related activities.
- *Resource quality*: a measure of rarity, intrinsic worth, or distinctiveness, including the local value and importance of a resource.
- *Resource quantity*: a measure of resource abundance and the amount of the resource potentially affected.

Several resources are more conducive to quantification than others. For example, impacts on vegetation can be characterized partly using acreage, and air quality can be measured against air quality standards. Evaluations of some resources are inherently difficult to quantify with exactitude. In these cases, levels of impact are based on best available information and professional judgment.

For purposes of discussion and to enable use of a common scale for all resources, resource specialists considered the following impact levels in qualitative terms. The terms *major*, *moderate*, *minor*, *negligible*, or *none* that follow, consider the anticipated magnitude, or importance, of impacts, including those on the human environment.

- **Major**: Impacts that potentially could cause irretrievable loss of a resource; significant depletion, change, or stress to resources; stress within the social, cultural, and economic realm; degradation of a resource defined by laws, regulations, and/or policy.
- **Moderate**: Impacts that potentially could cause some change or stress (ranging between significant and insignificant) to an environmental resource or use; readily apparent effects.
- **Minor**: Impacts that potentially could be detectable but slight.

- **Negligible:** Impacts in the lower limit of detection that potentially could cause an insignificant change or stress to an environmental resource or use.
- **None:** No discernible or measurable impacts.

Impacts are described for the four project components under Alternative A. Under Alternatives B and C, the coal-slurry pipeline would not be reconstructed nor operate in the future, and the C aquifer water-supply system would not be constructed.

Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

Black Mesa Complex

For the resumption and expansion of Black Mesa mining operations and continued Kayenta mining operations, the primary impacts at the Black Mesa Complex from the mining and reclamation process include the following.

The upper 250 feet of surface material would be removed from more than 13,529 acres. This would include a loss of about 8,500 acres of piñon/juniper woodland vegetation and about 4,200 acres of sagebrush. The existing vegetation on these 13,529 acres would be permanently removed during mining operations.

Before coal is removed, the vegetation is cleared and the topsoil is removed and saved. After topsoil is replaced, it is seeded and planted. Places where there are steep-sided slopes and sharp angled rocky hills would be replaced with gently rolling hills with smoother contours. The water drainage patterns would be restored to pre-mining conditions to the extent practicable through backfilling and grading of the mined areas. The areas would be reseeded with a mix of shrubs, forbs, and grasses. The regulatory requirement is to restore the land affected to a condition capable of supporting the uses which it was capable of supporting prior to any mining (grazing and wildlife) and to establish a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area of land to be affected and capable of self-regeneration and plant succession at least equal in extent of cover to the natural vegetation of the area. The replacement of piñon/juniper woodland with grassland results in 10 times the productivity for grazing. Plants that are important to and used by the Navajo and Hopi people for medicinal or ceremonial purposes also would be planted.

Once vegetation has been established on these reseeded areas, limited (or controlled) grazing would be allowed, to facilitate the revegetation process. Controlled grazing would continue for about 10 more years before an area is released from Peabody's management and transferred to the tribes. The total amount of time from when an area begins to be mined to when the land is returned to the tribes is about 20 to 25 years.

All the operations related to mining and handling the coal would result in about 145 tons of particulate matter being generated over current conditions (prior to suspension of the Black Mesa mining operations) by the end of the project.

There would be a very small decrease in the amount of surface-water flow traveling down the major washes within the Black Mesa Complex resulting from development and use of temporary and permanent impoundments, as well as reclamation actions to reduce erosion from surface water runoff. The change in flow would be so small, it would not be detected by the gauges that measure stream flow.

There could be some decrease in groundwater quantity as a result of the mining exposing pockets of porous rock that are saturated with water. Some local water wells and springs could go dry. Once mining has ceased and the land has been reclaimed and returned to its previous use (which could take up to 20 years), the groundwater system would reach a new balance. Some springs could return, but some would not. There also could be a decrease in groundwater quality, both from increased total dissolved solids and formation of acidic water pockets.

Where a water supply (e.g., a well or developed spring) has been affected by contamination, diminution, or interruption resulting from mining operations, Peabody would be required by OSM's permit to provide alternate water supplies as close to the original water supply as practicable.

Refuse from washing the coal, earth materials, would be reburied in mined pits. It is anticipated that impacts from this refuse would be similar to that already experienced by disposal of regraded spoil material (which are temporary and immeasurable). Peabody would carry out a sampling and testing plan to analyze the actual chemical constituents of the refuse to make sure the results are consistent with what is expected. If they are significantly different from what is expected and indicate a potential for greater adverse impacts, special disposal procedures would be implemented to make sure the material cannot mix with existing soil or water.

The primary impacts on the people and lands located adjacent to the Black Mesa Complex from the mining and reclamation operations within the Black Mea Complex include relocation of households and nuisance dust and noise.

Peabody would relocate 17 Navajo households currently located on land that would be permitted for mining under the proposed project. Peabody would attempt to relocate these families within the residents' customary use areas (e.g., where ranching activities take place or where socio-cultural ties exist). This relocation would include providing new houses, areas for family garden plots, and livestock grazing areas. These families would be able to return to their original home sites after reclamation is considered completed and the land is returned to tribal control, after about 20 to 25 years. The mined area would be reclaimed with the goal of increasing its grazing productivity.

Mining-related activities would continue to generate particulate matter (very small solid particles of chemicals, soil or dust, and liquid droplets) that can exacerbate breathing and health problems. Residents living next to the mining operations would have a greater exposure to this particulate matter for the duration of the mining operations.

Local residents would be allowed to continue to get free firewood, coal, and potable water at two water stands within the Black Mesa Complex for the duration of the proposed project.

The primary impacts on the region as a whole, from the mining and reclamation operations at the Black Mesa Complex, would include economic benefits from employment and coal and water royalties, which would benefit both tribal governments and the general economy. This would include restoration of about 400 mining jobs that were lost when the operation of the Mohave Generating Station was suspended, as well as about 80 additional mining jobs resulting from the increased production included under the proposed Black Mesa Project. There would be about a 10.5 percent increase in revenues historically paid to the Hopi Tribe and Navajo Nation from royalties related to increased coal production. This would result in the payment of royalties of about \$15.5 million and \$37.9 million annually to the Hopi Tribe and Navajo Nation, respectively. Other taxes, payments, and grants to the tribes resulting from resumption of coal mining activities would be restored and increased as a result of increased coal production. Retail revenues in the local economy also would be restored after mining operations resume. There also would be an increase of \$18.1 million annually to the State of Arizona in sales taxes paid by Peabody.

Payment of water royalties to the Navajo Nation would resume due to either continued use of the N aquifer, or as a result of development and use of the C aquifer water-supply system. There would be an increase in the amount of water used over past years due to the proposed increase in coal production for the Mohave Generating Station under the LOM revision.

A permanent access road would be built from water-supply pipeline Milepost 71 to 76. This would provide an incidental opportunity to have the road extended north from Arizona Route 264 (adjacent to the pipeline) to the mining operations. Developing the route would improve the transportation network for Hopi and Navajo residents, especially the Hopi villages and the Navajo chapters of Forest Lake and Hardrock.

Reconstruction and Operation of the Coal-Slurry Pipeline

Construction-related impacts along the existing coal-slurry pipeline alignment would include ground disturbance, disturbance of land uses and natural and cultural resources, and construction employment.

Construction would disturb about 2,100 acres of land. Depending upon the final route selected, between 24 and 38 percent of the impacted area has not been disturbed previously. Except for a permanent operations and maintenance road, the remainder of the pipeline right-of-way would be revegetated. There could be impacts from construction activities on several sensitive species that are protected by Federal, tribal, and/or State laws, including the destruction of some individual species; however, no permanent impacts on or threat to the species population as a whole are expected. Timing of construction activities and preconstruction surveys would reduce impacts on those species of special concern.

Twenty-three cultural resources were identified as being located within the existing coal-slurry pipeline right-of-way that are significant and eligible for listing on the National Register of Historic Places because of their potential to yield important information about the prehistory and history of the region. The alternate route would affect nine more sites, all of which also are National Register-eligible properties. The Hopi also consider all Ancestral Pueblo sites to be significant because of their association with important events in Hopi history, and sites with remnants of architecture to be eligible for listing on the National Register because they represent distinctive types. Efforts would be made during preparation of final designs to avoid or reduce impacts on the National Register-eligible properties. For sites that cannot be avoided, there is good potential to satisfactorily mitigate the impacts through data recovery studies.

In some areas, farming, grazing, out-structures, and/or development occur on top of or adjacent to the existing coal-slurry pipeline right-of-way. These uses of the pipeline right-of-way would be temporarily impacted during reconstruction of the pipeline. Structures that have been placed on top of the pipeline right-of-way would be relocated off the right-of-way. Nonpermanent uses of the right-of-way could be restored once construction has been completed.

Reconstruction of the pipeline using the existing route would affect about 70 residences in the Kingman and Laughlin areas, either by temporarily limiting access or disturbance to residential property during construction. If the alternate route is chosen, three low- to moderate-density residential areas adjacent to the right-of-way would be affected as access to residential and industrial properties may be limited temporarily during construction.

Construction-related employment would provide a temporary benefit to the local economy.

Long-term impacts from operation and maintenance of the coal-slurry pipeline include the following.

When mining resumes in mid 2009, 15 to 20 operational employees would be hired to staff the pipeline's booster-pump station locations and BMPI's office in Flagstaff. The jobs would continue through 2026.

Though unlikely, pipeline failure (with release of coal slurry) could occur, but it is not possible to estimate where it would occur or the amount of slurry that could be discharged. The impact would be short term and repairable. An emergency response plan that addresses clean-up and management of impacts, including the length of time required for cleanup, would be developed and followed for the coal-slurry pipeline operation.

Construction and Operation of the C-aquifer Water-Supply System

Impacts in the immediate area of the proposed well field and water-supply pipeline route from construction and operation of the system would include the following.

There would be temporary interruption of grazing and traffic, and presence of noise and dust from construction of the well field, water-storage facility, and road network; and construction of the water-supply pipeline, pump stations, and powerlines. The eastern route would follow existing roads for the majority of its length. There would be a greater temporary impact on traffic from construction of the eastern route, where it proceeds near and through Kykotsmovi. With the western route, there would be greater impact (loss of grazing habitat) on grazing from construction and creation of a permanent access road for operation and maintenance. If blasting is needed, there would be temporary noise from blasting along the pipeline route.

There are about 55 residences located within the area identified for the well field. Construction of access roads would temporarily limit access to and from residences, grazing, and other use areas. Pump stations would be located at least 0.25 mile from any permanent residence.

There would be a permanent loss of about 160 acres of grazing land due to the construction of permanent structures (i.e., pump houses, water-storage tank, pump stations, power lines, substations). Visual impacts would result from the permanent intrusion of these new structures on the landscape, but would be minimized by painting the structures to blend with the surroundings. Noise from the operating pumps at the pump stations would be audible; however, the pump stations would not be located near residences of public facilities.

There could potentially be impacts on numerous archaeological, historical, and traditional cultural resources. However, there is great flexibility in locating the individual wells and access roads, and, to a lesser degree, the power lines and pump stations related to the pipeline alignments. These resources would be avoided to the maximum extent practicable. If they cannot be avoided, treatment of the resources would be undertaken in compliance with Federal and tribal policies. Areas affected by the western water-supply pipeline route have some of the highest densities of archaeological sites in the region, and use of this route would require substantial time and money to mitigate impacts on these resources.

Temporary jobs for community members as construction workers would be available during construction.

Impacts in the region from long-term operation and use of the C aquifer water supply system include the following.

There could be a potential lowering of water levels in shallow livestock wells in the vicinity of the C aquifer well field; however, the project proponent would provide an alternate water source for livestock grazing should the groundwater levels drop such that these shallow wells become inoperable.

There could be a potential minor reduction of about 1.5 percent in base flow in three perennial stream reaches that receive discharge from the C aquifer—lower Clear Creek, lower Chevelon Creek, and the Little Colorado River from Woodruff downstream to Holbrook. These reaches are important to several native fish species including Little Colorado spinedace, bluehead sucker, Little Colorado sucker, and roundtail chub. Little Colorado spinedace is a federally threatened species, and the affected reach of the lower Chevelon Creek is designated as its critical habitat. Although these reductions in base flow that could result from the proposed project would be very small and likely may not even be measurable, they may affect the availability of suitable stream habitat and reduce the ability of fish populations to survive the dry seasons. The project proponents would implement conservation measures to offset the potential adverse effects of stream base flow depletion attributable to the proposed project. Funds would be provided to implement activities to aid in the survival, conservation, and recovery of the federally threatened Little Colorado spinedace, and the roundtail chub.

Construction and operation of the C aquifer water-supply system would provide the opportunity to develop a permanent water-supply system that could deliver water to numerous tribal communities along and off the main water-supply pipeline alignment. Also, with the construction of the powerlines to serve the well field and pump stations, there is a potential opportunity to provide electricity to local residents.

Impacts resulting from use of the N aquifer water-supply system include the following:

If the N aquifer water-supply system is used solely as a supplemental supply, as proposed, estimated reductions in base flow would average about 1.3 percent as compared to 1955 pre-mining base flow estimates, with the largest reduction occurring in Begashibito Wash, which would be about 1.48 percent, or 32 af/yr as compared to 1955 base flow estimates.

If the N aquifer water-supply system continues to provide all the water needed for the Black Mesa Complex, the amount of groundwater pumped would increase from about 4,400 af/yr to 6,000 af/yr. There would be reductions in groundwater discharges to streams. Based upon 1955 pre-mining estimates, the largest reductions from Peabody's pumping through 2038 are anticipated to occur in Begashibito Wash, where there would be an estimated 1.66 percent, or about 36 af/yr, reduction, and in Moenkopi Wash, where there would be an estimated 0.56 percent, or about 23 af/yr, reduction, as compared to 1955 base flow estimates.

Alternative B – Conditional Approval of the LOM Revision Without Approval of the Black Mesa Mining Operations, Coal-Slurry Pipeline, and C Aquifer Water-Supply System

It is anticipated that, under Alternative B, approximately 8,062 acres would be disturbed by mining from 2010 through 2026. The impacts are characterized similarly to those of Alternative A, for an area reduced in size (i.e., about 8,062 acres would be mined and the coal-haul road [127 acres] would be constructed. The areas in which vegetation would be disturbed would be reduced, but the relative proportions of the vegetation types impacted would be similar to those of Alternative A (i.e., 65 percent piñon/juniper, 30 percent sagebrush, and a few percent in other vegetation types). Fewer cultural resource and traditional cultural resources would be affected. The opportunity for improved livestock grazing would be foregone, because the unmined area would be less productive for grazing. With the reduction in mining, there would be fewer coal-haul roads constructed. No mining in 5,467 acres would preserve coal resources for future use.

Alternative C – Disapproval of the LOM Revision (No-Action)

Under Alternative C, most of the impacts are characterized the same as Alternative B. Because the mining facilities and infrastructure for the Black Mesa mining operation would be promptly reclaimed and the possibility of mining in the Black Mesa mining operation area would disappear, residents in or near the

Black Mesa mining operation who live a traditional lifestyle would experience the benefit of the end of nearby mining-related activities more rapidly than in Alternative B.

Cumulative and Indirect Effects

The most notable cumulative effects addressed are related to air quality, water resources (hydrology), vegetation and wildlife habitat, and social and economic conditions.

Air Quality. Regionally, the effects of particulates and gaseous air pollutants were assessed. During construction of the pipelines increased particulate matter (PM) emissions would be 206 tons per year. That temporary 3.6 percent increase in total regional PM emissions would not be anticipated to cause an exceedance of the National Ambient Air Quality Standards (NAAQS), especially since the Black Mesa mining operations would not occur during that time period. Consequently, the air quality impacts during construction of the pipelines are considered minor.

Upon completion of construction, the ongoing Kayenta and resumed Black Mesa mining operations would be the only project component contributing to regional PM₁₀ and the resumption of Black Mesa mining operations would increase total regional PM₁₀ emissions by 145 tons per year, an increase of 12 percent in total regional emissions. Peabody has demonstrated that the increased PM₁₀ emissions from the ongoing Kayenta and resumed Black Mesa mining operations would not cause exceedance of the NAAQS. Consequently, the air quality impacts are considered minor locally during construction and negligible during normal operation; negligible to no impact regionally

The effects of gaseous air pollutants also were assessed. Those pollutants, associated with vehicle and equipment exhaust emissions currently have minor, localized impacts within the immediate vicinity of the complex, but have negligible impacts on air quality in the region. During the time of construction of the pipelines, total regional gaseous pollutant effects would be negligible.

Water Resources (Hydrology). According to groundwater modeling completed for the project continued and increasing regional pumping of groundwater from the C aquifer (municipal and industrial, mostly unrelated to the Black Mesa Project) is expected to cause widespread declines in groundwater elevations, especially near major pumping centers. In 2026, declines of 20 feet or more are predicted in areas of Silver Creek along the Little Colorado River from Holbrook to Joseph City, and the upper Little Colorado River above St. Johns, while declines of 5 feet or more would occur at lower Chevelon and Clear Creek. This compares with less than 1 foot decline at lower Chevelon and Clear Creek due to maximum project pumping.

Cumulative regional pumping of groundwater from the N aquifer would reduce groundwater discharge to various streams on Black Mesa. The greatest change is expected to occur at Pasture Canyon near Tuba City. Diminution in groundwater discharge is predicted to be 58.9 af/yr in 2025, all of which is attributable to nonproject pumping. This reduction in discharge is 15 percent of the total 2005 estimated Pasture Canyon discharge. At Cow Springs, which is closer to the mine well field, the reduction due to community pumping is 2.0 af/yr versus 14.9 af/yr due to the project.

Vegetation and Wildlife Habitat. Historic and continuing grazing has caused reductions in perennial grasses and forbs in all ecosystems in northern Arizona, and increases in species that are not palatable to livestock, including some shrubs and weedy species. Natural fire regimes have been altered by removal of grasses through grazing and by fire suppression. This has led to encroachment of trees into former grassland areas and increases in tree density in both grasslands and wooded habitats. Large-scale piñon and juniper removal projects have been conducted in the project area within the past 30 to 50 years, resulting in short- or long-term conversion of woodlands to grasslands. Although reclamation of mined areas at the

Black Mesa Complex results largely in grassland, the herbaceous forage established in the reclaimed areas has been shown to be beneficial to wildlife. In addition, rock features are established to restore wildlife protection and cover, and islands of shrubs or trees are planted for more diversified habitat.

Activities that have affected and will continue to affect the distribution and abundance of wildlife in northern Arizona include grazing, fire suppression, rural residential development, spread of invasive species, increasing populations of brown-headed cowbirds (a nest parasite), fragmentation of large habitat blocks by new roads and utility corridors, and increasing human population. Increased attention by governmental and nongovernmental agencies to the management and protection of biodiversity is countering some of these activities.

Special Status Species. Depending on the hydraulic connection between the river alluvium and the C aquifer, projected drawdowns in excess of 20 feet effectively could preclude or reduce the development and persistence of large tracts of salt cedar in this area. Cumulative impacts from pumping also would reduce groundwater levels from 5 to 10 feet along lower Chevelon and lower Clear Creeks, but pumping for the Black Mesa project would contribute only to an additional reduction in groundwater levels from 0.1 to 1.0 feet along lower Chevelon and lower Clear Creeks, respectively. The incremental increase of project-related drawdowns when added to projected drawdowns from regional pumping are unlikely to contribute appreciably to cumulative effects on riparian vegetation in these areas. Due to these factors and the low likelihood that southwestern willow flycatchers are present and use riparian habitats along this portion of the Little Colorado River, cumulative impacts as a result of the proposed project are anticipated to be unlikely.

The decline and eventual elimination of base flow in lower Chevelon Creek from regional groundwater pumping would have significant adverse effects on Little Colorado spinedace and its habitat, including reductions in the length of flowing stream in the dry season, elimination of riffles and shallow runs during the dry season, and a marked reduction in the size and depth of pools. The effects would likely be most significant in the drier months of June and July, but impacts would be expected to be appreciable throughout other portions of the year as well. However, project-related groundwater pumping is not expected to contribute to appreciable long-term cumulative impacts on lower Chevelon Creek, because the cumulative effects from regional pumping essentially would eliminate all flow by 2060, even if the project were not constructed. Project-related pumping would contribute to an additional reduction of 0.1 cfs for lower Clear Creek.

Economic Conditions. Due to the existence of the Black Mesa Complex, mining drives the economy of the local area and makes the largest private-industry contribution to the revenue of the Hopi Tribe and Navajo Nation. The affected region includes the entire Hopi and Navajo Reservations, Page, and Flagstaff. Mining employees earn the highest wages in the local area, with many contributing to the support of extended families. Mining-related multiplier effects accrue to the local area, providing jobs and income in sectors such as wholesale and retail trade. When both mining operations are active, the local unemployment rate is about half that of both reservations, overall.

Final closure of the Black Mesa Complex would cause major economic impacts on the Kayenta area and major revenue impacts on both reservations. High rates of poverty—often three times the rate of the nation overall—have persisted on the Hopi and Navajo Reservations throughout modern history. With the loss of the mining operations, the historical (premining) level of poverty would return throughout the reservations absent other economic development, and would eliminate the island of relative prosperity in the Kayenta area.

AGENCIES' PREFERRED ALTERNATIVE

The lead and cooperating agencies' preferred alternative is Alternative A, which is approval of the LOM revision and all associated components of the Black Mesa Project, which includes the following:

- Approval of LOM revision for Black Mesa mine complex
 - approval of LOM revision application, including adding 18,984 acres to the permit area, the coal washing facility, increased coal production by the Black Mesa mining operation, revisions to the operation and reclamation plan, and reduced use of Navajo aquifer water in support of mining operations and as an emergency backup water supply
 - approval of changes to the mining plan for the Navajo and Hopi coal leases
 - issuance of right-of-way for the road corridor
 - approval of modification of NPDES permit
 - approval of modification of Title V air quality permit
- Approval of coal-slurry preparation plant permit application
- Approval of coal-slurry pipeline reconstruction along the existing alignment with realignments in Moenkopi Wash and a southern reroute around Kingman, Arizona
- Approval of C aquifer water-supply system along the eastern alignment, capable of delivering up to 11,600 af/yr, using directional drilling to cross under the Little Colorado River, and using the western alignment through Kykotsmovi

CONSULTATION AND COORDINATION

The analyses for this Draft EIS were completed in consultation with other agencies and the public. OSM sent letters inviting 11 agencies to participate in the preparation of the Black Mesa Project EIS; 9 decided to accept the invitation to be cooperating agencies: BIA, BLM, Reclamation, USEPA, Forest Service, Hopi Tribe, Navajo Nation, Mohave County, and the City of Kingman. The Arizona State Land Department and U.S Army Corps of Engineers, Los Angeles District, both responded to OSM that they would participate as reviewers of the EIS rather than as cooperating agencies in the preparation of the EIS. Later, at its request, the Hualapai Tribe became a cooperator. OSM has and will continue to work closely with the cooperating agencies throughout the EIS process. Many of the Federal cooperating agencies are participants in the multi-agency consultations for Section 7 under the Endangered Species Act and Section 106 under the National Historic Preservation Act. Several other Federal and State agencies and local governments were involved during the preparation of the EIS, but to a lesser extent than the cooperating agencies.

Public scoping meetings were held during January and February 2005 in Saint Michaels, Forest Lake, Kayenta, Kykotsmovi, Leupp, Kingman, and Flagstaff in Arizona, and in Laughlin, Nevada. More than 700 people attended the 10 scoping meetings, and 351 written submissions and 237 oral statements were made by the public and other governmental agencies to OSM during the scoping period. A detailed report of comments and issues heard from the public was developed and placed on the OSM project web site at www.wrcc.osmre.gov/WR/BlackMesaEIS.htm and an informational newsletter detailing the results of the scoping period were distributed in September 2005. OSM will conduct public meetings on the Draft EIS in early January 2007, and comments it receives during the 60-day public review period will be considered and incorporated into the Final EIS, which is expected to be completed in the summer of 2007.

PREFACE



PREFACE

This environmental impact statement (EIS) is being prepared in compliance with the National Environmental Policy Act (NEPA) in order to analyze and disclose the probable effects of the Black Mesa Project in northern Arizona. The Black Mesa Project would (1) continue the supply of coal to the Navajo Generating Station near Page, Arizona, from the Kayenta mining operation and (2) supply coal from the Black Mesa mining operation to the Mohave Generating Station in Laughlin, Nevada. The alternatives are as follows:

- Alternative A (agencies' preferred alternative)—Approval of the life-of-mine (LOM) revision for the Peabody Western Coal Company (Peabody) Kayenta and Black Mesa mining operations at the Black Mesa Complex and approval of all other components of the Black Mesa Project, which include permitting the coal-slurry preparation plant at the Black Mesa Complex, reconstruction of the 273-mile-long coal-slurry pipeline to transport the coal to Mohave Generating Station, and development and use of the Coconino aquifer (C aquifer) water-supply system including a 108-mile-long water-supply pipeline.
- Alternative B—Conditional approval of the LOM revision without approval of the Black Mesa mining operation, coal-slurry preparation plant, reconstruction of the coal-slurry pipeline, and C aquifer water-supply system.
- Alternative C—Disapproval of the LOM revision without approval of the coal-slurry preparation plant, reconstruction of the coal-slurry pipeline, and C aquifer water-supply system.

The Office of Surface Mining Reclamation and Enforcement (OSM) is the lead agency responsible for preparing this EIS. Other Federal agencies and tribal and local governments cooperating with OSM in the preparation of this EIS include the Bureau of Indian Affairs; Bureau of Land Management; Bureau of Reclamation; U.S. Department of Agriculture Forest Service; U.S. Environmental Protection Agency; Hopi Tribe; Hualapai Tribe; Navajo Nation; Mohave County, Arizona; and City of Kingman, Arizona.

This EIS identifies and analyzes the probable impacts on the human environment that would result from the Black Mesa Project: (1) surface coal-mining and reclamation operations at the Black Mesa Complex; (2) operation and reclamation of the coal-slurry preparation plant; (3) reconstruction of the coal-slurry pipeline; and (4) development of the C aquifer water-supply system.

Implementation of the Black Mesa Project is dependent on the Mohave Generating Station resuming operations. The Mohave Generating Station is the sole customer of the Black Mesa mining operation, and the Black Mesa coal-slurry preparation plant and coal-slurry pipeline exist only to supply coal to the Mohave Generating Station. The proposed new C aquifer water-supply system would be constructed only if coal were to be supplied to the power plant from the Black Mesa Complex.

Operation of the Mohave Generating Station was suspended in December 2005, during preparation of the EIS, because new air-pollution-control technology had not been installed on the plant under the terms of a consent decree. A number of steps must be completed before the power plant can resume operations including, among others, the construction of approximately \$500 million in additional pollution-control systems to significantly reduce emissions from the plant and protect public health and visibility in the Grand Canyon and other national parks. While the Black Mesa Project is necessary for the Mohave Generating Station to resume operations, reconstruction of the Mohave Generating Station is not a part of the Black Mesa Project and is not analyzed in this EIS.

After a comprehensive reassessment of efforts required to return the power plant to operation, Southern California Edison Company (SCE), the operator and majority owner of the Mohave Generating Station, announced on June 19, 2006, that it would not continue to pursue resumed operation of the power plant. Two other owners, Nevada Power Company and Los Angeles Department of Water and Power, made similar announcements. The fourth owner, Salt River Project (SRP), announced that it was continuing to assess the situation and might pursue resumed operation of the power plant with new partners, but not as sole owner. This uncertainty led OSM to announce in a July 2006 newsletter that it had suspended activities to publish the Draft EIS.

In September 2006, SRP announced that it was accelerating efforts to return the plant to service and requested that the EIS process resume while it attempts to form a new ownership group. With SCE's concurrence, SRP committed to replace SCE as the principal applicant for those aspects of the Black Mesa Project that SCE had initiated. At the end of September 2006, OSM announced in another newsletter that it had resumed the EIS process.

At this time, the current Mohave Generating Station co-owners are continuing to assess the full range of options for the future of the power plant including, among other things, the option of selling the power plant to a new owner or ownership group and the option of decommissioning the plant and disposing of the plant site. Alternatives B and C analyze and disclose the probable effects if some, or all, of the components of the Black Mesa Project are not approved, which would be the same effects if the power plant is not returned to service. Under any alternative, the Kayenta mining operation would continue through 2026 under the existing OSM permit.

This EIS consists of 7 chapters and 12 appendices. Chapter 1 provides a description of the proposed Federal actions and the need for these proposed actions; the proposals of Peabody, SCE, and Black Mesa Pipeline, Inc.; scope of the analysis; relation of the proposal to other development; and scoping issues and concerns.

Chapter 2 provides a description and comparison of the range of alternative decisions available to OSM and BLM regarding the proposed LOM revision for the Black Mesa Complex. Also described are the alternatives that were considered but eliminated from detailed study in this EIS.

Chapter 3 provides a description of the existing environment that would be affected by the proposed action. Chapter 4 provides a description and analysis of the probable effects on the environment that could result from each of the three alternatives. A comparison of the alternatives is found both in the Summary and in Section 2.5 in Chapter 2 of this EIS.

Chapter 5 provides a description of the consultation and coordination that occurred with the public, American Indian tribes, government agencies, and private organizations during the preparation of the EIS and lists those from whom comments were solicited. Chapter 6 contains a list of the individuals, with their qualifications, who prepared this document and/or the environmental analyses contained herein. Chapter 7 is a list of the selected references used in the preparation of this document.

Appendices have been included to provide supplemental information on mining and reclamation procedures and typical well field and pipeline construction, operation, and maintenance; legal authorities and mandates; estimated project costs; truck and rail alternatives to transporting coal via slurry; biological resources; land use; water resource impact assessment methodology; and visual resources.

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LIST OF ACRONYMS

°C	degrees Centigrade
°F	degrees Fahrenheit
2-D	two dimensional
3-D	three dimensional
μg/L	micrograms per liter
μg/m ³	micrograms per cubic meter
μS/cm	microSiemens per centimeter
A&Wc	Aquatic and Wildlife – Cold Water Fishery
A&We	Aquatic and Wildlife – Ephemeral
ACEC	areas of critical environmental concern
af/yr	acre-feet per year (1 acre-foot is equal to 325,851 gallons)
ADEQ	Arizona Department of Environmental Quality
ADOR	Arizona Department of Revenue
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
af/yr	acre-feet per year
AGFD	Arizona Game and Fish Department
AgI	agricultural irrigation
AgL	agricultural livestock watering
AIRFA	American Indian Religious Freedom Act
Alk	alkalinity
AMA	Aquifer Management Area
AML	Abandoned Mine Land
ANSI/AWS	American National Standards Institute/American Welding Society
API	American Petroleum Institute
APP	Aquifer Protection Program
APS	Arizona Public Service Company
ARPA	Archaeological Resources Protection Act
ARS	Arizona Revised Statutes
As	Arsenic
ASLD	Arizona State Land Department
ASME	American Society of Mechanical Engineers
ASU	Arizona State University
AUM	animal unit month
AWQS	Aquifer Water Quality Standards
AWWA	American Water Works Association
AZPDES	Arizona Pollutant Discharge Elimination System
BACT	best achievable control technology
bgs	below ground surface
BIA	Bureau of Indian Affairs
BIOME	BIOME Ecological and Wildlife Research
BLM	Bureau of Land Management
BMPI	Black Mesa Pipeline, Inc.

BNSF	Burlington Northern Santa Fe
BOR	U.S. Bureau of Reclamation
BTCA	best technology currently available
Btu	British thermal unit
C aquifer	Coconino aquifer
Ca	calcium
CAA	Clean Air Act
CAP	Central Arizona Project
CaSO ₄	gypsum (calcium sulfate)
CAWCD	Central Arizona Water Conservation District
CBM	coal bed methane
CCDAQEM	Clark County Department of Air Quality and Environmental Management
CDP	Census Designated Places
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHIA	Comprehensive Hydrologic Impact Assessment
Cl	chloride
CML	cement-mortar lined
CO	carbon monoxide
CO ₂	carbon dioxide
CPO	Cultural Preservation Office
CRPA	Cultural Resource Protection Act
CSP	coal-slurry pipeline
CWA	Clean Water Act
D aquifer	Dakota aquifer
dB	decibel
dBA	A-weighted decibels
DWS	domestic water source
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EPC	engineering, procurement, and construction
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FBC	full-body contact
FC	fish consumption
FHWA	Federal Highway Administration
FIRE	Finance, Insurance, and Real Estate
Fl	fluorine
FLPMA	Federal Land Policy and Management Act
FOIA	Freedom of Information Act
Forest Service	U.S. Department of Agriculture Forest Service
ft/bgs	feet below ground surface
ft/day	feet per day
ft ² /day	square feet per day

FWS	U.S. Fish and Wildlife Service
gpd/ft	gallons per day per foot
g/VMT	Grams emitted per vehicle mile traveled
GMU	Game Management Units
gpm	gallons per minute
HCO ₃	bicarbonate
HCPO	Hopi Cultural Preservation Office
HIS	Indian Health Services
HHTA	Hopi Tribal Housing Authority
HUD	Housing and Urban Development
Hz	hertz
I-40	Interstate 40
ICP	inductively coupled plasma spectrometry
IMPROVE	Integrated Monitoring of Protected Visual Environments
km	kilometer
kV	kilovolt
kVA	kilovolt amperes
L _{dn}	day-night average sound level
L _{eq}	equivalent noise level
LOM	life-of-mine
m/s	meters per second
Mg	magnesium
mg/L	milligrams per liter
ml	milliliter
MSHA	Mine Health and Safety Administration
MSL	mean sea level
N aquifer	Navajo aquifer
N42	Navajo Route 41
Na	sodium
NAAQS	National Ambient Air Quality Standards
NACE	National Association of Corrosion Engineers
NAGPRA	Native American Graves Protection and Repatriation Act
National Register	National Register of Historic Places
NDEP	Nevada Department of Environmental Protection
NDOH	Navajo Division of Health
NEPA	National Environmental Policy Act
NHA	Navajo Housing Authority
NHPA	National Historic Preservation Act
NNC	Navajo Nation Council or Navajo Nation Code
NNEPA	Navajo Nation Environmental Protection Agency
NNHSD	Navajo Nation Housing Services Department
NO ₂	nitrogen dioxide
NO ₃	nitrate

NO _x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resource Conservation Service
NSR	New Source Review
NTU	Nephelometric turbidity unit
NTUA	Navajo Tribal Utility Authority
O ₃	ozone
OHV	off-highway vehicle
OSM	Office of Surface Mining Reclamation and Enforcement
Pb	lead
PBC	partial body contact
Peabody	Peabody Western Coal Company
PH	measure of acidity
PM	particulate matter
PM ₁₀	particulate matter less than 10 microns in diameter
PM _{2.5}	particulate matter less than 2.5 microns in diameter
ppm	parts per million
PSD	Prevention of Significant Deterioration
R aquifer	Redwall aquifer
RAWS	remote automatic weather station
RCRA	Resource Conservation and Recovery Act
Reclamation	Bureau of Reclamation
RUSLE	Revised Universal Soil Loss Equation
SAIPE	Small Area Income and Poverty Estimates
SAR	sodium adsorption ratio
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison Company
SCS	Soil Conservation Service
SHPO	State Historic Preservation Officer
SLUD	Strategic Land Use and Development Plan
SMCRA	Surface Mining Control and Reclamation Act of 1977
SO ₂	sulfur dioxide
SO ₄	sulfate
SPCC	Spill Prevention Control and Countermeasure
SPLP	Synthetic Precipitation Leaching Procedure
SRP	Salt River Project
SSPA	S.S. Papadopoulos and Associates
STATSGO	State Soil Geographic
SWPPP	Stormwater Pollution Prevention Plan
TDS	total dissolved solids
THPO	Tribal Historic Preservation Officer
TMDL	Total Maximum Daily Load
tons/acre/yr	tons per acre per year

U.S. 160	U.S. Highway 160
U.S. 89	U.S. Highway 89
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978
URS	URS Corporation
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
U.S. 89	U.S. Highway 89
U.S. 160	U.S. Highway 160
VRM	Visual Resource Management
WQARF	Water Quality Assurance Revolving Fund
WQMP	Water Quality Management Plan
WRCC	Western Regional Climate Center
WSP	water-supply pipeline
WWTP	Waste Water Treatment Plant

INTRODUCTION

1.0 INTRODUCTION

1.1 PURPOSE AND NEED FOR ACTION

This environmental impact statement (EIS) is being prepared in compliance with the National Environmental Policy Act (NEPA) in order to analyze and disclose the probable effects of the Black Mesa Project in northern Arizona. The Black Mesa Project is composed of four actions, the purpose of and need for which would (1) continue the supply of coal from the Kayenta mining operation to the Navajo Generating Station near Page, Arizona, and (2) supply coal from the Black Mesa mining operation to the Mohave Generating Station in Laughlin, Nevada (Map 1-1). The Kayenta and Black Mesa mining operations comprise the sum of mining operations at the Black Mesa Complex. The four actions proposed by three applicants are as follows:

- Peabody Western Coal Company (Peabody) proposes revisions to the life-of-mine (LOM) operation and reclamation plans for the Black Mesa Complex. Peabody proposes to incorporate into the permanent program LOM permit (1) currently unpermitted parts of the Hopi Tribe and Navajo Nation lease areas (and all associated structures and facilities) and (2) new, proposed rights-of-way and easements. The revisions include, but are not limited to, construction of a coal-washing facility, an increase in the amount of coal produced from the Black Mesa mining operation, and increased need for water for slurry and coal washing.
- Black Mesa Pipeline, Inc. (BMPI) proposes to continue to operate the Black Mesa coal-slurry preparation plant.
- BMPI also proposes to reconstruct the 273-mile-long coal-delivery slurry pipeline, which has reached its 35-year design life, from the Black Mesa mining operation to the Mohave Generating Station.
- Salt River Project (SRP)¹ proposes to construct a new water-supply system, including a 108-mile-long water-supply pipeline and a well field near Leupp, Arizona, to obtain water from the Coconino aquifer (C aquifer) and to convey the water to the Black Mesa Complex for use in the coal slurry and other mine-related purposes.

Also, the Hopi Tribe and Navajo Nation have proposed that the C aquifer water-supply system could be expanded to provide an additional 5,600 acre-feet per year (af/yr) of water for tribal domestic, municipal, industrial, and commercial uses. Although not a part of the applicants' proposed project to meet the purpose and need of the project, both tribes have indicated that upsizing the pipeline and expanding the well field of the system is an alternative that would fulfill the needs of both tribes to significantly expand and improve tribal water supplies at a relatively modest cost. The construction of these water-distribution systems is not currently proposed and, accordingly, is not analyzed in this EIS, and would be the subject of future NEPA review processes, if and when appropriate. The tribes' potential future withdrawals of

¹ After a comprehensive reassessment of efforts required to return the power plan to operation, Southern California Edison Company (SCE), the operator and majority owner of the Mohave Generating Station, announced on June 19, 2006, that it would not continue to pursue resumed operation of the power plant. Two other owners, Nevada Power Company and Los Angeles Department of Water and Power, made similar announcements. The fourth owner, SRP, announced that it was continuing to assess the situation and might pursue resumed operation of the power plant with new partners, but not as sole owner. In September 2006, SRP announced that it was accelerating efforts to return the plant to service, and requested that the EIS process resume while it attempts to form a new ownership group. With SCE's concurrence, SRP committed to replace SCE as the principal applicant for those aspects of the Black Mesa Project that SCE had initiated.

C-aquifer water from the proposed well field, which are interrelated with the sizing of the currently proposed water-supply pipeline and well field and the total amount of C-aquifer water ultimately withdrawn from the well field, are analyzed in this EIS.

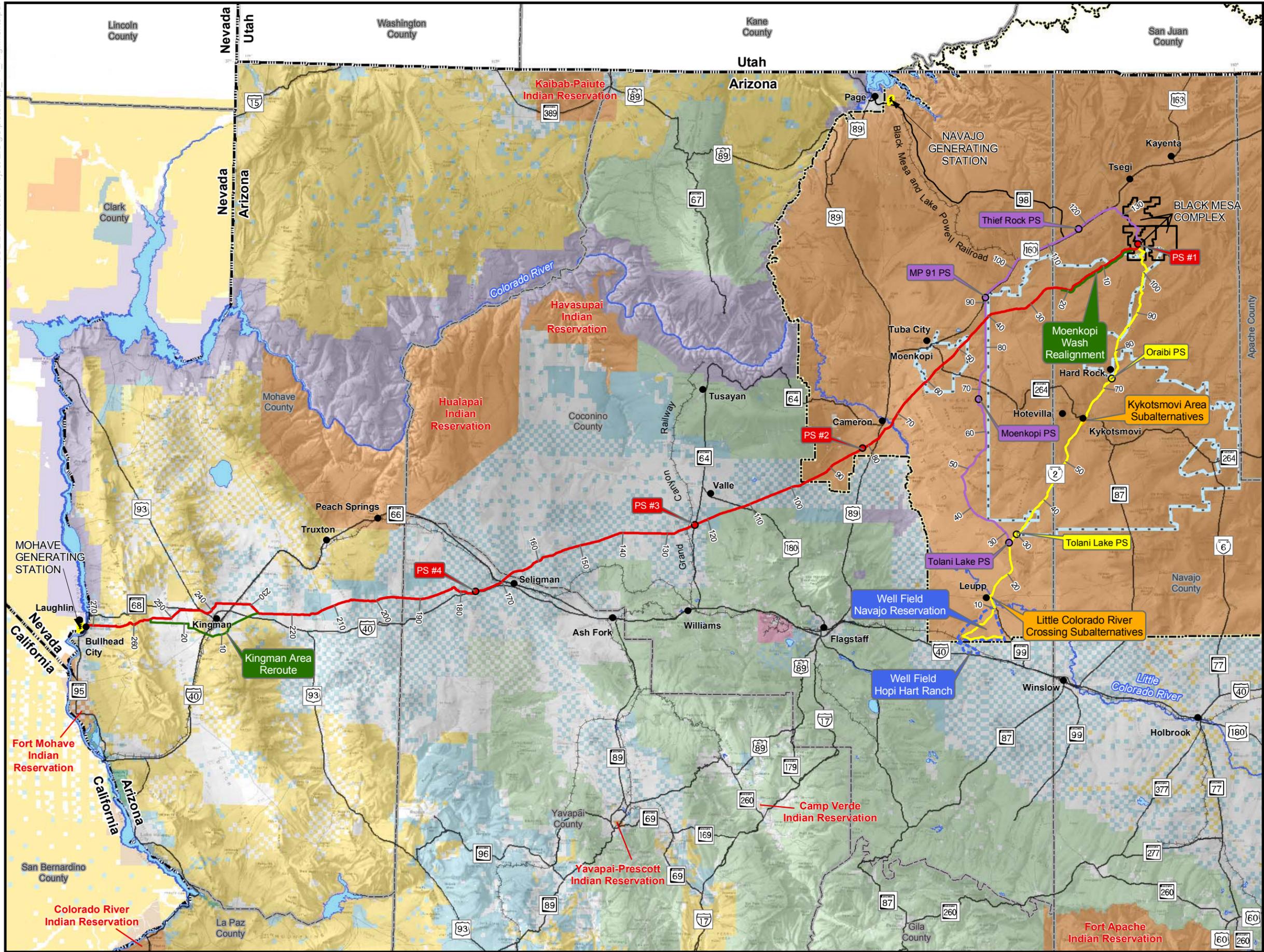
For the purposes of this EIS, construction of the coal-washing facility, reconstruction of the coal-slurry pipeline, and construction of the C aquifer water-supply system are estimated to begin on January 1, 2008. Production of coal from the Black Mesa mining operation would resume on April 1, 2009. Operation of the C aquifer water-supply system, coal-slurry preparation plant, and delivery of coal-slurry is estimated to begin on July 1, 2009, in preparation for start of operations at the Mohave Generating Station on January 1, 2010.

The Kayenta mining operation delivers coal from the Black Mesa Complex to the Navajo Generating Station, a distance of 83 miles, by the Black Mesa and Lake Powell Railroad. No changes to this coal-delivery system or to the generating station are needed and, therefore, the coal-delivery system and the generating station are not addressed in this EIS. Also, the installation of new pollution controls and other related modifications contemplated for the Mohave Generating Station are not addressed in this EIS due to the specific regulatory exemption under NEPA for air-pollution-control projects. No additional Federal action is required because all permits for the Mohave Generating Station have been obtained, including the U.S. Environmental Protection Agency's (USEPA) previous approval of the Title V permit revision.

The United States Department of the Interior (USDI), Office of Surface Mining Reclamation and Enforcement (OSM), is the lead agency responsible for preparing this EIS. Other Federal agencies and tribal and local governments cooperating with OSM in the preparation of the EIS include the Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Bureau of Reclamation (Reclamation), U.S. Forest Service (Forest Service), USEPA, Hopi Tribe, Hualapai Tribe, Navajo Nation, Mohave County, and City of Kingman.

1.2 BACKGROUND

The Black Mesa Complex, which Peabody has operated since the early 1970s, is an area composed of three contiguous leases and several surface rights-of-way and easements granted from the Hopi Tribe and Navajo Nation. The Black Mesa Complex comprises approximately 24,858 acres of land where the surface and mineral interests are held exclusively by the Navajo Nation and approximately 40,000 acres of land are located in the former Hopi and Navajo Joint Minerals Ownership Lease Area (Map 1-2). The tribes have joint and equal interest in the minerals that underlie the Joint Use Area; however, the surface has been partitioned. The portion of the leasehold that lies in the former Joint Use Area consists of approximately 6,137 acres partitioned to the Hopi Tribe and 33,863 acres partitioned to the Navajo Nation. The coal-mining leases with the Hopi Tribe and Navajo Nation provide that Peabody may produce up to 290 million tons of coal from the Navajo Lease Area (Lease 14-20-0603-8580) and up to 380 million tons of coal from the Hopi and Navajo Joint Mineral Ownership Lease Area (Leases 14-20-0603-9910 and 14-20-0450-5743) for a combined total of 670 million tons. While the specified leased coal tonnages are certain, the assignment of coal parcels to a particular buyer of the coal may change, depending on customer demand and coal-quality needs.



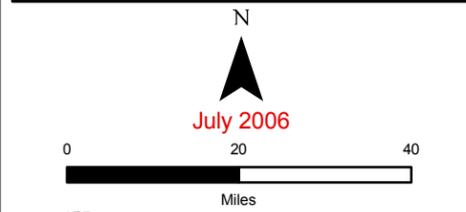
Map 1-1 Project Area

Black Mesa Project EIS

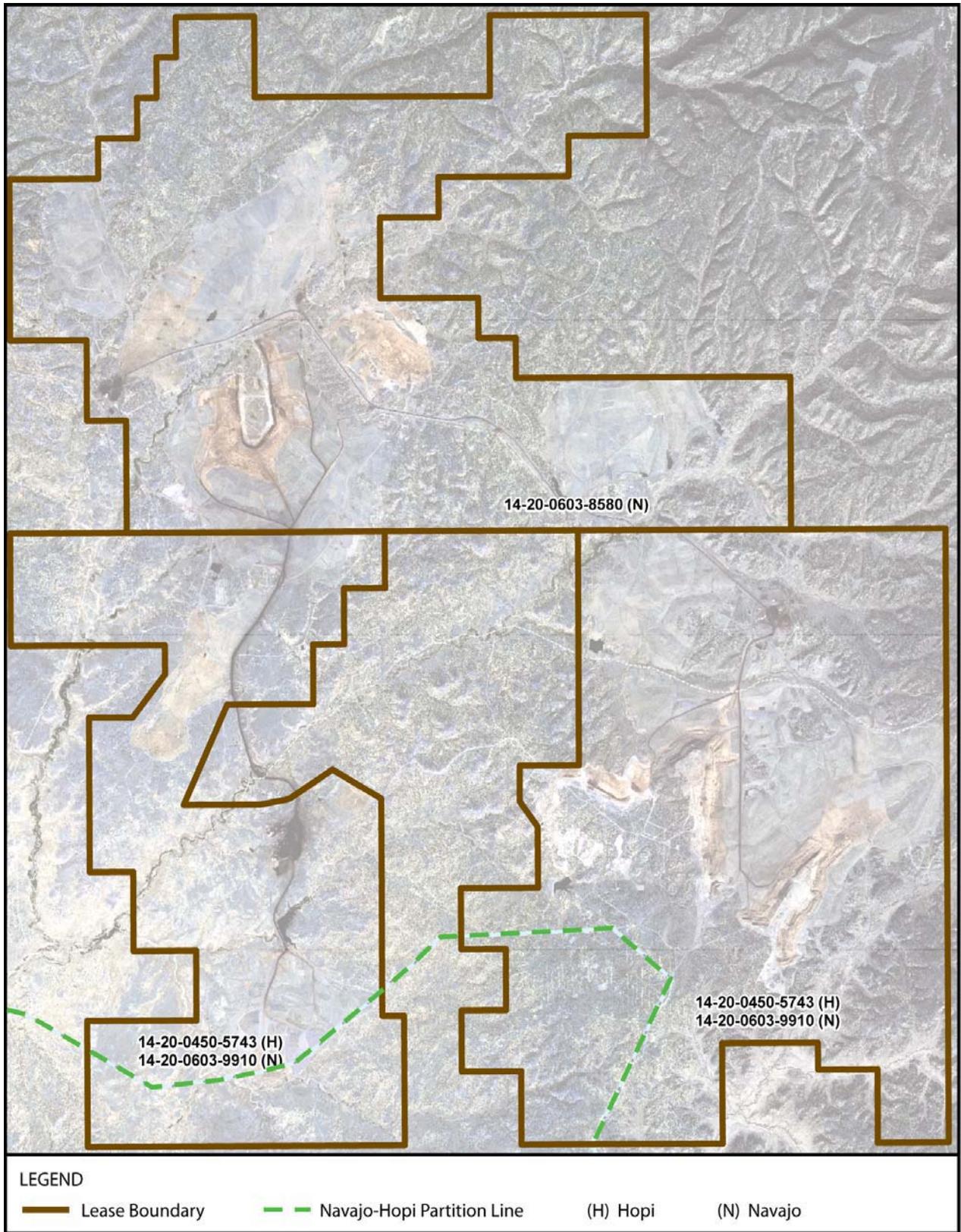
LEGEND

- Coal-Slurry Pipeline**
 - Existing Route
 - Realignments (Existing route with realignment/reroute is the preferred alternative)
- Proposed Water-Supply Pipeline**
 - Eastern Route (preferred alternative)
 - Subalternatives (preferred alternative)
 - Western Route
- Other Project Features**
 - C-Aquifer Well Field
 - PS = Pump Station
 - Peabody Lease Area
- Surface Management**
 - Bureau of Land Management
 - U.S. Forest Service
 - National Park Service
 - U.S. Fish and Wildlife Service National Wildlife Refuge
 - Bureau of Reclamation
 - American Indian Reservation
 - Military Reservations
 - State Trust
 - County, Park and Outdoor Recreation Areas
 - Private
- General Features**
 - River
 - Lake
 - Navajo Reservation Boundary
 - Hopi Reservation Boundary
 - State Boundary
 - County Boundary
 - Interstate/U.S. Highway/State Route

SOURCES:
URS Corporation 2005, 2006
Arizona State Land Department 2005
Teal Data Center 2000



Prepared By:
URS



Map 1-2 Lease Areas

The coal-mining leases provide Peabody rights to prospect, mine, and strip leased lands for coal and kindred products, including other minerals, except for oil and gas, as may be found. Peabody also is given the right to construct support facilities such as buildings, pipelines, tanks, plants, and other support structures; make excavations, opening, stockpiles, ditches, drains, roads, spur tracks, transmission lines, and other improvements; and to place machinery and other equipment and fixtures and do all other things on the leased lands necessary to carry on mining operations, including right of ingress and egress, and develop and use water for the mining operations including the transportation by slurry pipeline of coal mined from the leases.

There are several grants of rights-of-way and easements on Hopi and Navajo Nation lands allowing Peabody access and use of lands outside the existing coal-lease areas. These rights-of-way and easements include an overland conveyor; a coal-loading site; two parcels of land providing access for utilities, haul roads, maintenance roads, sediment-control ponds, and a rock-borrow area; and an electrical transmission line. More detailed description of the mine facilities is provided in Appendix A-1.

A complete coal-removal, preparation, and transportation system is in place and, though separate operations, the Kayenta and Black Mesa mining operations share some facilities and structures. Peabody has been supplying coal from the Kayenta mining operation to the Navajo Generating Station since 1973. The Black Mesa mining operation supplied coal to the Mohave Generating Station from 1970 to December 2005, when Peabody suspended mining operations due to suspension of operations at the Mohave Generating Station.

The Kayenta mining operation currently produces coal and reclaims land under OSM Permit AZ-0001D, originally issued in 1990 under OSM's permanent Indian lands program. Until December 2005, the Black Mesa mining operation produced coal and reclaimed land under OSM's initial regulatory program.²

On February 17, 2004, Peabody filed a permit revision application with OSM proposing several revisions to the LOM plans for the Kayenta and Black Mesa mining operations (LOM revision). Currently, the Kayenta mining operation is permitted to mine coal reserves that would last through 2026 at current production rates. Peabody is authorized to mine coal from the Black Mesa mining operation until such time that OSM makes a decision on the LOM revision that Peabody submitted to OSM. Approval of the LOM revision would allow the continued and increased mining of coal at the Black Mesa mining operation through 2026 and would facilitate the Kayenta mining operation by approving changes to the mine plan, including additional coal-reserve areas.

Each mining operation and the generating station it supplies are dependent on one another. The Kayenta mining operation is the sole coal supplier for the Navajo Generating Station, and the Navajo Generating Station is its sole customer. Likewise, the Black Mesa mining operation is the sole coal supplier for the Mohave Generating Station, and the Mohave Generating Station is its sole customer. Currently, the Kayenta mining operation continues to supply coal to the Navajo Generating Station while the Black Mesa mining operation is inactive until such time as the Mohave Generating Station resumes operations. At present, the Mohave Generating Station is not operating, pending installation of air-emissions-control equipment, which, for the purposes of this EIS, is estimated to be completed by January 1, 2010.

² Between 1990 and 2005, the Black Mesa mining operation occurred under OSM's initial regulatory program. Prior to 1990, Peabody had submitted a permanent program permit application to OSM for both the Kayenta and Black Mesa mining operations. In 1990, OSM approved an issued a permit for the Kayenta operation. Under the direction of the Secretary of the Interior, OSM administratively delayed its decision on the Black Mesa operation owing to concerns of the Hopi Tribe and Navajo Nation regarding use of Navajo-aquifer (N aquifer) water for coal slurry and mine-related purposes. Under this administrative delay, Peabody conducted the Black Mesa operation until December 2005, when mining operations ceased due to suspension of operations at the Mohave Generating Station.

Likewise, the Black Mesa mining operation is not producing coal, nor is coal being delivered from the Black Mesa mining operation to the Mohave Generating Station. Peabody has not indicated that any new customers, and the attendant increased production, are being considered at this time.

Under the Surface Mining Control and Reclamation Act of 1977 (SMCRA), OSM must make decisions on the LOM revision for the Black Mesa Complex. The primary decision options available to OSM are (1) approval of the LOM revision, (2) conditional approval of the LOM revision without approval of the Black Mesa mining operation, and (3) disapproval of the LOM revision. In making its decisions, OSM will consider issues associated with use of water from the N aquifer. Several other Federal agencies as well as the Hopi Tribe and Navajo Nation have authority and/or actions (decisions) to perform for the various proposals related to the mining operation or coal-delivery system from the Black Mesa mining operation to the Mohave Generating Station. These authorities and actions are summarized below and described in more detail in Section 2.3, Table 2-3.

Authorities and actions regarding Peabody's LOM revision include:

- OSM approval, conditional approval, or disapproval of Peabody's LOM revision;
- BIA and tribal approval of a right-of-way to Peabody for a coal haul-road transportation corridor;
- BIA and tribal approval of the use of C-aquifer groundwater;
- BLM approval of changes to Peabody's mining plan;
- U.S. Army Corps of Engineers (USACE) approval of modification of Peabody's Clean Water Act (CWA) Section 404 permit and USEPA (Hopi lands) and Navajo Nation Environmental Protection Agency (NNEPA) (Navajo lands) issuance of CWA Section 401 water-quality certification;
- USEPA and NNEPA approval of modifications of Peabody's National Pollutant Discharge Elimination System (NPDES) permit;
- USEPA approval of Peabody's notice of intent for coverage under the 2006 Multi-Sector General NPDES Permit for Storm Water;
- U.S. Fish and Wildlife Service (FWS) review of OSM's biological assessment and, if the action agencies enter into formal consultation, issuance of a biological opinion related to Section 7 of the Endangered Species Act (ESA);
- USEPA and NNEPA approval of a major modification of Peabody's Clean Air Act (CAA) Title V operating permit, or approval of a New Source Review (NSR)/Prevention of Significant Deterioration (PSD) permit, depending on the level of emissions associated with modification of the Black Mesa mining operation's coal handling facilities to accommodate washing coal; and
- OSM, BIA, BLM, and other Federal action agencies' consultation with the Hopi Cultural Preservation Office (HCPO), Navajo Nation Tribal Historic Preservation Officer (THPO), Arizona and Nevada State Historic Preservation Officers (SHPOs), and other tribes pursuant to Section 106 of the National Historic Preservation Act (NHPA) (Title 16, United States Code, Section 470f [16 U.S.C. 470f]).

Authorities and actions regarding BMPI's coal-slurry preparation plant permit application include:

- OSM approval or disapproval of BMPI's preparation-plant permit application;
- FWS review of OSM's biological assessment and, if the action agencies enter into formal consultation, issuance of a biological opinion related to Section 7 of the ESA; and

- OSM, BIA, BLM, and other Federal action agencies' consultation with the HCPO, Navajo Nation THPO, Arizona and Nevada SHPOs, and other tribes pursuant to Section 106 of the NHPA (16 U.S.C. 470f).

Authorities and actions regarding reconstruction of BMPI's coal-slurry pipeline include:

- BIA and tribal approval(s) of rights-of-way and permits;
- USACE issuance of a CWA Section 404 permit(s);
- USACE issuance of a River and Harbors Act Section 10 permit (Colorado River crossing);
- USEPA (Hopi lands), NNEPA (Navajo lands), and State (Arizona and Nevada) issuance of CWA Section 401 water-quality certification;
- FWS review of OSM's biological assessment and, if the action agencies enter into formal consultation, issuance of a biological opinion related to Section 7 of the ESA;
- OSM, BIA, BLM, and other Federal action agencies' consultation with the HCPO, Navajo Nation THPO, Arizona and Nevada SHPOs, and other tribes pursuant to Section 106 of the NHPA (16 U.S.C. 470f);
- BLM amendment of the existing right-of-way grant; and
- Forest Service amendment of the existing special-use permit for right-of-way.

Authorities and actions regarding the C aquifer water-supply system include:

- BIA and tribal approval(s) of rights-of-way, leases, and permits for the pipeline and associated facilities;
- BIA and tribal approval of well leases, drilling permits, and use of water;
- USACE issuance of CWA Section 404 permit(s);
- USEPA (Hopi lands) and NNEPA (Navajo lands) issuance of CWA Section 401 water-quality certification;
- BIA actions associated with tribal approvals of the use of tribal water;
- FWS review of OSM's biological assessment and, if the action agencies enter into formal consultation, issuance of a biological opinion related to Section 7 of the ESA; and
- OSM, BIA, BLM, and other Federal action agencies' consultation with the HCPO, Navajo Nation THPO, Arizona and Nevada SHPOs, and other tribes pursuant to Section 106 of the NHPA (16 U.S.C. 470f).

1.3 PROJECT LOCATION

The Black Mesa Project facilities are located in Navajo, Coconino, Yavapai, and Mohave Counties in northern Arizona, and a small part is located in the extreme southern tip of Nevada in Clark County (refer to Map 1-1). The Black Mesa Complex, which includes the Kayenta and Black Mesa mining operations, is located on about 65,219 acres of land leased within the boundaries of the Hopi and Navajo Indian Reservations near Kayenta in Navajo County, Arizona (about 125 miles northeast of Flagstaff, Arizona). Coal from the Kayenta mining operation is delivered by electric railroad 83 miles northwest to the Navajo Generating Station near Page in northern Coconino County, Arizona. Coal from the Black Mesa mining

operation is delivered via the 273-mile-long coal-slurry pipeline southwest to the Mohave Generating Station in Laughlin, Nevada.

The well field for the proposed C aquifer water-supply system would be located in the area of Canyon Diablo, south of Leupp in Coconino County, Arizona, on both the Navajo Indian Reservation and land owned by the Hopi Tribe. The C aquifer is a large aquifer system that encompasses more than 27,000 square miles in northern Arizona, and extends into northwestern New Mexico, Utah, and Colorado. From the well field, the 108-mile-long pipeline that would deliver water to the mining operations would travel northeast from the Diablo Canyon through Coconino and Navajo Counties and the Hopi and Navajo Indian Reservations to the Black Mesa Complex. The part of the N aquifer that has supplied the water for the coal slurry and continues to supply water for mine-related and domestic purposes is part of a larger area that encompasses an approximately 12,000-square-mile area and three hydrologic sub-basins.

1.4 RELATION TO OTHER DEVELOPMENT

1.4.1 Navajo Generating Station

The Navajo Generating Station is a coal-fired, steam electric-generating power plant that has a generating capacity of 2,250 megawatts from three 750-megawatt units. The first unit began producing electricity in 1974, and commercial operation of the other units began in 1975 and 1976. The power plant consumes 8.5 million tons of coal annually. The Black Mesa and Lake Powell Railroad, a 50,000-volt electric railroad, is a rail line dedicated to transporting the coal a distance of 83 miles from the Black Mesa Complex to the Navajo Generating Station.

The co-owners of the Navajo Generating Station are SRP (21.7 percent share and plant operator), Reclamation (24.3 percent share), Los Angeles Department of Water and Power (21.2 percent share), Arizona Public Service Company (14.0 percent share), Nevada Power Company (11.3 percent share), and Tucson Electric Power (7.5 percent share). The electrical power is used to serve residential, commercial, and industrial customers in Arizona, Nevada, and California. Also, the power supply is used to pump water through the Central Arizona Project, a 336-mile-long system that conveys water from the Colorado River to central Arizona for agricultural, commercial, and residential uses.

There are no proposals to modify the facilities or operation of either the Navajo Generating Station or the Black Mesa and Lake Powell Railroad that would require Federal approval. Therefore, the Navajo Generating Station is not part of the Black Mesa Project considered in this EIS. However, because approval by OSM of the LOM revision would enable the facility to potentially use coal from additional coal resource areas, a summary description of the impacts that would occur with the continued operation of the Navajo Generating Station is included in this EIS.

1.4.2 Mohave Generating Station

The Mohave Generating Station is a coal-fired, steam electric-generating power plant that produced electricity from 1970 until year-end 2005, when operation of the power plant was suspended. This facility, which has a generating capacity of 1,580 megawatts of power, was operated by SCE and, until new ownership arrangements are in place, is jointly owned by SCE (56 percent share), SRP (20 percent share), Los Angeles Department of Water and Power (10 percent share), and Nevada Power Company (14 percent share). The generating station has been and would continue to be important to the co-owners of the facility because of its dependability as a base source of power to the region and because it is fueled with coal, which is less expensive than natural gas.

In response to a lawsuit concerning air quality, the co-owners entered into a consent decree with the environmental organizations that filed the lawsuit. Under the consent decree, for the Mohave Generating Station to operate on coal beyond 2005, the co-owners would need to install new air-pollution-control technology on the plant (sulfur dioxide scrubbers, baghouses, and low nitrogen oxide burners). Under the terms of the consent decree, operation of the power plant was suspended on December 31, 2005, because the air-pollution-control technology had not been installed. For the purpose of this EIS, it is estimated that the new pollution-control technology will be installed and the plant will resume operation on January 1, 2010 at a cost estimated to exceed \$1 billion. This cost includes the purchase and installation of the new pollution-control and related equipment; reconstruction of the coal-slurry pipeline; and the development of an alternative water supply to replace the use of N-aquifer water for the slurry prepared at the coal-slurry preparation plant, for mine-related uses, and for the new coal-washing facility.

Construction activities at the Mohave Generating Station that are associated with the emission-control improvements do not require any Federal approvals. Environmental regulatory and statutory requirements affecting the Mohave Generating Station result in no requirement for Federal environmental review under NEPA for the reasons that follow:

- The USEPA has delegated NSR/PSD permitting authority to the State of Nevada. The Federal NSR/PSD regulatory requirements have been incorporated by reference in the Nevada Administrative Code along with state permitting requirements.
- The consent decree project underwent a PSD applicability determination in approximately December 2001, resulting in a determination by the Nevada Department of Environmental Protection (NDEP) Bureau of Air Pollution Control that no significant increase of PSD-regulated air pollutants will occur as a result of the project.
- As a result of the determination that PSD was not applicable, a PSD permit was not required by the NDEP under the authority delegated by USEPA Region 9.
- Instead, the consent decree project was granted authorization to construct (an authority or permit to construct) by NDEP and USEPA approval of a Class I-B Minor Revision of Mohave Generating Station's CAA Title V Operating Permit on February 28, 2002.
- Under Nevada Administrative Code (NAC445), no environmental assessment of the consent decree project was required.

Similarly, the decision on whether or not the Mohave Generating Station should resume operations and continue to operate is beyond the scope of OSM's and the cooperating agencies' decision-making and therefore is not considered in this EIS. Any resumed operations prior to 2010 using the current coal-supply system under existing permits also is beyond the scope of OSM's and the cooperating agencies' decision-making and is therefore not considered in this EIS. However, since the Mohave Generating Station would operate in the future only if OSM approves the LOM revision, Section 4.22 of this EIS includes, where appropriate, summary information about the impacts associated with resumed operation of the Mohave Generating Station in January 2010. Information on such impacts also is included in the Preliminary Environmental Assessment for the Mohave Generating Station Continued Operation Potential Project, prepared as directed by the California Public Utilities Commission Administrative Law Judge (Commission Proceedings A.02-05-046).

1.5 ISSUES IDENTIFIED THROUGH SCOPING

1.5.1 Scoping

OSM has a responsibility to solicit comments from the public regarding the proposed project and to consult with relevant Federal and State agencies, local governments, and federally recognized American Indian tribes. Scoping is a process that invites public input on the proposed project early in the NEPA process to help determine the scope of issues to be addressed and identify the significant issues related to the proposed action. OSM concurrently carried out the NEPA scoping process and administrative public participation process for Peabody's LOM revision pursuant to the SMCRA. For the convenience of the public, which has an interest in both processes, OSM held public meetings with the dual purposes of obtaining comments that would help define the scope of the EIS and holding informal conferences on Peabody's revision application. Accordingly, OSM considered the comments made by members of the public during the meetings and in writing to be relevant to both the EIS and the permit application processes.

OSM's notice of intent to prepare an EIS was published in the Federal Register on December 1, 2004. This marked the beginning of the scoping period for the Black Mesa Project EIS. The notice of intent indicated the scoping period, required to be a minimum of 30 days, would end on January 21, 2005. OSM solicited comments from relevant agencies and the public and held eight scoping meetings in January 2005. At the request of the public, OSM extended the scoping period and held two additional scoping meetings in February 2005. A second notice was published in the Federal Register on February 4, 2005, announcing the additional meetings and the extension of the scoping period to March 4, 2005. Comments received during the scoping period were analyzed and documented in the Black Mesa Project Scoping Summary Report issued in April 2005. By the end of the scoping comment period, OSM had received 237 statements made by speakers at public meetings and 351 written or electronically mailed submissions. In addition to these, more than 2,000 form letters regarding the LOM revision were received.

1.5.2 Summary of Issues

The comments received during scoping from agencies and the public generally were related to one of three major topics—actions and alternatives, environmental impacts, and process concerns. A summary of the comments, organized by the three major topics and subsidiary issue categories, is provided below. The summary is followed by Table 1-1, which is a list of issues derived from the scoping comments and where each issue is addressed in the EIS.

1.5.2.1 Actions and Alternatives

Concerns about a potentially diminishing water supply were expressed in many of the comments received from the public regarding the Black Mesa Project, and reflected a broader concern that the project may cause irreparable injury to "Mother Earth." The project's perceived effects on the natural balance of the area is seen by some as a challenge to traditional American Indian culture, and viewed by some as further evidence of the perceived insensitivity of the dominant culture towards traditional lifeways. The scarcity of water in a desert environment, coupled with this concern, generated public interest in investigating alternatives to the current method of transporting coal from the Black Mesa mining operation to the Mohave Generating Station. Operation of the coal-slurry pipeline is viewed by some as an unnecessary use of water resources and having potential repercussions for other water users and future generations. This concern was raised by some local community members who claim—by tradition and belief—attachment to the land and the ecosystem, and feel the need to exercise vigilance regarding local water resources that have supported Hopi and Navajo communities for generations. Suggested alternatives regarding water use fell into two major categories: (1) discontinue use of the coal-slurry pipeline and use alternate methods, such as railway or trucks for coal transportation; and (2) use a water alternative for

coal slurry or a source of water other than the N aquifer. The C aquifer has been identified as a possible alternative water source. Some commenters raised similar questions about use of the C aquifer, including a concern about potential impacts on local wells drawing from the C aquifer. In a letter from the Hopi Tribe, preference was expressed to use C-aquifer water if this alternative source proves to be viable. As a solution to the as yet undetermined impacts on the area's groundwater sources, the use of energy sources other than coal at Mohave Generating Station also was suggested. Alternative energy was a solution offered by those who fear the prospect of a changing environment.

Many believe that use of the C aquifer and/or the N aquifer would turn out to be unsustainable, and promoted use of alternative methods of coal delivery. In consideration that rail or truck transport may be found preferable, other issues were raised, such as potential impacts on property rights and public safety associated with overland truck and rail routes. Potential impacts on land uses were also a concern regarding both reconstruction of the coal-slurry pipeline and the water-supply pipeline route (from the C aquifer well field to the Black Mesa Complex). Others voiced concern about the potential loss of the local-community water supply currently provided by the N aquifer wells within Peabody's lease area, should use of N aquifer water be discontinued. Potential installation of a new C aquifer water-supply system raises the potential for use of that system to expand the current use of C-aquifer water to local tribal communities for municipal and industrial purposes. Some recommended upsizing the pipeline and installing lateral pipelines for that purpose.

1.5.2.2 Environmental Issues

The environment and the human community within that natural environment were of particular concern to the Hopi and Navajo communities, where a preference for traditional lifestyles by many in the community is closely linked to the natural world. The issue of water—especially the use of groundwater for the coal-slurry pipeline and the proposed coal-washing facility—dominated public discussion about the natural environment. Water-quantity concerns in part derive from decreasing water levels in wells in recent years and from the belief on the part of some commenters that sinkholes are being caused by decreasing groundwater levels. Water-quality concerns derive from fears regarding potential pollution from mining. Commenters also expressed concerns about the competing user demands on the N and C aquifers and whether the aquifers can support domestic, agricultural, municipal, and industrial uses, as well as Black Mesa coal mining and delivery operations. Drought adds to these concerns. Several commenters were concerned about the design and implementation of hydrologic studies to be conducted on the C aquifer. Another concern was raised about the adequacy of previous assumptions and groundwater modeling of the area, especially with the prospect of long-term drought. Surface water was also a concern. Some believe that the flow in the Moenkopi Wash has fallen from historically higher levels, and some suggest the impoundments created by Peabody to control sediment were the cause. Additional hydrologic study on impoundment effects was recommended. Potential interference in all water sources was a concern regarding impacts on local endangered species and riparian habitats.

Comments reflected deep respect for water as a source of life and a corresponding apprehension that the project would cause profound, hidden damage to local water sources, and thus to local culture. Water is essential to the culture of the Hopi and Navajo people. Traditional occupations such as farming and livestock raising depend on water. Free-flowing springs play a prominent role in various religious practices by both tribes and support the habitat of certain native plants used for medicinal and ceremonial purposes. Commenters expressed concern that interference with a traditional way of life would not be well tolerated by some people in the local communities and would be a cause of distress to those people in the area. The perception of industrial facilities as “a blight” on the landscape and incompatible with the indigenous culture is a view shared by some community members. At the same time, however, others, including government entities, welcome the economic benefits the mine operations bring to the community and expressed concern about the prolonged or permanent loss of jobs and other basic benefits

such as heating and potable water supply should the mining operations be interrupted or not resume. The skill involved in difficult and often dangerous mining jobs is also a source of pride for some and therefore a component of local culture. The prospect of the separation of family members as the potentially unemployed mine workers seek employment elsewhere is a worry for some, and the potential permanent closure of the mining operations is viewed as a danger to community cohesion. The effect of a loss of coal royalties on area schools and other educational programs is a related concern. Opinions are divided about traditional lifestyles versus acceptance of “mainstream” lifestyles and economic pursuits—the mining operations seem to be at the center of this debate.

A few residents living within the mine lease area who have chosen not to relocate or are living close to the Black Mesa mining operation say they have poor health, as a result of asthma and black lung disease, and consider it to be the result of air pollution from coal mining. Some urged that health care studies be a part of the EIS, and others promoted the use of alternative energy sources that would have less potential of affecting health. Concern about air quality extends to concern about the project’s potential effects on global warming. Skepticism about the cost/benefit ratio of the Black Mesa Project for the local community grew out of a perception of past injustices. Health issues, issues of environmental justice, and issues of violated trust are concerns of some members of the community who expressed wariness about information offered in this EIS. There is a corresponding call to keep elders in the discussion and to make every effort to adequately address issues important to local Hopi and Navajo communities.

1.5.2.3 Process Concerns

The issue of fairness was frequently at the center of process concerns. Many felt that, in order to accomplish equitable decisions about the proposed project, the local community should be more involved in the decision-making process. Suggestions included the extension of the scoping period (which was subsequently extended to March 4, 2005), a repeat of one scoping meeting at the Forest Lake Chapter that had limited attendance due to bad weather (which was done), larger meeting facilities for the Flagstaff meetings, broader notification of meetings, expansion of both the quality and quantity of available information, and translations of project materials and reports into the Hopi and Navajo languages. Effective collaboration and communication among stakeholders was also a theme—the desire to find common ground among stakeholders with different objectives.

Navajo members of the Leupp Chapter expressed frustration that the Leupp Chapter resolution against use of the C aquifer had not been accepted by the Navajo Nation Tribal Council. This frustration, for some, extends to other positions taken by its tribal council. A number of residents of the Black Mesa area object to the practice of depositing the coal royalty and lease payments into the tribal general fund, without due consideration of the disproportionate impact burden they bear as direct neighbors of the mine. They feel they should receive more compensation.

Table 1-1 Issues Raised by the Public and by Government Agencies

Issues	Section(s) of the EIS Where Addressed ¹
Actions and Alternatives	
Consider use of trucks to transport coal from the Black Mesa Complex to the Mohave Generating Station.	2.4.5.1, Appendix D
Consider use of rail to transport coal from the Black Mesa Complex to the Mohave Generating Station.	2.4.5.2, Appendix E
Consider use of the C aquifer instead of the N aquifer for water supply.	2.2.1.2
Consider a medium other than water as a coal-slurry medium.	2.4.5.3
Consider an alternative coal-slurry pipeline alignment to the south of Kingman, instead of building in the existing right-of-way.	2.2.1.1.2, 3.0, 4.0
Consider a C aquifer water-supply pipeline alignment that traverses only Navajo lands.	2.2.1.2.1.2.2, 3.0, 4.0
Consider a C aquifer water-supply pipeline alignment that avoids the developed Kykotsmovi area.	2.2.1.2.1.2.2, 3.0, 4.0

Table 1-1 Issues Raised by the Public and by Government Agencies

Issues	Section(s) of the EIS Where Addressed¹
Use alternative fuel sources, such as solar energy, instead of continuing operation of Mohave Generating Station.	2.4.7
Need to conduct comprehensive hydrologic studies of aquifers relative to the proposed use.	3.4, 4.4, 4.4.1.3, Appendix H
Water Resources	
Impacts of groundwater withdrawals on springs, in the context of biological resources.	4.7.1.3
Impacts of groundwater withdrawals on springs, as related to ceremonial, sacred, and religious resources.	3.10, 3.10.4.1, 4.10, 4.10.1.3
Impacts of groundwater withdrawals on land subsidence and sinkhole creation.	4.4.1.3, Appendix H
Impacts of groundwater withdrawals on wells.	4.4.1.1.2
Impacts of groundwater withdrawals on availability of water for agriculture and grazing.	4.4.1.1
Impacts of C-aquifer groundwater withdrawals on water supplies for future northern Arizona municipal and industrial use.	4.4.1.3
Impacts of surface-water impoundments on availability of water for agriculture and grazing.	4.4.1.1.1
Impacts of surface-water impoundments on downstream flows.	4.4.1.1.1
Impacts of the project on water rights.	1.1, 2.4.3.3
Impacts on water quality, as it relates to human consumption of groundwater supplies.	4.4
Impacts of surface-water impoundments on water quality.	4.4.1.1.1
Cumulative impacts of the project on groundwater and surface-water supplies, including the effects of the current drought.	4.24
Biological Resources	
Impacts on threatened and endangered species.	3.7, 3.8
Impacts on native plants used for ceremonial reasons.	3.7.1.4, 3.7.2.1.5, 4.7, 4.8
Impacts of the project, and of reclamation plans, on grazing.	3.9, 4.9
Air Quality	
Impacts of mining on air quality.	3.6, 4.7
Impacts of Mohave Generating Station on air quality.	4.23
Impacts of Mohave Generating Station on global warming (cumulative air quality effects).	4.5, 4.23
Land Use	
Impacts of mining on local land uses.	3.9.1, 4.9
Impacts of existing coal-slurry pipeline alignment on land development opportunities in the Kingman area.	3.9.2, 4.9.1.2
Impacts of C-aquifer water pipeline on land uses along the alignment.	2.2.1.2.1, 3.9.3.2
Impacts of mined land reclamation on future land uses.	3.9.1, 4.9.1
Aesthetics	
Impacts of mining on the visual (and spiritual) landscape.	3.14
Public Health and Safety	
Impacts of mining on health of local residents.	3.11
Impacts of operations on mine worker health and safety.	3.11.2.7, 4.6.5, 4.11.1.1
Impacts of mining on soil selenium levels.	3.3.1, 4.3.1.1.1
Social and Economic Conditions	
Impacts of continuing or discontinuing mining on tribal income.	3.11, 3.12, 4.11, 4.12
Impacts of continuing or discontinuing mining, pipeline, and power plant operations on jobs and employment.	3.11, 3.12, 4.11, 4.12
Impacts of discontinuing mining on local benefits and support provided by Peabody.	3.11, 3.12, 4.11, 4.12
Impacts of discontinuing mining on tribal scholarships and educational programs currently supported by Peabody and mining income.	3.11, 3.12, 4.11
Impacts of relocations of local residents to accommodate mining operations in expanded mine area.	3.9, 3.12, 4.8, 4.11

Table 1-1 Issues Raised by the Public and by Government Agencies

Issues	Section(s) of the EIS Where Addressed ¹
Environmental Justice	
Impacts of the project on American Indian lands and people.	3.11, 3.12, 4.11, 4.12
Concern about proper and fair compensation for resources used.	3.11, 4.11
Concern about fairness of using tribal resources for convenience of nontribal communities.	3.11, 3.12, 4.11, 4.12
Community Values and Traditional Knowledge, Cultural Resources	
Impacts of the project on natural resources (Mother Earth).	3.10, 4.9
Concern about the inherent value of water to human existence.	3.4, 4.4
Impacts on religious, sacred, and ceremonial resources such as water and native plants.	3.10, 3.10.4
Impacts on the American Indian traditional way of life, including agriculture (Hopi) and grazing (Navajo).	3.10, 4.10
Impacts on the availability of jobs, which provide dignity, a future for one's children, and a means of remaining near one's family.	3.11, 3.12, 4.11, 4.12
Impacts on archaeological and historical resources.	3.10, 4.10
Impacts on traditional cultural properties.	3.10, 4.10
EIS Process Concerns	
Should hold meetings in many locations.	1.4, 5.0
Should provide project-related materials in American Indian languages.	5.4.2
Should undertake and continue government-to-government relations with tribes.	5.0
Should make sure that the effort is collaborative, bringing everyone together for discussions and decisions.	5.0
Should consult with tribal elders in conducting data collection and impact assessments.	5.0

NOTE: ¹ Sections that provide background information that assist in understanding the issues, concerns, and/or impacts are listed.

ALTERNATIVES

2.0 ALTERNATIVES

This chapter presents the alternatives that are being considered to carry out the proposed actions. The process by which these alternatives were developed, and also alternatives that were considered initially but have been eliminated from detailed study in this EIS, are described.

As indicated in Chapter 1, the purpose of this EIS is to analyze and disclose the effects of OSM's action on the LOM revision for the Kayenta and Black Mesa mining operations, as well as the effects of other Federal actions that are related to the delivery of coal from the Black Mesa Complex to the Navajo and Mohave Generating Stations. Section 2.1 provides a description of the components that make up the Black Mesa Project. Section 2.2 provides a description of the alternatives that are being considered and evaluated in this EIS. Section 2.3 provides a summary of potential decisions or actions that are required by various Federal agencies before the proposed project can be implemented. Section 2.4 provides a description of the alternatives that were considered initially but eliminated from detailed study in this EIS.

2.1 BLACK MESA PROJECT COMPONENTS

The elements of the LOM revision that are associated with mining operations at the Black Mesa Complex are described in this section. Also described are the remaining components that make up the Black Mesa Project; that is, coal-slurry preparation plant, C aquifer water-supply system, and reconstruction of the coal-slurry pipeline. Some of these components themselves have alternative scenarios that are being considered, which are explained further, as applicable, in Section 2.2.

2.1.1 LOM Revision and Mining Plan Changes

Peabody's permit application proposes revisions to the LOM mining plans for the Black Mesa Complex. The application includes changes to the mine plan and contains some relatively minor changes to the Kayenta mining operation, several major elements related to the Black Mesa mining operation, and updated environmental baselines and hydrologic analyses, as described below. Mine plan areas are shown on Map 2-1. Table 2-1 is a list of coal resource areas and their status as it pertains to mining and reclamation. Coal-mining techniques and mine reclamation are described in Appendix A-1. Related to both mining operations, Peabody would obtain a separate and additional off-lease right-of-way from the Hopi Tribe to construct a coal-haul road as a support facility for continued mining at the Black Mesa Complex (Map 2-2). The roadway would be approximately 500 feet wide and approximately 2 miles long (about 127 acres), and would cross lands within the Hopi Reservation.

2.1.1.1 Kayenta Mining Operation

The Kayenta mining operation currently is authorized under a permanent Indian Lands Program permit originally issued by OSM in 1990 (OSM Permanent Program Permit AZ-0001D). The Permanent Program Permit AZ-0001D is an LOM permit renewable at 5-year intervals and has been renewed on three occasions: 1995, 2000, and 2005. The current permit area is 44,073 acres (Map 2-3). The Kayenta mining operation produces about 8.5 million tons of coal per year, all of which are delivered to the Navajo Generating Station. The LOM revision would allow changes to the operation and reclamation plans for the Kayenta mining operation. About 928 af/yr of water, used for mine-related purposes, is currently withdrawn from the N aquifer. Water from the proposed C aquifer water-supply system would replace, for the most part, the use of N-aquifer water. The LOM revision would not change the mining methods or the average annual production rate of the Kayenta mining operation.

2.1.1.2 Black Mesa Mining Operation

The Black Mesa mining operation is conducted in accordance with OSM's Initial Program under an administrative delay of OSM's permanent Indian Lands Program permitting decision instituted in 1990 by the Secretary of the Interior (refer to Map 2-3). The administrative delay was imposed due to the concerns of the Hopi Tribe and Navajo Nation regarding use of N-aquifer water for the coal slurry and mine-related purposes. OSM's permanent-program permitting decision on the Black Mesa coal-slurry preparation plant, an independent operation adjacent to the Black Mesa Mine main facilities, also is under an administrative delay for the same reasons.

If OSM approves the LOM revision for the Black Mesa Complex, the 18,984 acres where the Black Mesa mining operation has been conducted would be added to the 44,073 acres in the existing OSM permit area. The Black Mesa Complex permit area would total 63,057 acres including the 127 acres (2 miles long, 500 feet wide) for the proposed coal-haul road right-of-way. If approved, the permit area would not distinguish between the Kayenta mining operation and Black Mesa mining operation; they would be considered one operation for the purpose of regulation by OSM.

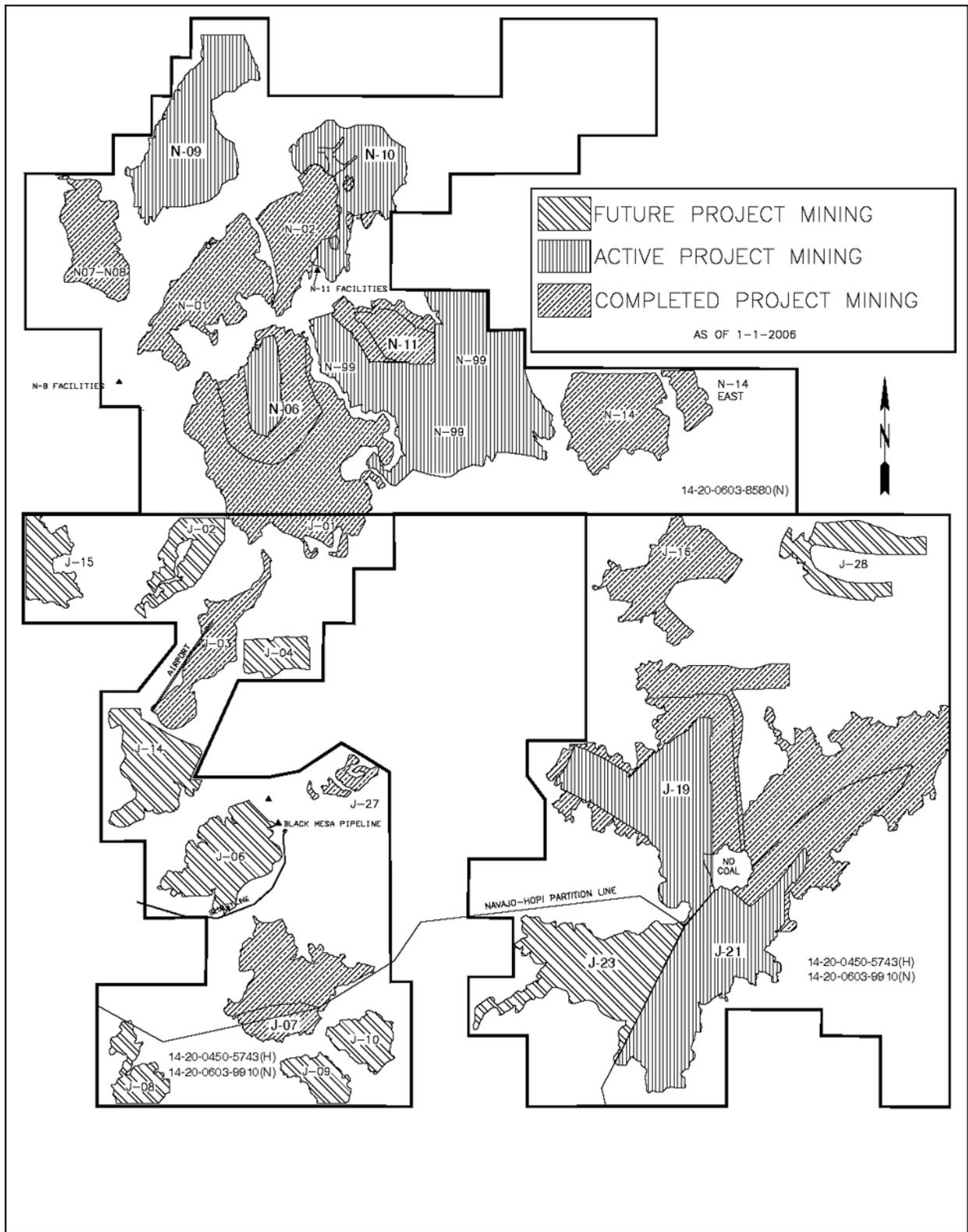
Until its suspension in December 2005, the Black Mesa mining operation produced about 4.8 million tons of coal annually, all of which were delivered to the Mohave Generating Station. The LOM revision would allow the Black Mesa mining operation to continue through 2026 under a permanent Indian Lands Program permit. The LOM revision does not propose to change the Black Mesa mining methods, but would increase the average annual production rate of the Black Mesa mining operation to about 6.35 million tons per year.

A new coal-washing facility (refer to Map 2-2) would be constructed adjacent to the existing Black Mesa coal-preparation facilities and operated as part of the Black Mesa mining operation to meet the anticipated future coal-quality requirements of the Mohave Generating Station. The coal-washing facility would use about 500 af/yr of C-aquifer water and would remove about 0.95 million tons per year of coal-processing refuse (earth material), resulting in about 5.4 million tons per year of washed coal being crushed and mixed with water at the coal-slurry preparation plant, and transported to the Mohave Generating Station through the coal-slurry pipeline. The estimated 0.95 million tons per year of coal-processing refuse would be returned by end-dump trucks to designated mine pits (N-06 and J-23) for disposal. Peabody would develop (and submit for regulatory approval) a refuse sampling and disposal plan that would be incorporated in the mining permit. No refuse piles or coal-mine-waste impoundments are proposed.

The LOM revision proposes actions to minimize the use of N-aquifer water, the use of which has resulted in the administrative delay in permitting the Black Mesa mining operation and the Black Mesa coal-slurry preparation plant. Under the preferred alternative, about 672 af/yr of water from the proposed C aquifer water-supply system would be used to replace much of the N-aquifer water used by the Black Mesa mining operation; C-aquifer water also would be used for the coal-washing facility. The proposed C aquifer water-supply system is described in more detail in Section 2.2.1.2.1. Up to 500 af/yr of water from the N aquifer would continue to be pumped to maintain operation of the N-aquifer wells. This water would be used in mining operations and to provide water to local residents.

2.1.1.3 Updated Baselines and Analyses

As part of the LOM revision permit application, new environmental baseline information was submitted for coal-resource areas within the existing lease area (coal-resource areas N-10, J-02, J-04, J-06, J-08, J-09, J-10, J-14, J-15, and J-28) (refer to Map 2-1) to augment the existing environmental baseline information contained in the currently approved permit application and the environmental monitoring data collected since the OSM permit was issued in 1990. Also, the LOM revision permit application provides updated discussion of hydrologic consequences of mining.



Map 2-1 Mine Plan Areas

Table 2-1 Coal Resource Areas and Mining Status¹

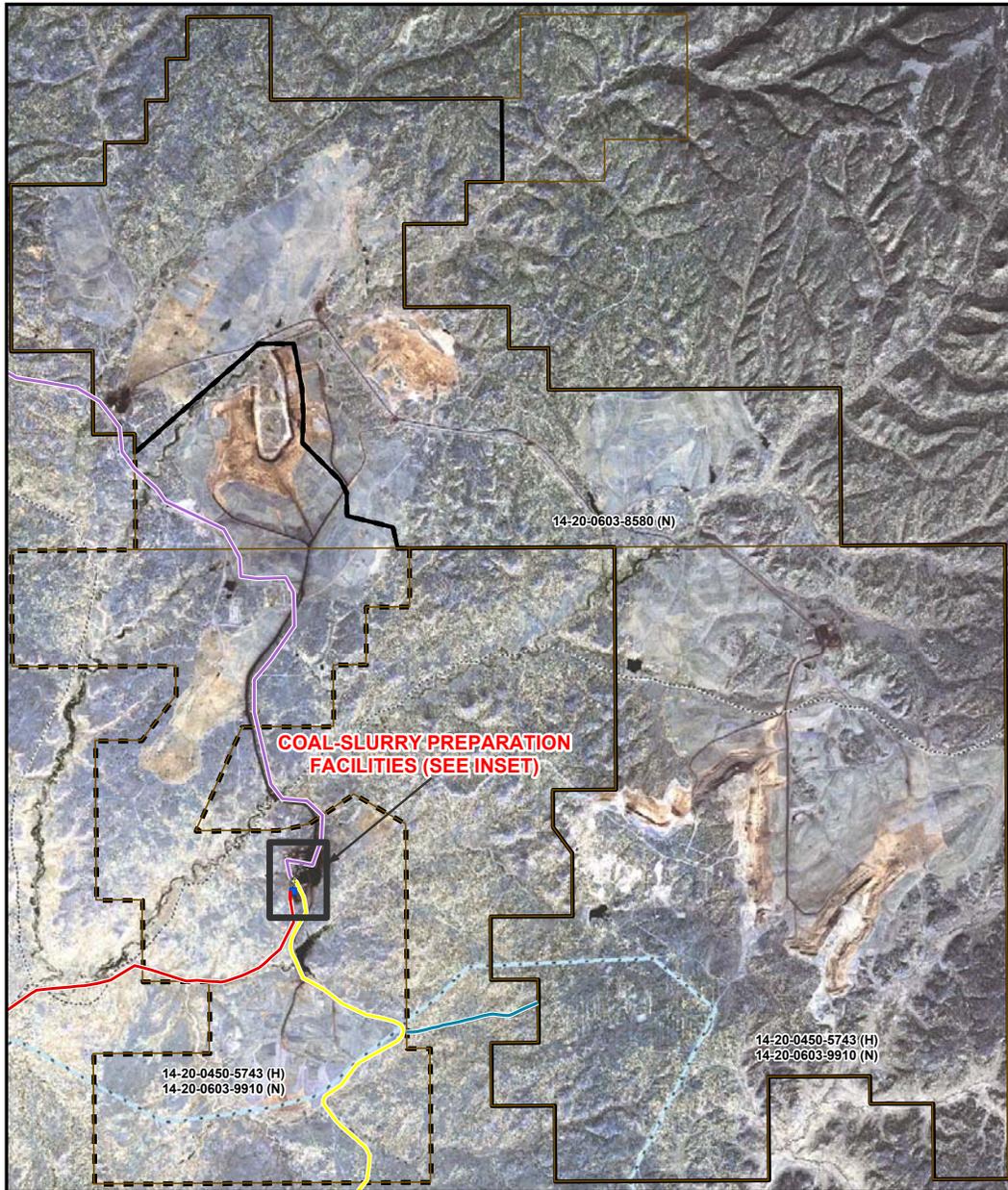
Coal Resource Area	Total Acres of Unit²	Mining and Reclamation Status
N-01	370	Mined and reclaimed
N-02	700	Mined and reclaimed
N-06	2,870	Active mining and reclamation in 970 acres, 1,730 acres reclaimed, 170 acres proposed to be mined and reclaimed in the future ³
N-7/8	920	Mined and reclaimed
N-09	2,170	Active mining and reclamation on 20 acres, 0 acres reclaimed, 2,150 acres to be mined and reclaimed in the future ³
N-10	1,790	Active mining and reclamation in temporary cessation; 50 acres disturbed, 130 acres reclaimed, 1,610 acres to be mined and reclaimed in the future ³
N-11	740	Mined and being reclaimed, 170 acres reclaimed, 570 acres in reclamation, no additional areas to be mined in the future ³
N-14	1,530	Mined and reclaimed
N-99	3,880	Undisturbed, to be mined and reclaimed in the future
J-01	480	Mined and reclaimed
J-02	900	Undisturbed, proposed to be mined and reclaimed in the future
J-03	120	Mined and reclaimed
J-04	520	Undisturbed, proposed to be mined and reclaimed in the future
J-06	1,220	Undisturbed, proposed to be mined and reclaimed in the future
J-07	1,050	Mined and reclaimed
J-08	730	Undisturbed, proposed to be mined and reclaimed in the future
J-09	470	Undisturbed, proposed to be mined and reclaimed in the future
J-10	430	Undisturbed, proposed to be mined and reclaimed in the future
J-14	950	Undisturbed, proposed to be mined and reclaimed in the future
J-15	730	Undisturbed, proposed to be mined and reclaimed in the future
J-16	1,230	Mined and reclaimed
J-19	3,910	Active mining and reclamation in 1,670 acres, 990 acres reclaimed, 1,250 acres to be mined and reclaimed in the future ³
J-21	5,280	Active mining and reclamation in 1,190 acres, 2,260 acres reclaimed, 1,830 acres to be mined and reclaimed in the future ³
J-23	2,500	Undisturbed, proposed to be mined and reclaimed in the future
J-27	50	Mined and reclaimed
J-28	1,440	Undisturbed, proposed to be mined and reclaimed in the future

SOURCE: Peabody Western Coal Company 2006

NOTES: ¹ In addition to the coal resource areas, about 4,100 acres are disturbed by actively used long-term support facilities including haul roads, other primary roads, coal handling areas, conveyors, railroad loading facilities, storage areas, shops, offices, and other structures and facilities. About 100 additional acres are proposed to be disturbed by construction of a haul road between the J-23 coal resource area and the coal-slurry preparation plant. The proposed coal-washing facility site is within an area currently disturbed by actively used long-term support facilities.

² Approximate acres subject to OSM regulation—areas mined before the effective date of the SMCRA (December 13, 1977), totaling approximately 2,760 acres, are not included.

³ Approximate acres on January 1, 2006.



COAL-SLURRY PREPARATION FACILITIES

Map 2-2

Black Mesa Mine Complex and Facilities

Black Mesa Project EIS

LEGEND

- Coal-Slurry Pipeline**
- Existing Route
 - (Existing route with realignment/reroute is the preferred alternative)
- Proposed Water-Supply Pipeline**
- Eastern Route (preferred alternative)
 - Western Route
 - Proposed Coal-Haul Road
- 14-20 Peabody Lease Area and Number
- Navajo Mining Operation Area (permanent permit)
- Black Mesa Mining Operation Area (currently unpermitted)
- Black Mesa Pipeline, Inc. Lease Area

General Features

- Navajo Reservation, Chapter Boundary
- Hopi Reservation Boundary

SOURCES:
URS Corporation 2005, 2006
Peabody Energy 2006
DigitalGlobe Incorporated 2003

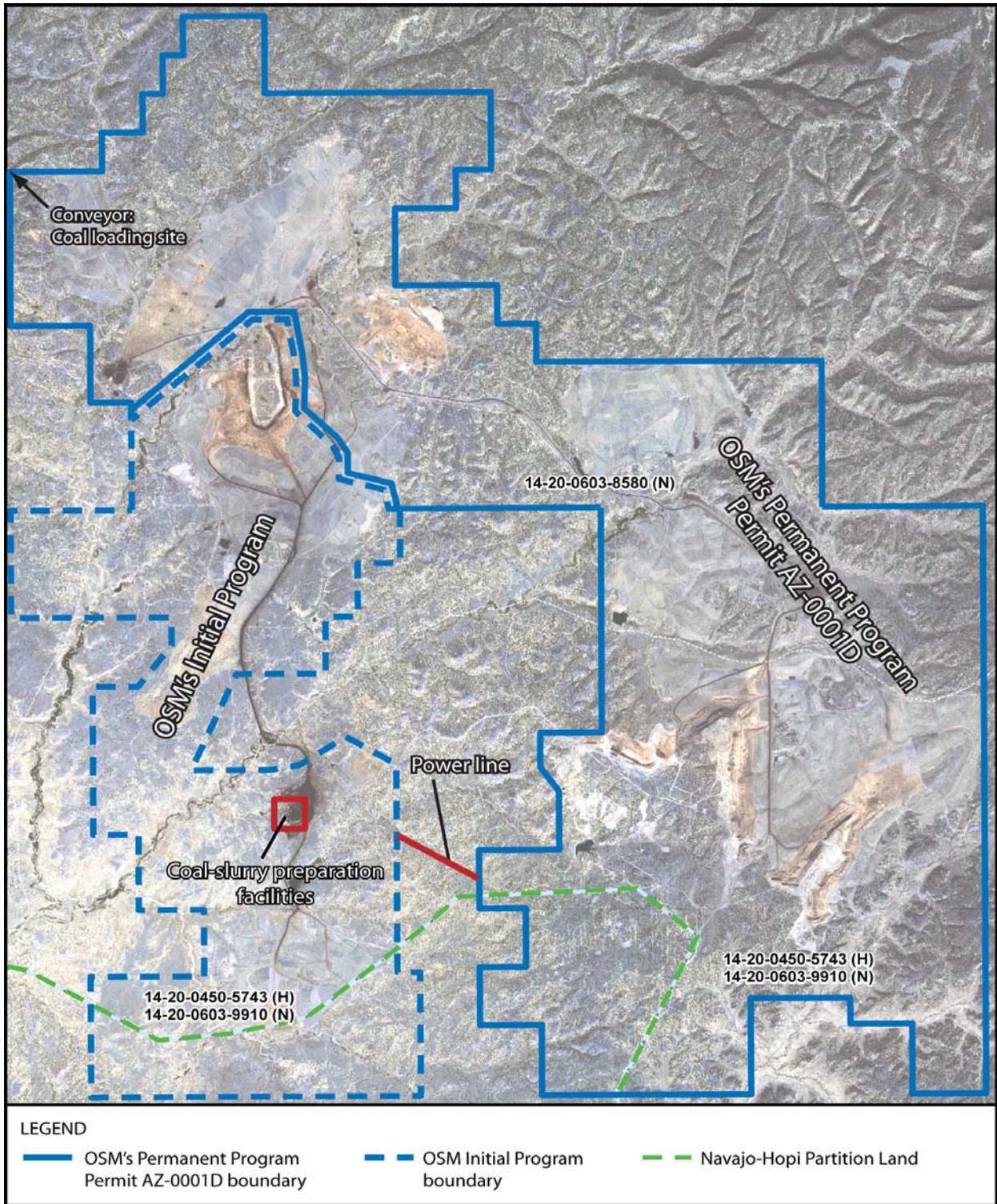
N



July 2006



Prepared By:
URS



**Map 2-3 Black Mesa Complex:
OSM's Initial and
Permanent Programs**

2.1.1.4 Coal-Slurry Preparation-Plant Permit

The coal from the Black Mesa mining operation is prepared at the coal-slurry preparation plant for transportation through the coal-slurry pipeline to the Mohave Generating Station (refer to Map 2-2). BMPI, owner and operator of the coal-slurry preparation plant and coal-slurry pipeline, leases a 40-acre parcel of land from both the Hopi Tribe and Navajo Nation (two leases) upon which the coal-slurry preparation plant was constructed in 1969. The land is located in Section 15, Township 32 North, Range 18 East and is about 6,470 feet in elevation (U.S. Geological Survey [USGS] 7.5-minute quadrangle, Great Springs, Arizona 1972, photorevised 1982). The preparation plant and associated facilities are located at the coal-slurry pipeline portal, directly southwest of Peabody's Black Mesa coal stockpiles and coal-handling facilities. BMPI's facilities consist of several small buildings and shops, a power substation, a sewage-treatment plant, and the main coal-slurry facilities and pumps. Directly south of the above-ground structures are several constructed ponds and catchments for waste water.

BMPI submitted a permanent Indian Lands Program permit application (preparation-plant permit application) to OSM in 1988 for operation of the plant. Like the Black Mesa mining operation, OSM's decision on the preparation-plant permit application was delayed due to issues associated with the use of N-aquifer water. On January 3, 2005, BMPI submitted a revised permit application to OSM, which was determined to be administratively complete. The proposed continuation of the preparation plant operations was included for consideration in the public review and comment period as a part of scoping for the Black Mesa Project. Under the proposed action, about 3,700 af/yr of water would be used to transport about 5.4 million tons of coal to the Mohave Generating Station. Only minor modifications, if any, to the current configuration of the coal-slurry preparation plant would be needed to handle this increase.

2.1.2 Reconstruction of the Coal-Slurry Pipeline

Until December 2005, the coal from the Black Mesa mining operation was transported by BMPI via a coal-slurry pipeline from the Black Mesa Complex to the Mohave Generating Station, a distance of approximately 273 miles (refer to Map 1-1). The pipeline passes through five counties—Navajo (approximately 25 miles), Coconino (approximately 145 miles), Yavapai (approximately 26 miles), and Mohave (approximately 76 miles) Counties in Arizona, crosses under the Colorado River, and terminates at the generating station in Clark County, Nevada (approximately 1.5 miles). The pipeline crosses the Hopi and Navajo Reservations, as well as Federal, State, local government, and private lands (Table 2-2).

Table 2-2 Approximate Miles Crossed by the Black Mesa Coal-Slurry Pipeline, by Surface Manager or Owner

Surface Management or Ownership	Miles
Hopi	35
Navajo	61
Bureau of Land Management	14
U.S. Forest Service – Kaibab National Forest	5
Arizona State Trust	66
Private (including county and municipal lands)	92

SOURCES: Arizona Land Resource Information System 2002; Black Mesa Pipeline, Inc. 2005

The coal-slurry pipeline is buried. Pipeline reconstruction would involve burying a new pipeline adjacent to the existing pipeline. The existing pipeline would be abandoned and left in place underground, but a very limited number of sections would require removal. A temporary right-of-way width of about 15 feet would be needed, in addition to the existing 50-foot-wide permanent right-of-way, for construction activities. Appendix A-2 provides a description of typical construction techniques and reclamation.

The reconstructed pipeline would pass under the Colorado River at Laughlin, Nevada, and under the Little Colorado River east of Cameron, Arizona. It is anticipated that the Colorado River would be crossed by horizontally boring under the river. At the crossing of the Little Colorado River, east of Cameron, Arizona, the existing pipeline is buried in a trench. The Little Colorado River would be crossed by directionally drilling under the river. All other water bodies, where crossed, are dry during much of the year and would be crossed using conventional open-trench cutting during the dry season. The pipe would be buried deep enough in the water channels and banks to avoid potential future scouring and/or erosion.

The current alignment crosses the City of Kingman in areas that were undeveloped when the pipeline was constructed originally. Because these areas now contain major residential and commercial developments, this segment would be abandoned and a new segment would be constructed around the city.

Existing booster-pump stations (one at the coal-slurry preparation plant and three along the coal-slurry pipeline (CSP) at Mileposts 81.5, 123.5, and 176.5) are expected to require only minor modification, if any. Each station is on 10 to 20 acres of land; the principal structures at each site include a main pump building of steel-sided construction, residential trailers for employees, an above-ground earthen water-storage reservoir, a slurry settling and retention pond, pipeline fixtures including valves and piping, and an electrical substation. Reconstruction work at the pump stations would include equipment modifications, building modifications, and replacement of above- and below-ground pipe and conduits. The layout of the facilities would not change and no acreage would be added.

2.1.3 C Aquifer Water-Supply System

Future water use for the Black Mesa Complex and coal slurry would total an average of 6,000 af/yr (Table 2-3). The water from the C aquifer would be supplied from a well field to be located near Leupp, Arizona, and conveyed via pipeline to the Black Mesa Complex. The N aquifer would be a contingency standby source to be used in case of interruptions or curtailments of the C-aquifer water supply.

Table 2-3 Proposed Project Use of C-Aquifer Water

Use	Acre-Feet per Year
Coal slurry	3,700
Coal washing	500
Mine-related and domestic purposes	1,600
Contingency	200
Total	6,000

The components of the C aquifer water-supply system, as proposed for the Black Mesa Project, are described below. Appendix A-3 provides a description of typical construction techniques for the well field, water-supply pipeline, and associated facilities.

- A well field in the southwestern part of the Navajo Reservation (south of Leupp, Arizona) including 12 wells and associated facilities (e.g., well yards, collector pipelines, access roads, electrical power lines).
- An approximately 108-mile-long main pipeline with a capacity of 6,000 af/yr from the well field north-northeast to the Black Mesa Complex following, to the extent practicable, existing roads.
- An estimated two pump stations and associated facilities (e.g., access roads, electrical transmission lines).

2.2 ALTERNATIVES

Based on the description of the applicants' proposals and the issues derived from public comments received during the scoping process, a list of alternatives to the applicants' proposals was developed. All of the alternatives were screened to determine whether they would meet the purpose of and need for the Black Mesa Project, and were reasonable and feasible. The following issues and/or factors were considered in evaluating whether alternatives were technically or economically feasible or practical, and whether they would meet the purpose and need for any of the four actions of the Black Mesa Project: legal issues; environmental issues; design and/or engineering issues; economics of the tribes and others; and capital cost, operating cost, and funding.

Those alternatives that satisfy the criteria and achieve the purpose of and need for the Black Mesa Project have been studied and analyzed. Other alternatives that did not satisfy the criteria and/or did not achieve the purpose of and need for the Black Mesa Project were eliminated from detailed study. These are described in Section 2.4.

Based on the purpose of and need for the Black Mesa Project, agency authorities, and the issues identified through the scoping process, OSM identified three primary alternative Federal actions as follows:

- Alternative A (Agencies' Preferred Alternative) – Approval of the LOM revision, and all necessary associated components of the Black Mesa Project.
- Alternative B – Conditional approval of the LOM revision without approval of the Black Mesa mining operations, coal-slurry preparation plant, and C aquifer water-supply system.
- Alternative C – Disapproval of the LOM revision.

Each of these action alternatives is described in more detail below.

2.2.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

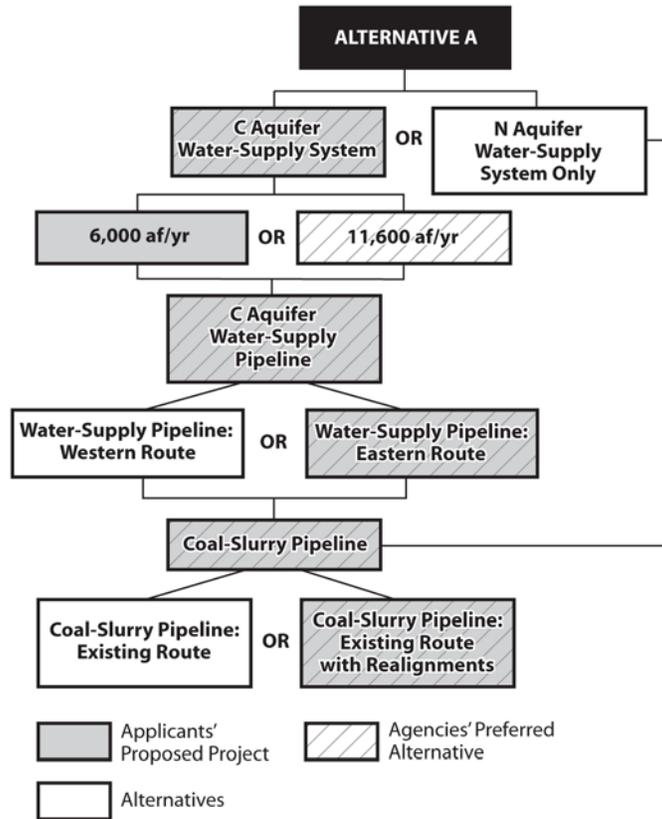
Under Alternative A, Peabody's LOM revision would be approved and a Federal permit would be issued to continue surface-coal-mining and reclamation operations at the Black Mesa Complex with conditions necessary to meet the requirements of the SMCRA. The LOM revision and other associated components of the Black Mesa Project would be approved. OSM's existing permanent Indian Lands Program permit area (the 44,073 acres within the current permit area for the Kayenta mining operation) would be expanded to incorporate the unpermitted parts of the existing lease area (Map 2-4) and existing and proposed rights-of-way (the 18,984 acres associated with the current Black Mesa mining operation including the 127 acres for the proposed coal-haul road) and the Kayenta mining operation and Black Mesa mining operation would continue through 2026.

The decision to approve the LOM revision must be combined with decisions regarding the other project components related to the Black Mesa mining operation to achieve the purposes of the project; that is, reconstruction of the coal-slurry pipeline and construction of a new water-supply system. Alternatives (or subalternatives) for each of these are described in the following sections and illustrated in Figure 2-1.

2.2.1.1 Coal-Slurry-Pipeline Route Subalternatives

For the coal-slurry pipeline, two alternative routes are addressed—the existing route and the existing route with realignments along the Moenkopi Wash and around the Kingman area. Estimated costs for construction and operation and maintenance of the coal-slurry pipeline are shown in Appendix B.

**Figure 2-1
Alternative A Subalternatives**



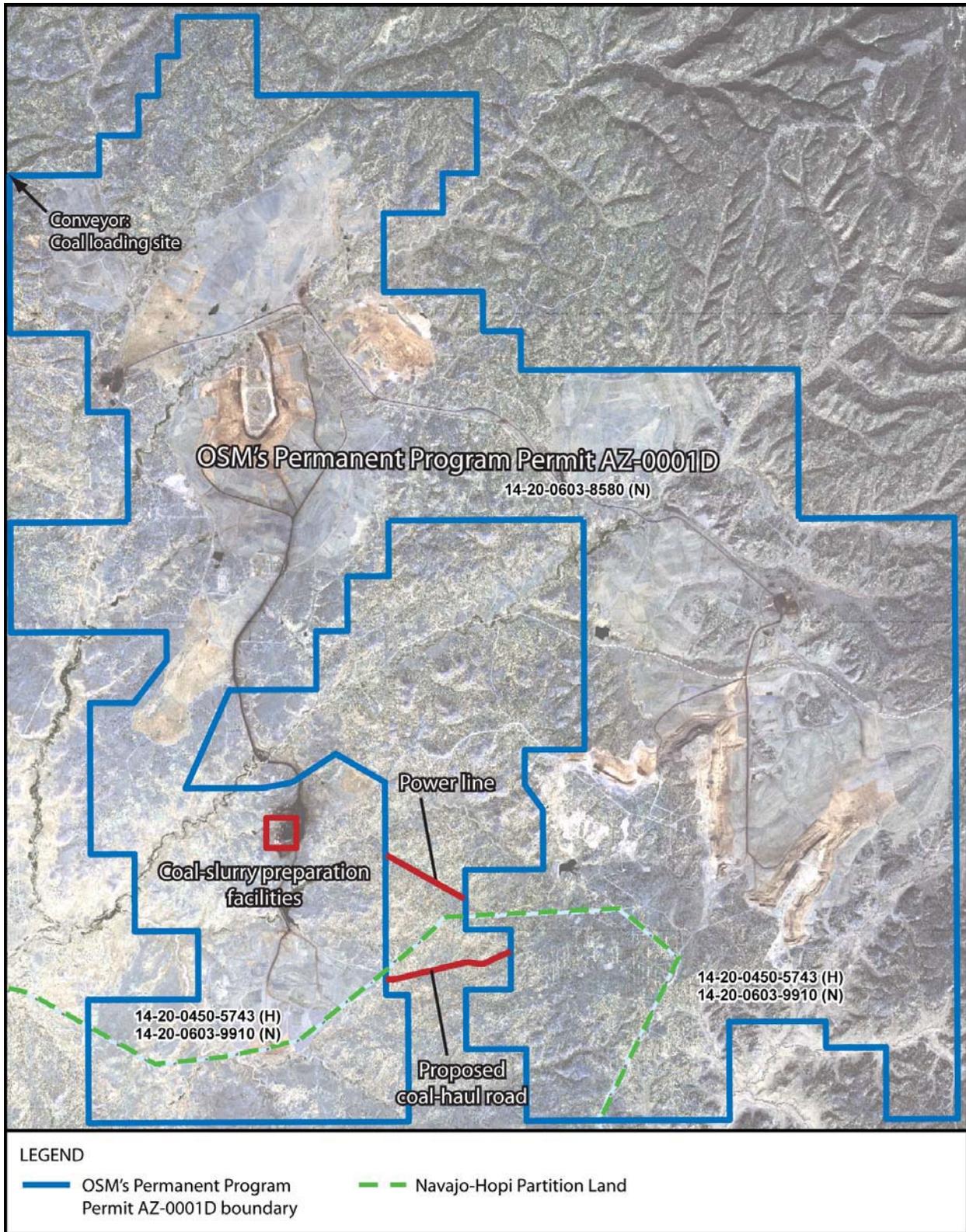
2.2.1.1.1 Coal-Slurry Pipeline: Existing Route

As described previously, the 273-mile-long coal-slurry pipeline would be reconstructed by burying a new pipeline adjacent and parallel to (about 5 feet from) the centerline of the existing pipeline in the existing right-of-way. Permanent access road exists along the majority of the pipeline route within the right-of-way. The existing pipeline would be abandoned and, for the most part, left in place under ground. In a few very limited number of sections, BMPI would remove the old pipeline and rebury new pipeline. The locations of these segments of pipeline would be identified during final engineering and design.

2.2.1.1.2 Coal-Slurry-Pipeline: Existing Route with Realignments (Agencies' Preferred Alternative)

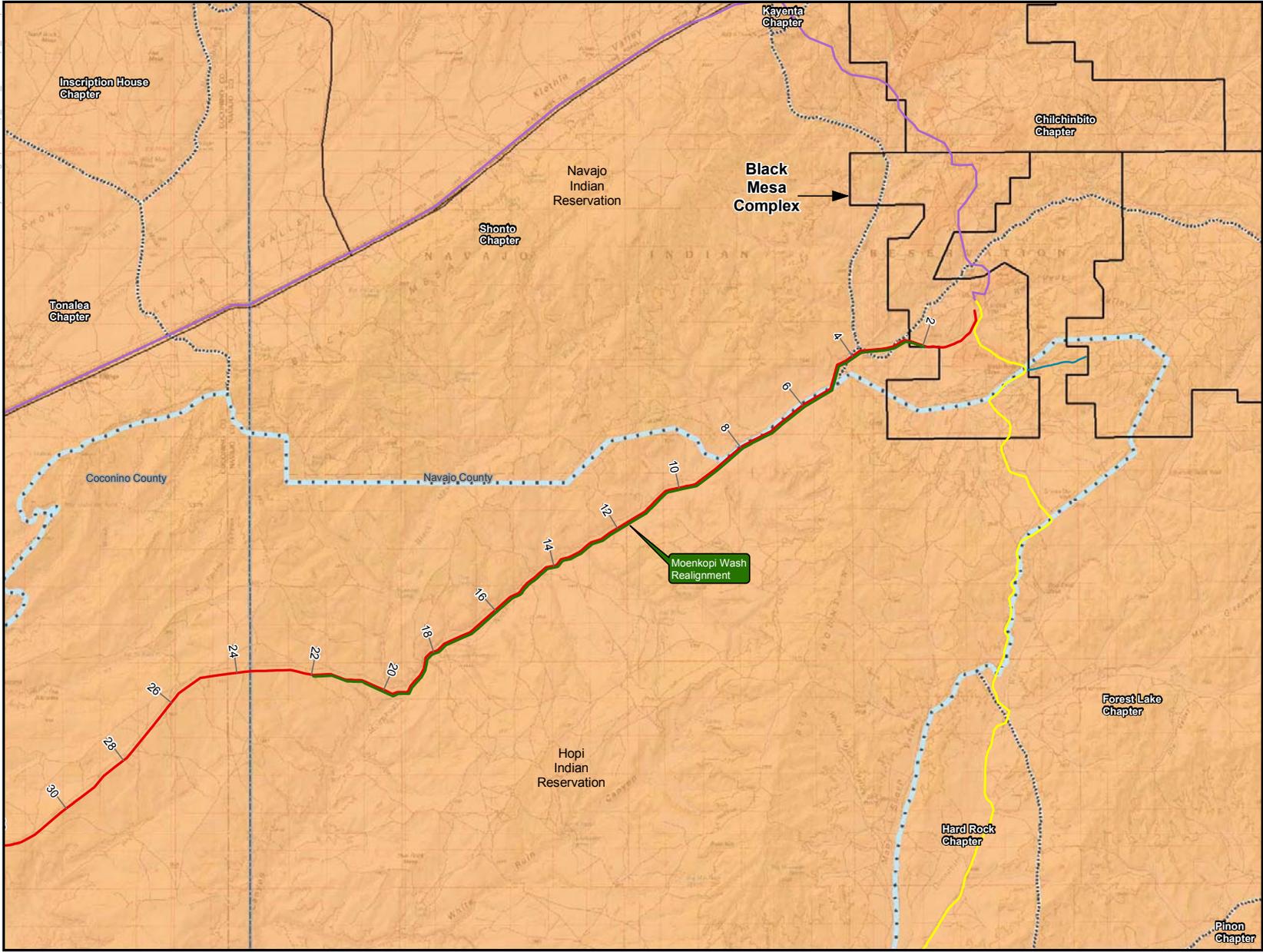
The alternative is to reconstruct the coal-slurry pipeline along the existing route for the majority of the route. Two realignments are proposed—Moenkopi Wash Realignment and Kingman Area Reroute.

Along the Moenkopi Wash, segments of the pipeline would be realigned between CSP Mileposts 2 and 22. The existing alignment is beneath and parallel to the Moenkopi Wash in proximity to the active channel in the wash. BMPI proposes to realign the pipeline where needed, up to 200 feet on either side of the existing pipeline, to locate the pipeline, still in the wash, but out of the active channel (Map 2-5a). The specific segments of pipeline that would be realigned have not yet been identified. However, along the 20 miles identified on Map 2-5a, it is anticipated that the segments to be realigned would cumulatively add to approximately 1 mile.



Map 2-4
Alternative A – Approval of LOM Revision

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Map 2-5a Moenkopi Wash Realignment

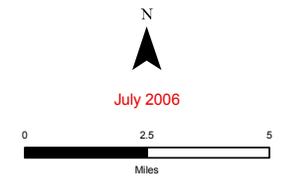
Black Mesa Project EIS

LEGEND

- Coal-Slurry Pipeline**
- Existing Route
 - Realignment
- (Existing route with realignment/ reroute is the preferred alternative)
- Proposed Water-Supply Pipeline**
- Eastern Route (preferred alternative)
 - Western Route
- Proposed Coal-Haul Road
- Peabody Lease Area
- Surface Management**
- American Indian Reservation

- General Features**
- Navajo Reservation, Chapter Boundary
 - Hopi Reservation Boundary
 - County Boundary
 - Interstate/U.S. Highway/State Route

SOURCES:
URS Corporation 2005
Arizona State Land Department 2005



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Chapter

The Kingman area reroute would be south of the area of Kingman, Arizona. The existing pipeline route crosses through the City of Kingman in areas that were undeveloped when the pipeline was constructed originally. BMPI proposes to reroute the pipeline to the south, from CSP Mileposts 228 to 255 (27 miles of the existing route; the Kingman reroute would be about 28.5 miles), to avoid construction in these areas that are now residential and commercial developments (refer to Map 1-1; Map 2-5b).

2.2.1.2 Project Water Supply

Water for the project is proposed to come primarily from the C aquifer with some supplemental use of the N aquifer. The proposed new C aquifer water-supply system would provide up to 6,000 af/yr of water for coal-slurry transportation and mine-related use (see Section 2.2.1.2.1 below). The existing N aquifer water-supply system could continue to supply up to 500 af/yr of water for mine-related and domestic uses and also would be used as an emergency back-up supply in the event that the C aquifer failed for an extended period of time (see Section 2.2.1.2.2.1).

Use of the existing N aquifer water-supply system as the sole water supply for the proposed project also is an alternative (i.e., the C aquifer water-supply system would not be constructed). Under this alternative, the existing N aquifer water-supply system would provide up to 6,000 af/yr of water for coal-slurry transportation and mine-related use (see Section 2.2.1.2.2.2).

2.2.1.2.1 C Aquifer Water-Supply System (Agencies' Preferred Alternative)

The C aquifer water-supply system would replace the N-aquifer water supply as the primary water source for mine operations, although some use of N-aquifer water would continue. Additionally, the development of a water-supply system from the C aquifer provides an opportunity to enhance water availability to the Hopi Tribe and Navajo Nation for municipal, industrial, and commercial uses by expanding the system capacity. Although SRP is leading the effort to develop the C-aquifer water-supply system, ownership of the system had not been determined at the time this Draft EIS was published.

Two different water-withdrawal scenarios and two water-supply pipeline alternative routes are being considered in this EIS. Estimated costs for construction and operation and maintenance of the water-supply system are shown in Appendix B.

2.2.1.2.1.1 Water Withdrawal and Supply

Two water-withdrawal scenarios and pipeline capacities are being considered.

2.2.1.2.1.1.1 C-Aquifer Water Withdrawal and Supply: 6,000 af/yr

Under this alternative, up to 6,000 af/yr would be withdrawn from the C aquifer and delivered to the Black Mesa Complex for the life of the project (i.e., 2010 through mid 2026). This is the amount of water needed annually for the coal-delivery system (coal slurry [3,700 af/yr], coal-washing facility [500 af/yr]), other mine-related and domestic purposes (1,600 af/yr), and a contingency (200 af/yr). After 2026, the water would no longer be needed for the project and pumping from the C aquifer would cease. Water for reclamation at the Black Mesa Complex would be supplied from the existing N-aquifer wells.

2.2.1.2.1.1.2 C-Aquifer Water Withdrawal and Supply: 11,600 af/yr (Agencies' Preferred Alternative)

Under this alternative, the Hopi Tribe and Navajo Nation would have an option to pay the incremental costs of increasing water production from the C aquifer and increasing the size of the water-supply pipeline in anticipation of the potential future use of the system for tribal purposes. The total maximum amount of water that could be delivered would be 11,600 af/yr—6,000 af/yr for project-related purposes

and an additional 5,600 af/yr for tribal use (2,000 af/yr for the Hopi Tribe and 3,600 af/yr for the Navajo Nation). Under this alternative, the 6,000 af/yr of water used for project-related purposes would be used by the Navajo Nation when no longer needed for project-related purposes. Pumping the C-aquifer water up to 11,600 af/yr would continue for the estimated 50-year life of the pipeline (until 2060). In order to deliver water from the system to Hopi and Navajo communities, spur lines would need to be constructed; however, the details of the locations and design of the delivery spur pipelines, timing of construction, and ultimate use of the water are not known at this time. The consequences of increased and sustained production are considered in the impact section of this EIS. The impacts of developing spur pipelines to tribal villages and use by these communities are not considered in this EIS. Any future Federal actions on such spur pipelines would be subject to NEPA analysis at the time of plan development.

2.2.1.2.1.2 *Infrastructure*

2.2.1.2.1.2.1 Well Field

Test wells used to quantify well yields ranged from 400 to 700 gallons per minute (USGS 2005). To produce 6,000 af/yr of water, a minimum of 12 wells would be developed and to produce 11,600 af/yr of water, 21 wells would be developed (Reclamation 2006). However, the final well field design would be determined by pump testing completed project wells that may produce higher yields potentially resulting in a reduction of the numbers of wells needed to produce water for the project.

For producing the 11,600 af/yr of water, the section of the well field proposed to produce the 6,000 af/yr for the Black Mesa Complex (12 wells) and 3,600 af/yr for the Navajo Nation (5 wells) would be located on the Navajo Reservation in a triangular area bounded approximately by State Route 99, Canyon Diablo, and the Burlington Northern Santa Fe (BNSF) Railroad just north of Red Gap Ranch and Interstate 40 (I40). To provide 2,000 af/yr of water to the Hopi Tribe, four wells would be developed in the section of the well field that is within the Hopi Hart Ranch (owned in fee by the Hopi Tribe) in a triangular area bounded approximately by the BNSF Railroad, Canyon Diablo, and I-40 (refer to Map 1-1; Map 2-6).

Proposed use of the C-aquifer water is shown in Table 2-4.

Table 2-4 Proposed Use of C-Aquifer Water

Use	Acre-Feet per Year
Black Mesa Complex	
Coal slurry	3,700
Coal washing	500
Mine-related and domestic uses	1,600
Contingency	200
<i>Subtotal Black Mesa Complex</i>	<i>6,000</i>
Tribal	
Hopi Tribe	2,000
Navajo Nation	3,600
<i>Subtotal tribal</i>	<i>5,600</i>
Grand total	11,600

The well field would consist of production wells, access roads, an electric power distribution system, water-storage tank, and associated piping. The locations of the wells are not known at this time; however, the wells would be spaced such that there is a minimum separation between each site of 1.2 to 1.5 miles. Each well site would require a temporary right-of-way of 200 feet by 200 feet for construction and a permanent right-of-way of approximately 50 feet by 50 feet, which would be surrounded by a security fence. The well yard would be gravel paved and the only above-ground equipment at each well site would

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Map 2-5b Kingman Area Reroute

Black Mesa Project EIS

LEGEND

Coal-Slurry Pipeline

- Existing Route
- Reroute

(Existing route with realignment/reroute is the preferred alternative)

Surface Management

- Bureau of Land Management
- State Trust
- County, Park and Outdoor Recreation Areas
- Private

General Features

- Interstate/U.S. Highway/State Route

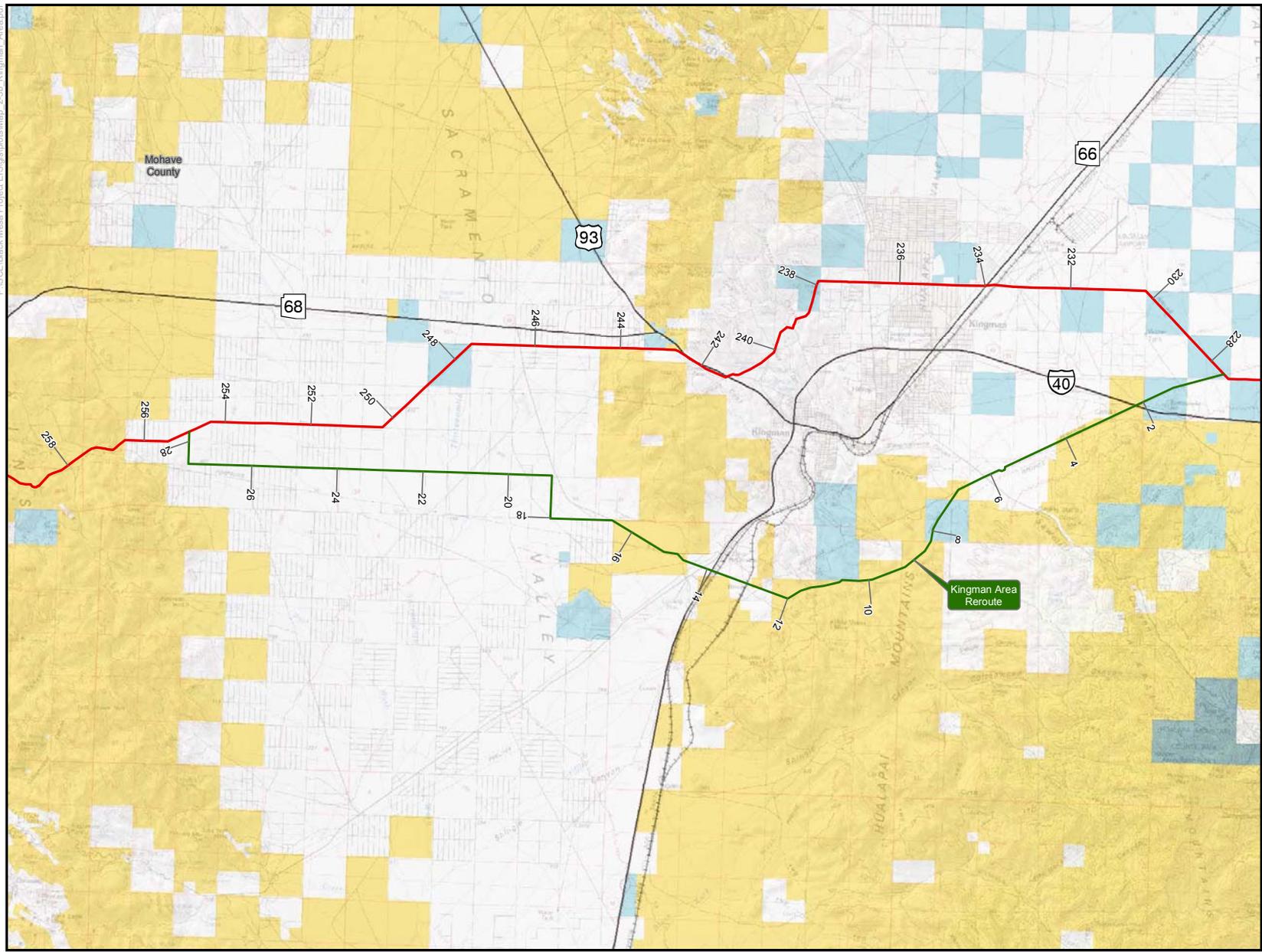
SOURCES:
URS Corporation 2005
Arizona State Land Department 2005

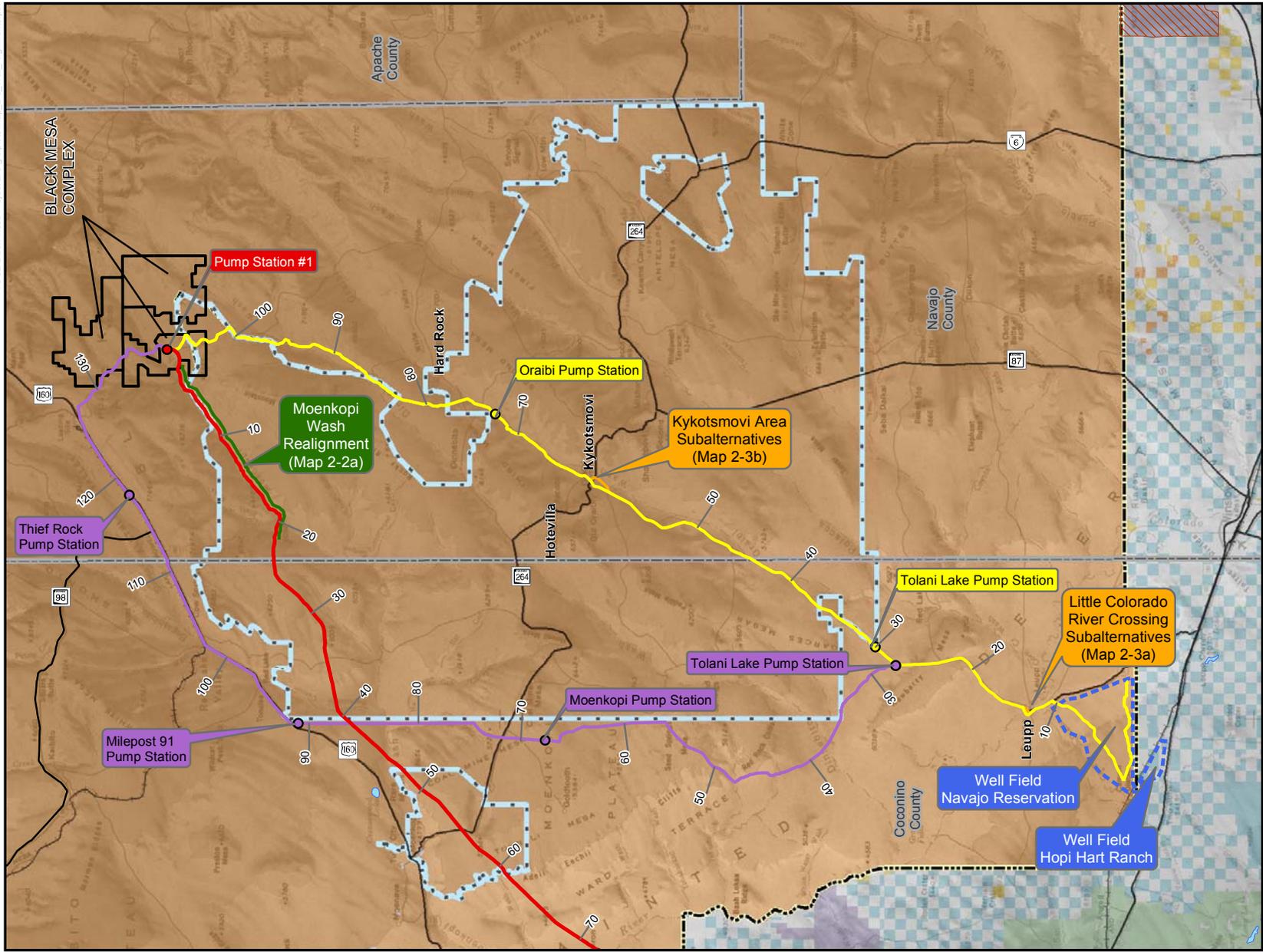


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Map 2-6 Water-Supply Pipeline Route Alternatives

Black Mesa Project EIS

LEGEND

- Coal-Slurry Pipeline**
 - Existing Route
 - Realignment
 - (Existing route with realignment/reroute is the preferred alternative)
- Proposed Water-Supply Pipeline**
 - Eastern Route (preferred alternative)
 - Subalternatives (along preferred alternative)
 - Western Route
 - C-Aquifer Well Field
 - Peabody Lease Area

- Surface Management**
 - Bureau of Land Management
 - U.S. Forest Service
 - National Park Service
 - American Indian Reservation
 - State Trust
 - Private

- General Features**
 - Lake
 - Navajo Reservation Boundary
 - Hopi Reservation Boundary
 - State Boundary
 - County Boundary
 - Interstate/U.S. Highway/State Route

SOURCES:
URS Corporation 2005, 2006
Arizona State Land Department 2005



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be the security fencing, lighting, and electrical power and control cubicle. The preliminary design of each well is a 1,100-foot-deep, 24-inch-diameter pilot borehole (1,000-foot-deep, 18-inch-diameter standard casing). Single-lane, unpaved access roads, the travel surface of which would be about 10 to 15 feet within a 40-foot-wide temporary right-of-way (25-foot-wide permanent right-of-way), with turnouts for passing, would be constructed to each site from the existing roads in the area. Electric power would be supplied to the well field by a new power-distribution system. Each well site would receive power via a 24.9 kilovolt (kV) line on wood-pole structures. The power lines would be constructed parallel to the access roads within the road right-of-way where possible.

One power line is anticipated to bisect the Navajo well field to provide the Navajo Tribal Utility Authority (NTUA) better access for providing power to local residents. The power supply for the new distribution system would be supplied from either a new substation that would be constructed along an existing 230kV transmission line or a new local substation that would be constructed at approximately Milepost 6 of the route of the water-supply pipeline. It is expected that APS would supply power to the Hopi well field from either an existing substation near Sunrise, Arizona, or from an existing 69kV transmission line in the area. In the latter case, APS would install a new 69/24.9kV tap on the transmission line. APS then would use a steel pole line and pole-top transformers to provide power to each well site. The detail would not be known until Hopi conducts engineering design for its well field and enters into electrical method-of-service discussions with APS.

A main collector pipeline would be constructed underground, within a 65-foot-wide temporary right-of-way (50-foot-wide permanent right-of-way), to convey pumped groundwater to the water-storage tank. The storage tank would require a permanent right-of-way or easement of approximately 215 feet by 215 feet, and would be fenced and lighted for security.

2.2.1.2.1.2.2 C Aquifer Water-Supply-Pipeline Route Alternatives

Two major alternative routes for the water-supply pipeline have been identified (refer to Map 2-6). A permanent access road would be needed to perform maintenance on and repairs to the pipeline. In areas where the pipeline is adjacent to public roads, the public road would serve as that access road. In areas where there is no existing access road, a permanent road approximately 25 feet wide would be maintained within the permanent pipeline right-of-way.

C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative). The eastern route for the C aquifer water-supply pipeline is approximately 108 miles long. The route crosses approximately 54 miles of the Hopi Reservation and approximately 54 miles of the Navajo Reservation.

It is estimated that two pump stations with four pumps each (one pump would be a spare) would be located along the pipeline alignment to lift and move the water to the Black Mesa Complex. The summit elevation along this route is 6,774 feet (the well field is 5,050 feet in elevation). The Tolani Lake Pump Station, located at water-supply pipeline (WSP) Milepost 30, would be approximately 31,350 square feet (0.7 acre) and the Oraibi Pump Station, located at WSP Milepost 73, would be approximately 25,500 square feet (0.6 acre). Permanent rights-of-way or easements to accommodate the two pump stations and access roads to each site would be required. Each site would be enclosed by a security fence, and the pump and other equipment would be enclosed in a building to provide weather protection and security. Electric power to the pump stations would be provided by a 69kV transmission line on steel-pole structures, which would be located along the roadway on the opposite side of the road from the pipeline (east side).

Along this route, minor routing alternatives have been identified in two areas—at the crossing of the Little Colorado River and in the Kykotsmovi area.

Little Colorado River Crossing Subalternatives. The water-supply pipeline would cross the Little Colorado River between approximately WSP Mileposts 13 and 14. Two alternative crossings are being considered (Map 2-6a):

- Crossing under the river by drilling a horizontal tunnel approximately 50 to 200 feet beneath the river and pulling the pipeline through the tunnel, which is the applicant's and agencies' preferred alternative.
- Crossing over the river on an existing but abandoned bridge.

Kykotsmovi Area Subalternatives. Two minor routing alternatives are being considered in the Kykotsmovi area (Map 2-6b):

- Along the western subalternative, the water-supply pipeline would be buried beneath the main roadway through the village of Kykotsmovi (agencies' preferred alternative). This subalternative is preferred by the Hopi.
- Along the eastern subalternative, the water-supply pipeline would be buried in the right-of-way of the road that bypasses Kykotsmovi on its eastern edge.

C Aquifer Water-Supply Pipeline: Western Route. This alternative water-supply pipeline route is approximately 137 miles long and crosses lands of the Navajo Reservation (refer to Map 1-1 and Map 2-6). It is estimated that four pump stations would be located along the pipeline route to lift and move the water to the Black Mesa Complex. These pump stations would have the same configuration as those described for the Eastern Route. The summit elevation along this route is higher (7,320 feet in elevation) than the eastern route. The four pump stations would be Tolani Lake Pump Station at approximately WSP Milepost 27.5; Moenkopi Pump Station at WSP Milepost 67.8; Milepost 91 Pump Station at WSP Milepost 91.0; and Thief Rock Pump Station at WSP Milepost 118.0.

2.2.1.2.2 N-Aquifer Water Supply

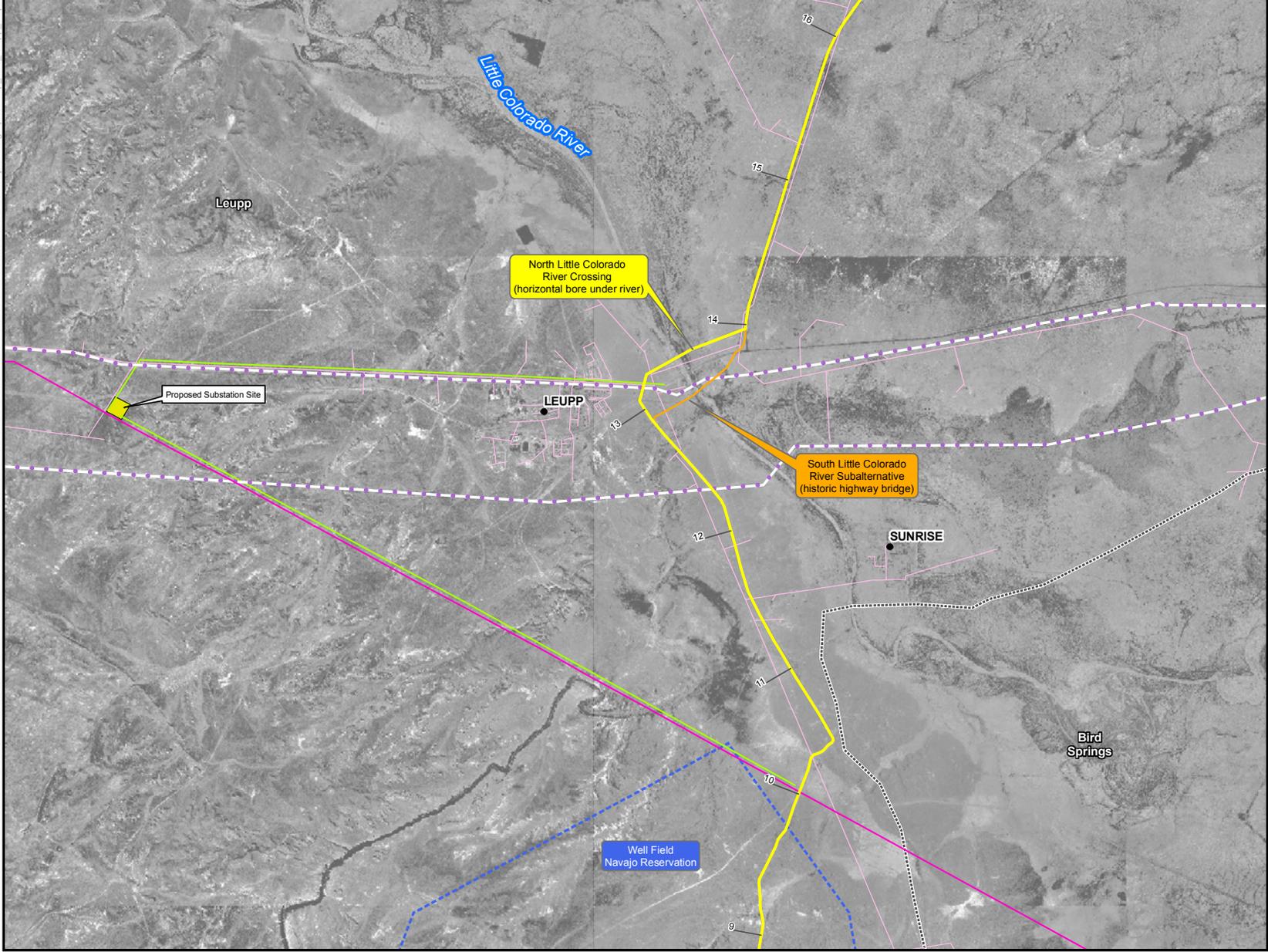
Until December 2005, approximately 4,400 af/yr of water were drawn from the N aquifer within Peabody's lease area—3,100 af/yr of water for slurry of 4.8 million tons of coal and 1,300 af/yr of water for mine-related and domestic purposes. Both mining operations and local residences together accounted for the 1,300 af/yr of water.

2.2.1.2.2.1 Supplemental Use of N-Aquifer Water

Under Alternative A, 6,000 af/yr of water from the C aquifer would provide the majority of the water needed for the mining operations; use of the N aquifer would continue at a reduced rate. The reliability of the C aquifer is difficult to quantify, but reliability would be very high. The C-aquifer wells would be capable of supplying water at some level at all times and at least one spare well would be installed initially. Peabody's N-aquifer well field would be conserved to provide potable water for the public and as an emergency back-up supply should the primary C-aquifer source supply be interrupted for any reason. It is the applicants' intent to no longer use water from the N aquifer for mine-related or slurry use except as noted below.

In order to maintain the N-aquifer well field in an operationally ready state to supply the public and in case water from the well field is needed for emergencies, the wells must be pumped periodically for extended periods of time. As a worst case, an estimated average of 2,000 af/yr of N-aquifer water would be used for (1) public consumption, (2) withdrawal from the N-aquifer wells to maintain their function, (3) emergencies, and (4) the Kayenta mining operation.

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**Map 2-6a
Proposed
Water-Supply Pipeline:
Little Colorado River
Crossing Subalternatives**

Black Mesa Project EIS

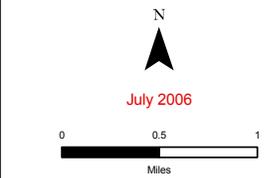
LEGEND

- Proposed Water-Supply Pipeline**
- Eastern Route (preferred alternative)
 - Subalternative (along preferred alternative)
 - 230kV Power Line
 - 69/12kV Power Line
 - Proposed 69kV Distribution Line
 - - - Gas Pipeline
 - - - C-Aquifer Well Field
 - Proposed Substation Site

General Features

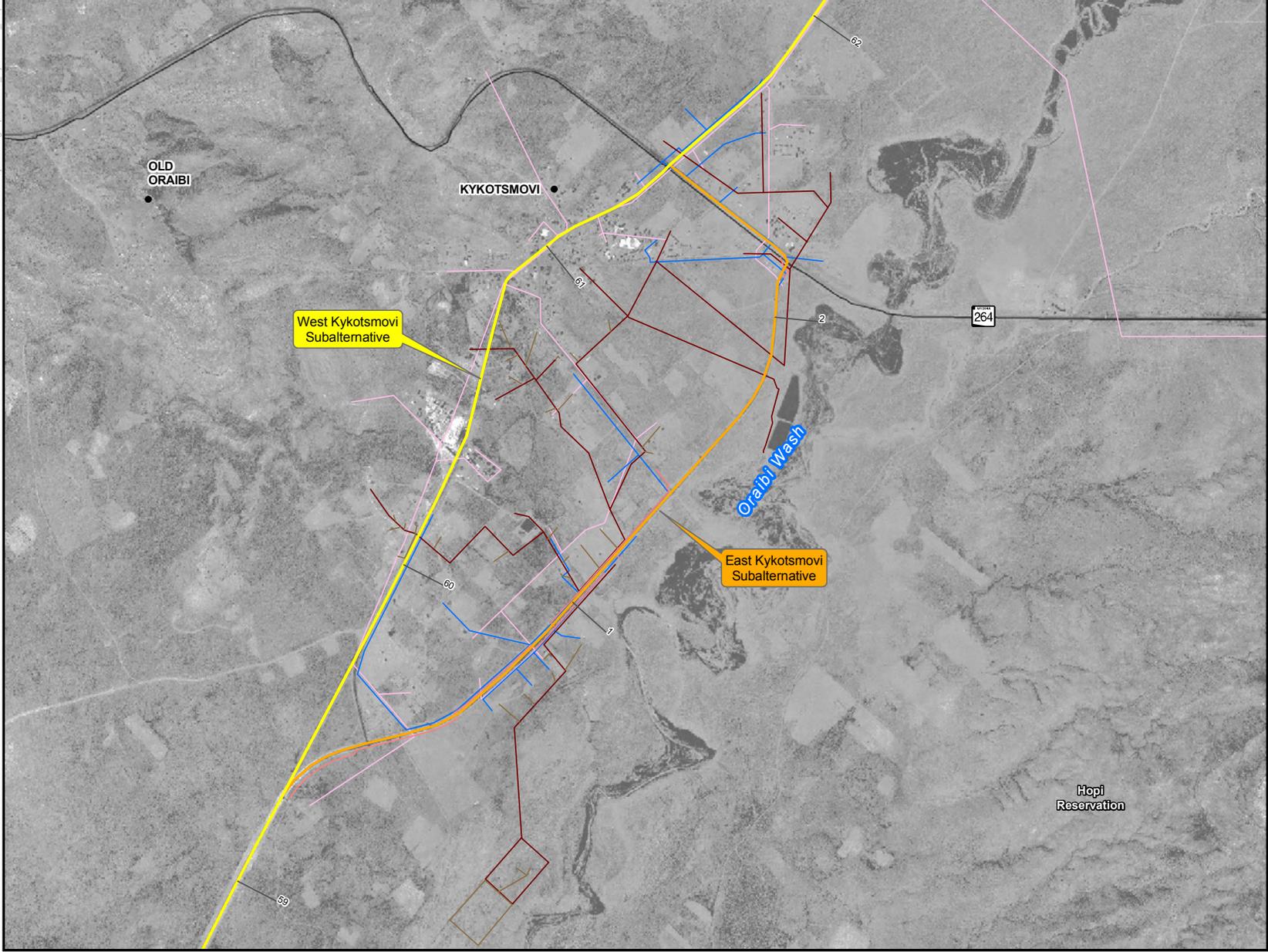
- Navajo Chapter Boundary
- and Name

SOURCES:
URS Corporation 2005
USGS DOQQ 1992-1996
Navajo Tribal Utility Authority 2005



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URS

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Map 2-6b
Proposed
Water-Supply Pipeline:
Kykotsmovi Area
Subalternatives

Black Mesa Project EIS

LEGEND

- Proposed Water-Supply Pipeline**
- West Kykotsmovi Subalternative (preferred alternative)
 - East Kykotsmovi Subalternative
 - Phone Line
 - 69/12kV Power Line
 - Water Line
 - Waste Water Taps
 - Waste Water Line

General Features

- Interstate/U.S. Highway/State Route

SOURCES:
 URS Corporation 2005
 USGS DOQQ 1992-1996
 Hopi Tribe 2005



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A conservative approach was used to estimate the average amount of water needed for emergencies because uncertainty exists in the source, supply infrastructure, and operating functions of the water-supply system. The estimate was based on alternating 1- and 6-month duration interruptions of supply from the C aquifer, which would occur at 3-year intervals and extend for the life of the project. Thus, the C aquifer water supply was assumed to be unavailable every 3 years for either 1 month or 6 months, and during this time, full use of N-aquifer water would occur.

The Kayenta and Black Mesa mining operations would cease in 2026, and the mines would be reclaimed. From 2026 to 2028, up to 500 af/yr of N-aquifer water would be used for reclamation and public use and, from 2029 to 2038, up to 444 af/yr of N-aquifer water would be used for post-reclamation maintenance and public uses. Under this alternative, pumping the N aquifer for project-related uses would cease when the water is no longer needed for project-related uses (i.e., mine operations, coal delivery, and reclamation). The leases require N-aquifer wells to be transferred to the tribes in operating condition. The wells would be transferred to the tribes once Peabody successfully completes reclamation and relinquishes the leases.

2.2.1.2.2.2 N Aquifer as the Sole Water Supply

Under this alternative (see N aquifer water-supply system alternative to the proposed action in Figure 2-1), up to 6,000 af/yr would be drawn from the N aquifer within Peabody’s lease area for the life of the project (i.e., 2010 through mid 2026). This is the amount of water needed annually for the coal-delivery system (coal slurry [3,700 af/yr], coal-washing facility [500 af/yr]), other mine-related and domestic purposes (1,600 af/yr), and a contingency (200 af/yr).

From 2026 to 2028, up to 500 af/yr of water would be needed for mine reclamation and public (domestic) uses. From 2029 to 2038, up to 444 af/yr of N-aquifer water would be needed for post-reclamation maintenance and public uses. After 2038, the water would no longer be needed for the project and pumping from the N aquifer for project purposes would cease. The wells would be transferred to the tribes once Peabody successfully completes reclamation and relinquishes the leases.

Under this alternative, the concern leading to the administrative delay of OSM’s permanent Indian Lands Program permitting decision described in Section 2.1.1.2 would not be resolved. The delay of permitting decisions for the Black Mesa mining operation and Black Mesa coal-slurry preparation plant stem from the concerns of the Hopi Tribe and Navajo Nation regarding use of N-aquifer water for the coal slurry purposes.

2.2.1.3 Costs

Total cost by alternative is shown in Table 2-5. More detailed costs are shown in Appendix B.

Table 2-5 Total Costs by Alternative

	Agencies' Preferred Alternative 11,600 af/yr (\$ million)		Applicants' Proposed Alternative 6,000 af/yr (\$ million)	
	Capital Cost ⁴	Annual Operation and Maintenance ⁴	Capital Cost ⁴	Annual Operation and Maintenance ⁴
Eastern Route				
C Aquifer well field and pump stations	42	3.9 ⁶	34	3.2 ⁶
Eastern water-supply pipeline ³	155		145	
Construction Costs	197		179	

	Agencies' Preferred Alternative 11,600 af/yr (\$ million)		Applicants' Proposed Alternative 6,000 af/yr (\$ million)	
	Capital Cost ⁴	Annual Operation and Maintenance ⁴	Capital Cost ⁴	Annual Operation and Maintenance ⁴
Water costs for Black Mesa Complex ⁵		5.4		5.4
Annual Operation and Maintenance Costs		9.3		8.6
Coal-slurry pipeline ⁷	200	24	200	24
Total Estimated Costs for Coal-Delivery System¹	397	33.3	379	32.6
Western Route				
C Aquifer well field and pump stations	53	6.7 ⁶	45	6 ⁶
Western water-supply pipeline ³	179		169	
Construction Costs	232		214	
Water costs for Black Mesa Complex ⁵		5.4		5.4
Annual Operation and Maintenance Costs⁵		12.1		11.4
Coal-slurry pipeline ⁷	200	24	200	24
Total Estimated Costs for Coal-Delivery System²	432	36.1	414	35.4

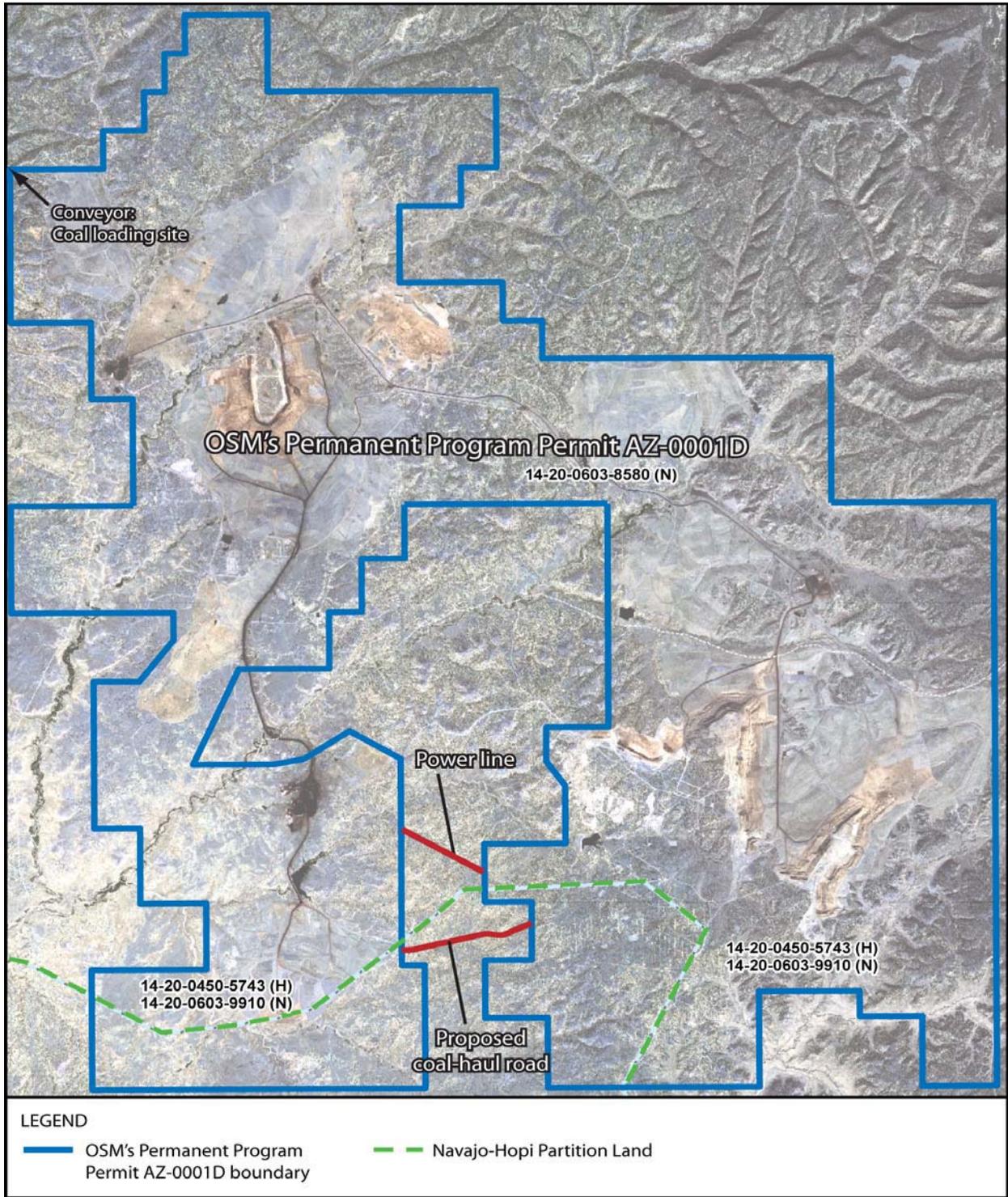
SOURCES: Black Mesa Pipeline, Inc. 2005; Peabody Western Coal Company 2005; Southern California Edison Company 2006

- NOTES: ¹ Includes costs for well field, 108 miles of pipeline (includes West Kykotsmovi and north crossing of the Little Colorado River subalternatives), and two pump stations.
² Includes costs for well field, 137 miles of pipeline, and four pump stations.
³ Does not include costs for right-of-way.
⁴ 2006 dollars.
⁵ Annual water royalties to Hopi Tribe and Navajo Nation.
⁶ Includes operation and maintenance for pipeline
⁷ The capital costs do not include right-of-way costs.

2.2.2 Alternative B – Conditional Approval of the LOM Revision Without Approval of the Black Mesa Mining Operations, Coal-Slurry Pipeline, and C Aquifer Water-Supply System

The Black Mesa mining operation, coal-slurry preparation plant, and coal-slurry pipeline that supplied coal to the Mohave Generating Station until the end of 2005 would not resume operations. The coal-washing facility and the C aquifer water-supply system, in any configuration, would not be constructed. The 127-acre coal-haul road would, however, be constructed and maintained.

Areas previously disturbed by the Black Mesa operation (6,965 acres) would be incorporated into the expanded permit area for the Black Mesa Complex (Map 2-7). Areas mined out by the Black Mesa operation by the end of 2005 have already been or are being reclaimed (areas J-01, J-03, J-07, and J-27) (refer to Map 2-1). One coal-resource area that was not completely mined out by the end of 2005 (N-06) is currently producing coal for the Navajo Generating Station. Several coal resource areas, totaling 5,950 acres, that were never mined by the Black Mesa mining operation (J-02, J-04, J-06, J-08, J-09, J-10, J-14, and J-15) would be incorporated into the expanded permit area for the Black Mesa Complex, although Peabody does not propose in the current LOM revision to mine them. Under the current permit, Peabody has approval to produce from other mining areas (N-09, N-10, N-99, J-19, and J-21) all of the coal needed by the Navajo Generating Station through 2026. It is anticipated that Peabody would continue to request that OSM renew its permit every 5 years until the coal is mined out. Impacts of an extended



Map 2-7
Expanded Permit Area Under Alternative B: Conditional
Approval of the LOM Revision
Without Approval of the Black Mesa Mining Operation,
Coal-Slurry Pipeline, and C Aquifer Water-Supply System

mining scenario beyond 2026, which could include mining of some or all of the aforementioned nine coal-resource areas, are addressed in the cumulative effects section of the EIS. In the time period 2006 through 2026, the Black Mesa operation infrastructure would be used as necessary to facilitate mining and reclamation by the Kayenta mining operation.

The Kayenta mining operation would continue into 2026 but stop before the year is completed. It would use N-aquifer water in amounts averaging 1,236 af/yr from 2006 to 2025. As proposed in the LOM revision, the Kayenta mining operation would cease in 2026, and the mine would be reclaimed.

From 2026 to 2028, up to 500 af/yr of N-aquifer water would be used for reclamation and public use. From 2029 to 2038, up to 444 af/yr of N-aquifer water would be used for post-reclamation maintenance and public uses. The wells would be transferred to the tribes once Peabody successfully completes reclamation and relinquishes the leases.

2.2.3 Alternative C – Disapproval of the LOM Revision (No-Action Alternative)

OSM's decision under Alternative C to disapprove the LOM revision would have the same effect as OSM taking no action on the LOM revision.

The Black Mesa mining operation, coal-slurry preparation plant, and coal-slurry pipeline that supplied coal to the Mohave Generating Station until the end of 2005 would not resume operations. The coal-washing facility and the C aquifer water-supply system, in any configuration, would not be constructed.

Areas previously disturbed by the Black Mesa operation (6,965 acres) would not be incorporated into the expanded permit area for the Black Mesa Complex (Map 2-8). The infrastructure for the Black Mesa mining operation (offices, roads, etc.) would be expeditiously reclaimed. Unmined coal-resource areas, totaling 5,950 acres that were previously within the area of the Black Mesa operation (areas J-02, J-04, J-06, J-08, J-09, J-10, J-14, and J-15) would not be incorporated into the expanded permit area for the Black Mesa Complex. They would not be mined.

Under its current permanent Indian Lands Program permit for the Kayenta mining operation, Peabody already has OSM-approved mining, operation, and reclamation plans that allow it to produce all of the coal needed by the Navajo Generating Station through 2026. The Kayenta mining operation would use N-aquifer water in amounts averaging 1,240 af/yr from 2006 to 2025. Similar to Alternative B, the Kayenta mining operation would cease after 2026, and the mine would be reclaimed. From 2026 to 2028, up to 500 af/yr of N-aquifer water would be used for reclamation and public uses. From 2029 to 2038, up to 444 af/yr of N-aquifer water would be used for post-reclamation maintenance and public uses. The wells would be transferred to the tribes once Peabody successfully completes reclamation and relinquishes the leases.

Although it is reasonably foreseeable under Alternative C that Peabody would request future permit revisions to mine all remaining coal reserves within the lease area, the cumulative impacts of such foreseeable future permitting already area addressed under Alternative B; thus, Alternative C assumes that none of the currently unpermitted coal reserves within the leases would be mined after 2026 for the purpose of evaluating impacts (other than those which are currently approved in the existing permit).

2.3 AGENCY AUTHORITY AND ACTIONS

Implementation of the proposed project would require certain Federal, State, tribal, and/or local actions or approvals, which are listed in Table 2-6. Brief descriptions of Federal legal authorities and mandates are provided in Appendix C.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY IN THE EIS

The alternatives described in this section were considered but eliminated from detailed analysis in the EIS as not being reasonable alternatives; i.e., not being technically or economically feasible or practical, and/or not meeting the purpose and need for the project.

2.4.1 Approval of the Black Mesa Portion of the LOM Revision and Disapproval of the Kayenta Portion of the LOM Revision

During scoping, an alternative was proposed that would result in the approval of the Black Mesa portion of the LOM revision and disapproval of the Kayenta portion of the LOM revision. Under this alternative, the Black Mesa mining operation, coal-slurry preparation plant, and coal-slurry pipeline would resume operations as described in Alternative A (refer to Section 2.2.1). The Kayenta mining operation would continue to operate through 2026 (under OSM's existing permanent Indian Lands Program permit). After 2026, Kayenta mining operation would cease and be reclaimed. This alternative is not substantively different than the approval alternative (Alternative A) and therefore is not considered further.

For the Kayenta mining operation, the LOM revision proposes to add the J-21 South mining area to the currently permitted mining areas and proposes that the currently permitted N-99 mining area would be a coal supply for both the Kayenta and Black Mesa mining operations. If the Kayenta part of the LOM revision were not approved, the J-21 South mining area would not be mined, but the Kayenta mining operation would continue through 2026 as currently authorized in OSM's Permit AZ-0001D.

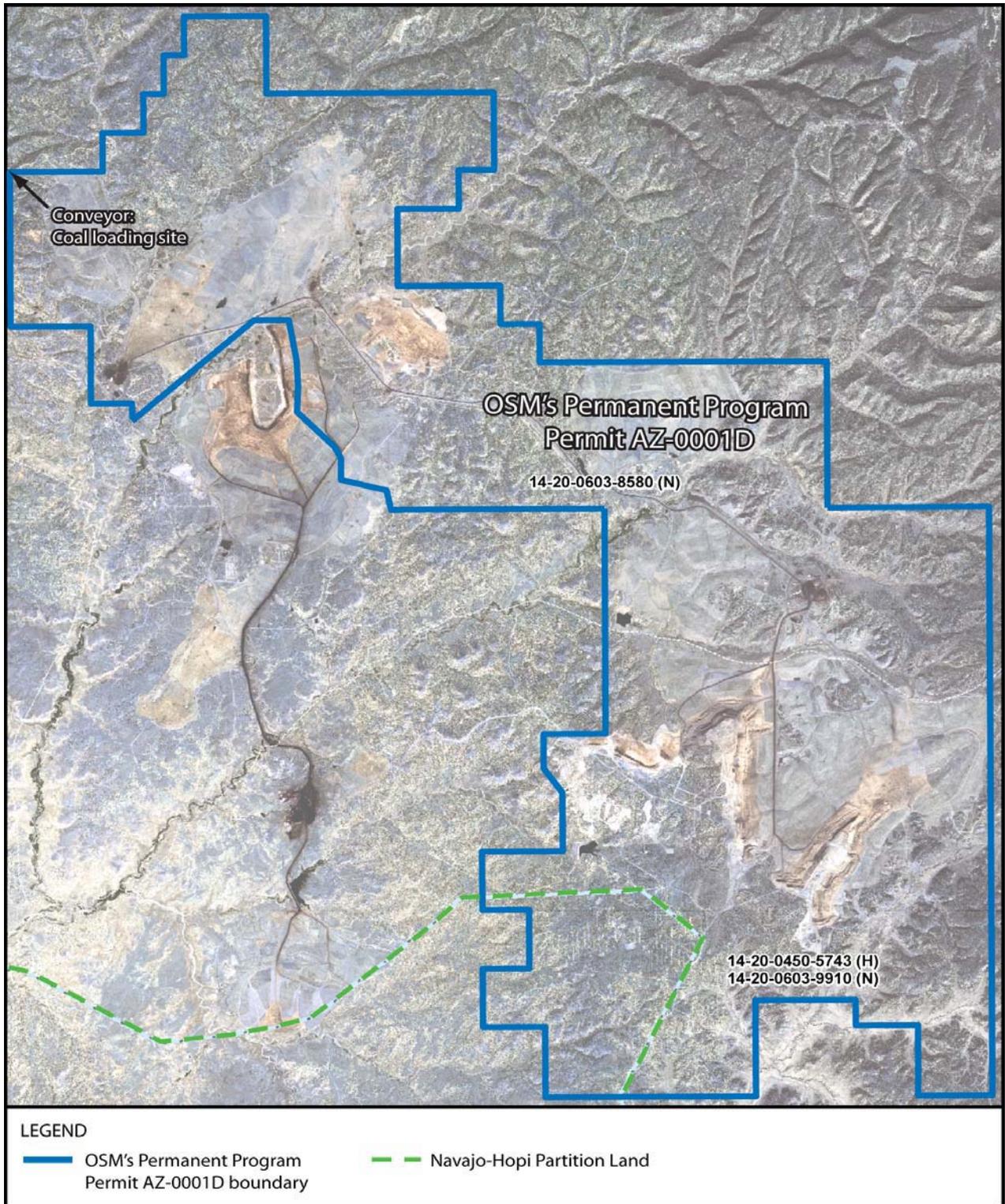
2.4.2 Other Water Sources

Many scoping comments suggested the use of a water alternative for the coal slurry, or a source of water other than the N aquifer be considered. While the latter has been considered and the C aquifer has been identified as the preferred alternative in this EIS, a number of other alternative sources of water have been investigated over several years. The following summaries briefly describe investigations of water-supply options from the Colorado River, groundwater basins near the coal-slurry pipeline, groundwater sources near the Black Mesa Complex, and gray water from the City of Flagstaff.

2.4.2.1 Colorado River Water-Supply Options

Between 1990 and 2003, the United States, Hopi Tribe, Navajo Nation, SCE, Peabody, and SRP evaluated various Colorado River water-supply options to see if they could meet the demands for mining operations, the coal slurry, and the Hopi Tribe and Navajo Nation. The evaluations were part of discussions to resolve tribal water-rights claims to the Little Colorado River watershed and to resolve issues related to the Black Mesa mining operation. Eventually, all of the Colorado River options were determined to be technically infeasible, at least within the time available to develop an assured water supply for the Black Mesa Project. Though considered, the Colorado River water-supply options were eliminated from further study in this EIS (Sommers 2005).

One of the most important considerations in any proposal to divert water from the Colorado River is the "Law of the River," a complex set of laws and regulations governing the use of water from the Colorado River and its tributaries. Moreover, an important component of the Law of the River is the Colorado River Compact of 1922, which divided the Colorado River Basin into an Upper Basin and Lower Basin, with a dividing point at Lee Ferry, just downstream from Lake Powell (Reclamation 2004).



Map 2-8
Permit Area Under Alternative C: Disapproval of the LOM Revision

Each basin has an annual allocation of water from the Colorado River. The Upper Basin states have an obligation to deliver 7.5 million acre feet of water to the Lower Basin. The water in each basin is divided, or apportioned, by percentage among the states in which the water use occurs. The State of Arizona has only a small allocation from the Upper Basin (50,000 af/yr), which is largely consumed by existing uses on the Navajo Reservation, the City of Page, and the Navajo Generating Station. Moreover, because the Black Mesa Complex is located in the Lower Basin, new diversions for mining, slurry, and tribal demands would likely have to come from Arizona's allocation from the Lower Basin (Reclamation 2006; SRP 2002).

Several potential sources of Lower Basin water were identified for possible use by the Black Mesa Project; however, changing the point of diversion and location of use of any Colorado River water source would require the approval of the Arizona Department of Water Resources (ADWR). In addition, most sources would likely require consent of the Central Arizona Water Conservation District (CAWCD) because supplies from the Central Arizona Project would likely be affected. ADWR and CAWCD were reluctant to consent to any use of Colorado River Lower Basin water supplies for use in northern Arizona, outside the three-county Central Arizona Project area, unless there was also some direct benefit to the rest of the State. Thus, progress on identifying a specific source of Colorado River water for the Black Mesa Project was slow (SRP 2002).

Lake Powell is the closest point of diversion from the Colorado River for use in the Black Mesa Project and for nearby tribal demands. During the 1990s, a number of Lake Powell diversion alternatives were extensively studied, involving a range of water quantities and different pipeline alignments. The primary diversion point from the lake that was evaluated was a location near the existing pump station for the Navajo Generating Station using a similar pumping scheme. Locating the pump station near the Navajo Generating Station pump station would take advantage of existing infrastructure and minimize environmental impacts. The various pipeline alignments evaluated followed the railroad alignment that transports coal from the Kayenta mining operation to the Navajo Generating Station and/or existing highways and roads, again to minimize environmental impacts. Additional alignments also were evaluated to provide water to nearby Navajo towns and villages. The major stumbling block for the use of water from Lake Powell is the potential legal issue associated with the diversion of water from the Upper Basin for use in the Lower Basin, where the mine complex is located. Such a diversion is not explicitly authorized by the Colorado River Compact of 1922. It is possible that Lake Powell diversion of water for use in the Lower Basin would require, either legally or politically, the consent of the seven Basin states, which would likely take a number of years to negotiate with an uncertain outcome. Also, the high cost of an extensive network of pipelines to distribute the water was a consideration (Sommers 2005; SRP 2002).

In order to avoid delays associated with resolution of the trans-basin diversion and use issues, a Lower Basin diversion location just downstream of Lee Ferry was investigated—a Marble Canyon diversion at the mouth of Jackass Canyon was evaluated in 2002. The diversion alternative was strongly opposed by environmental groups, especially because of its location at the upper end of the Grand Canyon in or immediately adjacent to Grand Canyon National Park. The diversion location and pipeline alignment also presented engineering challenges and were expected to result in substantial environmental impact within the Grand Canyon and elsewhere. The estimated costs were extremely high. This Lower Basin diversion location was deemed to be technically and economically unacceptable.

Table 2-6 Summary of Potential Agency Authorities and Actions

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
FEDERAL			
Life-of-Mine Revision			
Life-of-mine (LOM) plan revision	Office of Surface Mining Reclamation and Enforcement (OSM)	LOM revision permit approval	Surface Mining Control and Reclamation Act of 1977 (SMCRA) (30 United States Code [U.S.C.] 1201 et seq)
		Environmental Impact Statement (EIS) and Record of Decision	National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq); Council on Environmental Quality NEPA implementing regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508); OSM Handbook on Procedures for Implementing the National Environmental Policy Act
Right-of-way for transportation corridor	Bureau of Indian Affairs (BIA) ^{1,2} Western Regional Office and Hopi Agency	Grant of easement for a right-of-way across American Indian lands	25 CFR Part 169, Stipulations for Rights-of-way over Indian Land
Modification of a Section 404 permit	Army Corps of Engineers (USACE)	Modify permit for discharge of dredged or fill material to waters of the United States	33 U.S.C. 1344(a); 33 CFR Parts 320, 323, 325
Effects on species listed as critical habitat designated under the Endangered Species Act (ESA)	U.S. Fish and Wildlife Service (FWS)		50 CFR 402
Modification of the National Pollution Discharge Elimination System (NPDES) permit	U.S. Environmental Protection Agency (USEPA)	EIS and Record of Decision	Clean Water Act (33 U.S.C. 1342); 40 CFR 124.9
Changes to the mining plan	Bureau of Land Management (BLM)	Approval	25 CFR Part 216; 43 CFR 3480
Amend right-of-way by Federal land-managing agency	Federal land-managing agencies, in consultation with FWS	Endangered Species Act (ESA) compliance by Federal land-managing agency and lead agency	ESA of 1973, as amended (16 U.S.C. 1531 et seq)

Table 2-6 Summary of Potential Agency Authorities and Actions

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Effects on historic properties	All Federal action agencies, Arizona and Nevada State Historic Preservation Offices (SHPOs), Navajo Tribal Historic Preservation Office (THPO), Hopi Cultural Preservation Office (HCPO), and Advisory Council on Historic Preservation if it chooses to participate	Consultations with all interested parties to determine whether there will be adverse effects on historic properties, and if so how to take those effects into account; usually means development of a "Section 106 Memorandum of Agreement"	National Historic Preservation Act (NHPA) Section 106, 16 U.S.C. 470f; 36 CFR Part 800
Coal-Slurry Preparation Plant			
Conduct surface coal-mining operations (coal-slurry preparation plant) on American Indian reservations	OSM	Coal-slurry preparation plant permit	SMCRA (30 U.S.C. 1201 et seq); 30 CFR Parts 750, 785.21
C-Aquifer Water-Supply System			
Grant rights-of way for well field, pipeline gathering system, water-conveyance pipeline, and other associated facilities	BIA ^{1,3,4} Phoenix Area Office Navajo Area Office	Rights-of-way grant across American Indian reservations, permit or lease for the water-conveyance pipeline and associated facilities	25 CFR Part 169
Approval of lease or permits for water supply and related facilities	BIA ^{1,3,4} Western Regional Office Navajo Regional Office	Lease or permits for water supply and related facilities	25 CFR 162
Construction, operation, maintenance, and abandonment of pipeline across or within highway right-of-way	Federal Highway Administration (FHWA)	Permits to cross Federal-Aid Highway	Federal-Aid Highway Act, 23 U.S.C. 101, et seq. 23 CFR 1.23 23 CFR Part 645 23 CFR Part 771
Construction sites with greater than 5 acres of land disturbed	USEPA (on American Indian reservations)	Section 402 NPDES Permit for Storm Water Discharges from Construction Sites	Clean Water Act (33 U.S.C. 1342); 40 CFR Part 122
Construction across water resources	USACE	Section 10 and/or Section 404 Permit, for construction of obstructions to navigable capacity of navigable waters or for discharge of dredged or fill material to waters of the United States, respectively	33 U.S.C. 403, 1344(a); 33 CFR Parts 320, 322, 323, 325

Table 2-6 Summary of Potential Agency Authorities and Actions

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Construction in or modification of floodplains	All Federal action agencies	Consider alternatives to avoid adverse effects and incompatible development in the floodplains	Executive Order 11988; 33 CFR Part 320.4(l) (USACE)
Potential discharge of dredged or fill material to waters of the United States (including wetlands and washes)	USACE	Section 404 Permit to discharge dredged or fill material to waters of the United States	Clean Water Act (33 U.S.C. 1344(a)); 33 CFR Parts 320, 323, 325
Discharge of dredged or fill material to waters of the United States (including wetlands and washes)	USEPA (Navajo Nation EPA on Navajo Reservation)	USEPA has authority to “veto” a USACE permit issued under 33 U.S.C. 1344(a) (Clean Water Act Section 404(a))	Clean Water Act Section 404(c) (33 U.S.C. 1344(c)); 40 CFR Part 231
Placement of structures and construction work in navigable waters of the United States	USACE	Section 10 Permit for construction of obstructions to navigable capacity of navigable waters	Rivers and Harbors Act of 1899 (33 U.S.C. 403); 33 CFR Parts 320, 322, 325
Potential pollution discharge during construction, operation, and maintenance	USEPA	Spill Prevention Control and Countermeasure (SPCC) Plan	Oil Pollution Act of 1990; 33 U.S.C. 2701 et seq.; 40 CFR Part 112
Grant right-of-way by Federal land-managing agency	Federal land-managing agency, in consultation with FWS	ESA compliance by Federal land-managing agency and lead agency	ESA of 1973, as amended (16 U.S.C. 1531 et seq)
Effects on historic properties	Lead Federal agency, BIA, Navajo THPO, HCPO, and Advisory Council on Historic Preservation if it chooses to participate	Consultations with all interested parties to determine whether there will be adverse effects to historic properties, and if so how to take those effects into account; usually means development of a “Section 106 Memorandum of Agreement”	NHPA of 1966 (16 U.S.C. 470f); 36 CFR Part 800
Excavation of archaeological sites on tribal lands	BIA ¹ , tribal consents	Permits to excavate	Archaeological Resources Protection Act of 1979 (ARPA) (16 U.S.C. 470aa to 470mm); 25 CFR Part 262; 43 CFR Part 7
Potential conflicts with freedom to practice American Indian religions	Lead Federal agency and BIA ¹	Consultation with affected American Indians	American Indian Religious Freedom Act (AIRFA) (42 U.S.C. 1996); Executive Order 13007 (61 Federal Register 26771)
Disturbance of graves, associated funerary objects, sacred objects, and items of cultural patrimony	BIA ¹ , Tribal consents	Consultation with American Indian group regarding treatment of remains and objects	Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (25 U.S.C. 3001); 43 CFR Part 10

Table 2-6 Summary of Potential Agency Authorities and Actions

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Investigation of cultural and paleontological resources	BIA ¹	Permit for study of historical, archaeological, and paleontological resources	Antiquities Act of 1906 (16 U.S.C. 432-433); 36 CFR Part 296; 43 CFR Parts 3, 7 and 2300; ARPA; 25 CFR Part 262; 43 CFR Part 7
Coal-Slurry Pipeline			
Rights-of way for coal-slurry pipeline, and other associated facilities	BIA ^{1,3,4}	Grant of easement for rights-of-way.	25 CFR Part 169
Rights-of-way grant for coal-slurry pipeline	Forest Service	Special use authorization permit or easement	Federal Land Policy and Management Act of 1976 (FLPMA), Title V (43 U.S.C. 1761-1771) 36 CFR Part 251
Preconstruction surveys; reconstruction, operation, maintenance, and abandonment of coal-slurry pipeline on public land; right-of-way extension	BLM	Right-of-way grant across public land; temporary use permit; land use plan maintenance	FLPMA, Title V (43 U.S.C. 1761-1771) 43 CFR Part 2800
	Forest Service	Special use authorization permit or easement	36 CFR Part 251
Construction, operation, maintenance, and abandonment of pipeline across or within highway right-of-way	FHWA	Permits to cross Federal-Aid Highway	Federal-Aid Highway Act, 23 U.S.C. 101, et seq. 23 CFR 1.23 23 CFR Part 645 23 CFR Part 771
Construction sites with greater than 5 acres of land disturbed	USEPA (on Indian land)	Section 402 NPDES Permit for Storm Water Discharges from Construction Sites	Clean Water Act (33 U.S.C. 1342); 40 CFR Part 122
Construction across water resources	USACE	Section 10 and/or Section 404 Permit, for construction of obstructions to navigable capacity of navigable waters or for discharge of dredged or fill material to waters of the United States, respectively	33 U.S.C. 403, 1344(a); 33 CFR Parts 320, 322, 323, 325
Construction in or modification of floodplains	All Federal action agencies	Consider alternatives to avoid adverse effects and incompatible development in the floodplains	Executive Order 11988; 33 CFR 320.4(l) (USACE)
Potential discharge of dredged or fill material to waters of the United States (including wetlands and washes)	USACE	Section 404 Permit to discharge dredged or fill material to waters of the United States	Clean Water Act (33 U.S.C. 1344(a)); 33 CFR Parts 320, 323, 325

Table 2-6 Summary of Potential Agency Authorities and Actions

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Placement of structures and construction work in navigable waters of the United States.	USACE	Section 10 Permit for construction of obstructions to navigable capacity of navigable waters	Rivers and Harbors Act of 1899 (33 U.S.C. 403); 33 CFR Parts 320, 322, 325
Potential pollution discharge during construction, operation, and maintenance	USEPA	SPCC Plans for pump stations	Oil Pollution Act of 1990, 33 U.S.C. 2701 et seq.; 40 CFR Part 112
Grant right-of-way by Federal land-managing agency	Federal land-managing agency, in consultation with FWS	ESA compliance by Federal land-managing agency and lead agency	ESA of 1973, as amended (16 U.S.C. 1531 et seq)
Effects on historic property	Federal lead agency, SHPOs, Navajo Nation THPO, HCPO, and Advisory Council on Historic Preservation if it chooses to participate	Consultations with all interested parties to determine whether there will be adverse effects to historic properties, and if so how to take those effects into account; a “Section 106 Programmatic Agreement” is being developed	NHPA (16 U.S.C. 470, et seq.); 36 CFR Part 800
Excavation of archaeological sites	Federal land-managing agency and tribes	Permits to excavate	ARPA (16 U.S.C. 470aa to 470ee)
Potential conflicts with freedom to practice American Indian religions	Federal lead agency, Federal land-managing agency	Consultation with affected American Indians	AIRFA (42 U.S.C. 1996); Executive Order 13007 (61 Fed. Reg. 26771)
Disturbance of graves, associated funerary objects, sacred objects, and items of cultural patrimony	Federal land-managing agency	Consultation with American Indian group regarding treatment of remains and objects	NAGPRA (25 U.S.C. 3001); 43 CFR Part 10
Investigation of cultural and paleontological resources	Affected land-managing agency	Permit for study of historical, archaeological, and paleontological resources	Antiquities Act of 1906 (16 U.S.C. 432-433); 36 CFR Part 296; 43 CFR Parts 3, 7 and 2300; ARPA; 25 CFR Part 262; 43 CFR Part 7
Investigation of cultural resources	Affected land-managing agency	Permits to excavate and remove archaeological resources on Federal lands; American Indian tribes with interest in resources must be consulted prior to issuance of permits	ARPA (16 U.S.C. 470aa to 470mm); 43 CFR Part 7
Ground disturbance on Federal land or Federal Aid project	BLM, Forest Service	Compliance with BLM mitigation and planning standards for paleontological resources on public lands	FLPMA (43 U.S.C. 1701-1771) Antiquities Act of 1906 (16 U.S.C. 431-433) 7 CFR Part 3100 (Department of Agriculture, including Forest Service) BLM Manual Section 8270

Table 2-6 Summary of Potential Agency Authorities and Actions

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
TRIBAL			
Hopi Tribe			
Use of Hopi lands and resources	Hopi Tribal Planning	1) Hopi Tribe’s input in planning for reservation development 2) Procedural review and approval of community development plans 3) Approval of well leases, drilling permits, and use of water	Hopi Indian Tribe Ordinance 55
Engaging in the business of investigating, conducting tests, and collecting scientific information/data concerning the natural resources of the Hopi Reservation	Hopi Office of Revenue Commission Hopi Department of Natural Resources	Business license; procedures, terms, and conditions of permits and penalties for violation	Hopi Indian Tribe Ordinance 14
Engaging in business on the Hopi Reservation	Hopi Office of Revenue Commission	Revenue Commissioner to administer tribal licensing ordinances	Hopi Indian Tribe Ordinance 31
Engaging in business on the Hopi Reservation	Hopi Tribal Council	Nonmember business license; ordinance exemption for sales to tribe; license fees on the privilege of doing business on the reservation; compliance with rules reservation business and protection consumers; bonding requirement for nonresidents	Hopi Indian Tribe Ordinance 17
Possession or use of Hopi land without permission	Civil Trespass	Compliance with provisions on prohibitions on the possession or use of Hopi land without permission	Hopi Indian Tribe Ordinance 52
Indian preference provisions for employment	Tribal Employment Rights Office	Provisions for Indian employment	Hopi Indian Tribe Ordinance 37
Construction of improvements within District 6 of Hopi Reservation	Construction	Control of new construction on the 1882 reservation outside District 6	Hopi Indian Tribe Ordinance 23
Effects on water	Hopi Water Resources Program	Establish water quality standards applicable to all water resources; provide wellhead protection; permits for well drilling and adherence to defined well specifications	Hopi Tribal Resolution H-107-97
Construction debris	Hopi Environmental Protection Office	Removal of construction debris via Environmental Protection Plan	Solid Waste Ordinance 44

Table 2-6 Summary of Potential Agency Authorities and Actions

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Preconstruction activities: 1) Historical or scientific research 2) Conducting archaeological surveys and excavations	Hopi Cultural Preservation Office	1) License authority 2) Tribal approval	Hopi Indian Tribe Ordinance No. 26
Preconstruction activities – site visit	Hopi Tribal Council	Written permission from Hopi Tribal Council chairman to visit archaeological or historical site	Hopi Indian Tribe Executive Order 78-1
Construction in or removal of range improvements	Hopi Office of Range Management	Written authorization for Hopi Department of Range Management	Hopi Indian Tribe Ordinance No. 43
Construction in or removal of woodlands	Hopi Department of Natural Resources	Permit to harvest woodland products	Hopi Indian Tribe Ordinance No. 47
Navajo Nation			
Modification of Title V air quality permit	Navajo Nation EPA	Title V Permit	Clean Air Act (42 U.S.C. 7661a) 40 CFR 71
On-ground investigations for tribal or federally protected species	Navajo Nation Fish and Wildlife Department	Biological Investigation Permit	Government Services Committee Resolution SFCF-3-94
Preconstruction activities, construction, operation, and maintenance	Resources Committee of the Navajo Nation Council	Formal written approval (e.g., well leases, drilling permits, use of water)	2 Navajo Nation Code (NNC) 164
Wetlands	USEPA Region IX Navajo Nation EPA	NPDES Permit 401 Water Quality Certification	NNC CJA-16-96
Permission to survey on Navajo Tribal Trust Land for surveying, map legal description, environmental assessment, ethnographic and archaeological studies	Navajo Nation reviewing departments (*) *Project Review Office	Navajo Nation Council consent letter or permit per Resource Committee	2 NNC 695 25 CFR 169
Discharge of dredged or fill material to waters of the United States (including wetlands and washes)	Navajo Nation EPA	Section 404 Permit	Clean Water Act (33 U.S.C. 1344(a)); 33 CFR Parts 320, 323, 325
Construction disturbance in areas of sensitive animal and plant species	Navajo Nation Fish and Wildlife Department, *Natural Heritage Program	Review and approval by Navajo Nation	25 CFR 169.4 to 169.5
Construction disturbance in areas of cultural resources	*Historic Preservation Department	Review and approval by Navajo Nation	25 CFR 169.5
Encroachment of all existing rights-of-way	Navajo Nation reviewing departments	Navajo Nation consent letter	25 CFR 169.3

Table 2-6 Summary of Potential Agency Authorities and Actions

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Construct, operate, and maintain right-of-way	Resource Committee of Navajo Nation Council; BIA agencies or area office	Resource Committee Resolution and Navajo Nation consent letter	2 NNC 695 (B)(6)
Restoration of right-of-way	Navajo Nation EPA	Review and approval	25 CFR 169.5
Cultural resource investigations on Navajo Nation lands	Navajo Nation Historic Preservation Department; BIA, Navajo Regional Office	Class B inventory permits, Class C excavation permits, ARPA permits for disturbance to archaeological resources	Navajo Nation Cultural Resource Protection Act (CRPA-19-88) ARPA (43 CFR 47)
Clearing, transporting, selling, trading, or bartering any Navajo forest product	Navajo Nation Forestry Department	Commercial permit	Resource Resolution RCJN-69-88; 23 NNC 902 (c); 17 NNC 525; 18 U.S.C. 1853; 18 U.S.C. 1855; 18 U.S.C. 1850
Potential effects on the water of Navajo Nation lands	Navajo Nation Department of Water Resources	Water use permit	Chapter 7, NNC 254 22 NNC 1101 et seq.
Survey activities for geologic or paleontologic resources	Navajo Nation Minerals Department	Reconnaissance permit	Government Services Committee Resolution GSCAP-20-94
Removal of fossil resources for study purposes	Navajo Nation Minerals Department	Collection permit	Government Services Committee Resolution GSCAP-20-94
STATE			
Arizona			
C-aquifer groundwater pumping from proposed wells on the Hart Ranch, land owned in fee by the Hopi Tribe	Arizona Department of Water Resources (ADWR)		
Storm water management from potential discharges associated with industrial activity or construction of sites greater than 5 acres (cumulative)	Arizona Department of Environmental Quality (ADEQ)	Arizona Pollutant Discharge Elimination System (AZPDES) permit	Arizona Revised Statute (A.R.S.) 49-255 and Arizona Administrative Code (A.A.C.) R18-9-1, 2; A.A.C. R18-11-1
Construction across water resources	ADEQ	State Water Quality Certification (State review required for all Federal Section 404 permits)	Clean Water Act (33 CFR Parts 320, 322, 323, 325)
NPDES Permit	ADEQ	Consistency Review Form to ensure that a proposed facility or use will be consistent with the existing Certified Regional Water Quality Management Plan (WQMP)	Clean Water Act (Section 303, et al.), Federal Water Pollution Control Act Section 208
Construction and operation of sedimentation pond	ADEQ	Aquifer Protection Permit	A.R.S. 49-241 through 49-252, and A.A.C. R18-9-101 through R18-9-403

Table 2-6 Summary of Potential Agency Authorities and Actions

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Fugitive dust as a result of project construction	ADEQ	Compliance with dust control measures and standards	A.A.C: R-18-2-604, R-18-2-605, R-18-2-606, R-18-2-607, R-18-2-612
Construction, operation, maintenance, and abandonment of pipeline across or within state highway right-of-way	Arizona Department of Transportation	Crossing permit, permit for use of right-of-way	A.R.S. 28-7053, AAC R17-3-501 through 509
Encroachment onto State Trust Lands	Arizona State Land Department	Right-of-way permit	A.R.S. 37-461
Loss of special status plant species	Arizona Department of Agriculture	Permit to remove plants	Native Plant Law (A.R.S. 3-901 through 916)
Disturbance to or loss of special status animal species habitat	Arizona Department of Game and Fish	Coordination with the FWS/BLM/USACE	U.S. Fish and Wildlife Coordination Act
Potential disturbance to cultural resources on State land	Arizona State Museum	Permit to investigate	A.R.S. 41-841 through 847
	SHPO	Review and approval of use of any State Trust Lands	A.R.S. 41-861 through 864
Potential disturbance to human remains or funerary objects	Arizona State Museum	Grant for permission to disturb	A.R.S. 41-865
Pumping groundwater from C aquifer from well field on the Hopi Hart Ranch	ADWR	Notice of Intent to Drill	A.R.S. 45-596
Nevada			
Storm water management from potential discharges associated with industrial activity or construction of sites greater than 5 acres (cumulative)	Nevada Department of Environmental Protection (NDEP), Bureau of Water Pollution Control	General Permit for Stormwater Discharges Associated with Construction Activity (NVR100000)	NRS 445A.300 through 445A.730
Construction across water resources	NDEP, Bureau of Water Quality Planning	State Water Quality Certification (State review required for all Federal Section 404 permits)	Clean Water Act (33 CFR Parts 320, 322, 323, 325); NRS 445A.010 through 445A.730
Potential for fugitive dust from project construction	NDEP, Bureau of Air Pollution Control	Surface Area Disturbance Permit Authority overridden by Clark County	NAC 445B.22037
Disturbance or modification of special status plant species or habitat	Division of Forestry	Compliance survey for identification of plant species; permit for lawful take of protected plant	NRS 527.050, 527.270, NRS 527.250
Disturbance to or loss of special status animal species	Division of Wildlife	Special permit	NAC 503.093

Table 2-6 Summary of Potential Agency Authorities and Actions

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Potential disturbance to human remains or funerary objects	Office of Historic Preservation	Notification of discoveries, consultation with affiliated groups	NRS 383.150 to 383.190
LOCAL			
Navajo County, Arizona			
Construction of pipeline	Department of Public Works, Planning and Zoning	Special Use Permit	Zoning Ordinance
Potential encroachment onto county rights-of-way	Department of Public Works	Right-of-Way Use Permit	A.R.S. 11-562
Coconino County, Arizona			
Construction of pipeline	Public Works Department	Blanket Permit	County Ordinance
Construction activities	Public Works Department	Grading and Excavation Permit	County Ordinance
Potential encroachment onto county rights-of-way	Public Works Department	Encroachment Permit	County Ordinance 94-01, A.R.S. 11-562
Yavapai County, Arizona			
Construction of pipeline	Department of Public Works	Special Use Permit	County Ordinance
Potential encroachment onto county rights-of-way	Development Services Department	Right-of-Way Permit	County Ordinance 2001-1, A.R.S. 11-562
Mohave County, Arizona			
Potential encroachment onto county rights-of-way	Public Works Department	Right-of-Way Use Permit	A.R.S. 11-562, Mohave County ordinance
Construction of pipeline	Planning and Zoning Office	Special Use Permit	Zoning Ordinance
City of Bullhead City, Arizona			
Construction of pipeline	Community Development Department	Conditional Use Permit	Municipal Code 17.08
Construction of pipeline	Community Development Department	Grading Permit	Municipal Code 15.40
Potential encroachment onto city rights-of-way	Engineering Department	Notification 24 hours in advance of work	Municipal Code 12.04.030
City of Kingman, Arizona			
Construction of pipeline	Planning and Zoning Division	Conditional Use Permit	Municipal Code 29.000
Construction of pipeline	Building Department	Grading Permit	Municipal Code Section 3310
Potential encroachment onto city rights-of-way	Public Works Department	Right-of-Way Permit	Streets and Sidewalks Development Rules and Regulations, Div. 3, 6
Clark County, Nevada			
Potential for fugitive dust from project construction	Air Quality and Environmental Management	Dust Control Permit	Clark County Air Quality Regulations, Section 94

Table 2-6 Summary of Potential Agency Authorities and Actions

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Clearing vegetation, rough grading, stockpiling, altering natural ground surface or its elevation	Comprehensive Planning	Grading Permit Land Disturbance Permit	County Ordinance 30.32.040
Disturbance to or loss of special status animal species habitat	Comprehensive Planning	Incidental Take Permit	County Ordinance 30.32.050
Potential encroachment onto county rights-of-way	Department of Development Services	Encroachment Permit Improvement Plans	County Ordinance 30.32.070 County Ordinance 30.32.080
Construction of pipeline	Comprehensive Planning	Conditional Use Permit	County Ordinance 30.44.010

NOTES:

¹ All BIA permits and/or leases require prior Hopi Tribe and/or Navajo Nation concurrences that typically require completed environmental assessment document.

² The J-23 coal resource area is in a portion of the mine that contains both Navajo and Hopi trust land. The corridor location would need to be clearly identified to establish which BIA Regional Office is responsible for addressing this request (BIA March 11, 2005).

³ The proposed C-aquifer pipeline would require a BIA right-of-way approved by the Navajo Regional Director. These rights-of-way permits are administered and processed by the Navajo Regional Office Branch of Real Estate Services (BIA March 11, 2005).

⁴ Grazing permit holders should, at a minimum, be consulted if the proposed C-aquifer pipeline crosses their customary use area and if compensation is necessary.

At a minimum, provisions should be made for rehabilitation of areas impacted by construction activities and compensation for areas removed from forage production for facilities such as pumping stations, transmission lines, and access roads (BIA March 11, 2005).

At this time, it is not certain whether a permit or lease would be the best means of addressing the proposed C-aquifer well sites (BIA March 11, 2005).

Another Lower Basin diversion location was evaluated at Bullhead City, where the existing coal-slurry pipeline crosses the Colorado River. The concept was to use the existing coal-slurry pipeline, which was to be retired and replaced as part of the Black Mesa Project, to convey water upstream to the mine using a series of pump stations. Although costs, including pumping costs, were a very serious concern with this option, which would involve pumping the water approximately 273 miles generally uphill over an elevation gain of more than 5,000 feet, it was never fully evaluated because of increased opposition to using Arizona's allocation from the Lower Basin for a Nevada-related project.

Increased opposition to diversion and use of Lower Basin water for mining, coal slurry, and tribal use followed the Navajo Nation's filing of a lawsuit against USDI in March 2003. The lawsuit alleged that USDI was not adequately asserting and protecting the rights of the Navajo Nation to water from the main stem of the Colorado River in the Lower Basin. In response to the lawsuit, the State of Arizona and central Arizona water users took the position that the claims of the Navajo Nation to water from the Lower Colorado River in the Lower Basin must be resolved before a supply of Colorado River water could be allocated for the Black Mesa Project. Preliminary discussions to resolve the Navajo Nation's Lower Basin claims revealed that it would likely take many years to settle those claims. As a result, the United States, tribes, and companies concluded that the Colorado River was not a viable source for the immediate future, and turned to the C aquifer as an alternative.

2.4.2.2 Groundwater Basins Near the Coal-Slurry Pipeline

Peabody investigated potential water sources along the coal-slurry pipeline. Again, the concept was to use the existing coal-slurry pipeline, which was to be retired and replaced, to convey water upstream to the mine. At the same time, Peabody evaluated the potential to purchase gray water from the City of Flagstaff. The City of Flagstaff had indicated that a portion of its potential capacity would be available, and with augmentation from groundwater, might supply enough water for the needs of the mines (discussion of gray water alternative is provided below). Peabody conducted a preliminary evaluation of the potential areas of groundwater production along the coal-slurry pipeline route for use in (1) augmenting the Flagstaff gray water and (2) providing a stand-alone water supply that could be delivered using the existing coal-slurry pipeline after its replacement (URS Corporation 2003a).

As part of the investigation, the areas underlying the coal-slurry pipeline were partitioned into six zones. These zones generally, and in many cases specifically, were identified based on known hydrogeologic basins. None of the basins entirely underlie either the Hopi or Navajo Reservations. Certain areas in some of the groundwater basins that were studied exhibited good groundwater development potential. However, with the exception of one zone, Zone D—Little Colorado River Plateau Hydrologic Basin, further investigations were deemed to be unjustified because of Arizona's present groundwater management code. Article 8, Title 45, of Arizona Revised Statutes governing the transportation of groundwater precludes transportation of groundwater between basins in the State of Arizona, unless approval is granted by the state legislature. There are certain exceptions to this rule, but none apply to the basins included in this evaluation.

Although there are provisions to allow other exceptions to the statute, further investigations were abandoned due to the uncertainty associated with a positive outcome in the legislature and the length of time it might take to get the exception.

Though considered, a water supply from groundwater basins along the coal-slurry pipeline was determined technically infeasible and eliminated from further study. Further investigation of the potential for a well field in Zone D was discontinued for the following reasons: (1) concerns voiced by ADWR about potential surface-water impact from significant additional groundwater development that could interfere with adjudication claims in the Little Colorado River water rights case; (2) questionable water quality and yield in the northern portion of the basin (total dissolved solids of about 3,000 parts per

million); (3) proximity to sensitive springs (Blue Springs) if a well field were to be sited in the northern portion of the basin; (4) interference with existing users if a well field were to be sited in the southern portion of the basin; and (5) relatively high costs per acre-foot for well construction.

Peabody also investigated the potential for purchasing water from a source in the vicinity of Drake, Arizona, near enough to the coal-slurry pipeline that Peabody determined further investigations might be warranted. This source is believed to tap the Martin Limestone, an aquifer system known to produce large volumes of water of superior quality. However, this alternative was rejected for the same reasons previously discussed (trans-basin diversion and use issues), and because potential impacts on flow in the Verde River system were indicated.

2.4.2.3 Groundwater Sources Near the Black Mesa Complex

Peabody re-evaluated the feasibility of supplementing water supplies at the Black Mesa Complex using the Dakota aquifer (D aquifer) (GeoTrans, Inc. 2001). Though considered, groundwater sources near the mines were eliminated from further study in this EIS based on the information summarized below.

Peabody investigated whether 500 af/yr could be pumped from the D aquifer from five wells. The D aquifer overlies the N aquifer and comprises four geologic formations—Morrison, Cow Springs, Entrada, and Dakota. For purposes of the investigation, all four formations were modeled as one hydrostratigraphic unit. Hydraulic properties were determined from previous studies conducted by Peabody (1999) and Stetson Civil & Consulting Engineers (1966). Pumping was assumed to be continuous and at 500 af/yr (62 gallons per minute for each of the five wells). The target pumping rate produced about 414 feet of drawdown at the well bore after 30 years of simulation. According to the model, after only 2 to 3 years, the wells would begin to interfere with each other. The results indicated that the feasibility of pumping the target volumes is low, due to the large drawdown relative to the available head in the D aquifer. In addition, the quality of D-aquifer water in the Black Mesa area makes it unsuitable for potable and coal-slurry uses due to elevated total dissolved solids. It could only be used for certain dust suppression applications, and would require a separate distribution system from the N-aquifer distribution system. Thus, previous conclusions were affirmed that the D aquifer in the vicinity of the Black Mesa Complex could not provide water of sufficient quantity and quality on a sustained basis to replace a significant portion of the current water supply. Nor could it provide the additional water needed for the proposed LOM revision (2,000 af/yr).

Peabody evaluated use of the N aquifer in areas outside of the Black Mesa Basin, under the premise that the aquifer might be able to be used in areas where issues could be avoided regarding potential impact on springs and streams located in the Black Mesa Basin sensitive to the Hopi Tribe. Also, groundwater use by the Navajo Nation is less in the other basins as compared to usage in the Black Mesa Basin. The areas evaluated were the so-called Northwest N aquifer and the Northeast N aquifer.

The Northwest N aquifer is the principal aquifer beneath the Kaibito Plateau. A northeast-trending groundwater divide occurs within the N aquifer along the southeastern margins of the Kaibito Plateau, roughly parallel to U.S. Highway 160 and passing close to Shonto, Arizona. Groundwater entering the N aquifer in this area flows either to the northwest, beneath the Kaibito Plateau and toward Lake Powell, or to the south and east toward the Black Mesa Basin. It is believed that this basin stores about 80 million acre-feet of very good quality water (URS Corporation 2001).

The Northeast N aquifer is located north and east of the Black Mesa Complex in the Blanding Hydrologic Basin. A 500-square-mile area of interest located west of Chinle Wash was evaluated. Surface drainage is to the northeast in this area toward Chinle Wash, which ultimately drains to the San Juan River above Lake Powell. The area of interest was on the northeast side of the groundwater divide north and east of the Black Mesa. Groundwater recharged along the divide flows either northeast toward the Blanding

Basin and toward the San Juan River, or southeast toward the Black Mesa Basin. It is estimated that about 25 million acre-feet of very good quality water is stored in the area of interest (URS Corporation 2001).

Preliminary evaluations of water supplies from these two sources were performed, including estimating costs to develop delivery systems to the mines (URS Corporation 2001). The Northwest and Northeast N-aquifer alternatives were rejected primarily because preliminary feedback from the tribes indicated that they were uncomfortable using the N aquifer for mine uses at any location, regardless of the potential impact on tribal water supplies, springs, and streams. Furthermore, a review of potential issues associated with Colorado River water rights indicated potential issues that could preclude development of a well field in either the Northwest or the Northeast N aquifers.

Both of these potential water sources are located in the Upper Colorado River Basin (URS Corporation 2002). It appears that well fields developed in the Upper Basin that could be hydraulically connected to surface water could not be constructed unless the user demonstrates the well field is not interfering with the existing appropriation of surface water for Arizona. Given the proximity of the Northwest N-aquifer study area to Lake Powell and the perennial reaches of Navajo and Kaibito Creeks, it is very possible that technical information would show that operation of a well field would consume groundwater that is tributary to the Colorado River, and would have to be considered part of Arizona's 50,000 acre-foot allocation from the Upper Colorado River Basin. It is known that Lake Powell waters recharge the N aquifer in the area in question, so hydraulic communication is documented. Arizona's allocation is already consumed, so the portion of a new well field that removes surface water could not be authorized. The same situation applies, although to a lesser extent and probability, to the Northeast N aquifer via connectivity to perennial reaches of Chinle Wash.

2.4.2.4 Gray Water Alternatives

Peabody evaluated the use of reclaimed sanitary wastewater from Flagstaff, Arizona, to supply at least a portion of the supply needed by the Kayenta and Black Mesa mining operations. Conceptual-level engineering and capital-cost analyses for this alternative were performed (URS Corporation 2003b). This alternative consisted of a new pipeline to deliver the gray water from Flagstaff's Wildcat Hill Treatment Plant to the existing coal-slurry pipeline near Gray Mountain, Arizona, following U.S. Highway 89N.

Reclaimed water used for the coal-slurry system must meet "A+ Reclaimed Water" requirements as specified by the Arizona Administrative Code (Title 18, Chapter 11, Article 3). At the time this alternative was evaluated, Flagstaff was in the process of designing improvements to one of its wastewater-treatment plants to bring the plant's effluent to this standard, and to another of its treatment plants to improve efficiency. The scope and cost of the improvements were not included in the report. However, Flagstaff had indicated that in order to obtain the water the user would have to commit to financing the upgrades, including a pipeline between two of the treatment plants to accumulate the desired volume of water needed. The cost of the treatment plant upgrades was estimated to exceed \$20 million dollars. The tie-across pipeline between the city's two major treatment plants was estimated at another \$2 to \$3 million.

Initially, Flagstaff indicated 4,388 acre-feet of gray water that were being discharged into the Rio del Flag would be available for use. By the time the report was prepared, the city revised its estimate of available water to 3,095 af/yr. This amount was based on treatment-plant average monthly output in 2002, adjusted for existing and future use commitments the city had made (primarily for irrigation at local golf courses, schools, and parks). This amount assumed increases in future flow from the Flagstaff treatment systems attributable to growth. Removal of the future flow increase from the estimate resulted in approximately 2,552 af/yr available, based on 2002 output from the plants. Thus, the Flagstaff gray water alternative had the potential to provide about 64 percent of Peabody's existing water requirement (4,000 af/yr) and about 43 percent of the future water requirement (6,000 af/yr). In either case, it was insufficient to replace all of

the water needed for coal transportation. Ultimately, Flagstaff committed a significant portion of the remaining available water to other users, rendering this alternative not viable.

2.4.3 Water-Return Pipeline

Construction of a pipeline to return the slurry water to the mine once the water is separated from the coal at the Mohave Generating Station also was suggested as an option during scoping. However, about half of the water in the coal slurry can be reclaimed, and used for cooling and other purposes at the power plant, which reduces the plant's requirements for Colorado River water. Construction of a return pipeline would be very costly, and it still would be necessary to obtain additional water from another source, greatly increasing the cost of this option. For this reason, implementing the use of a water-return pipeline was determined to be economically infeasible and eliminated from further study in this EIS.

2.4.4 Alternative Coal Delivery Methods

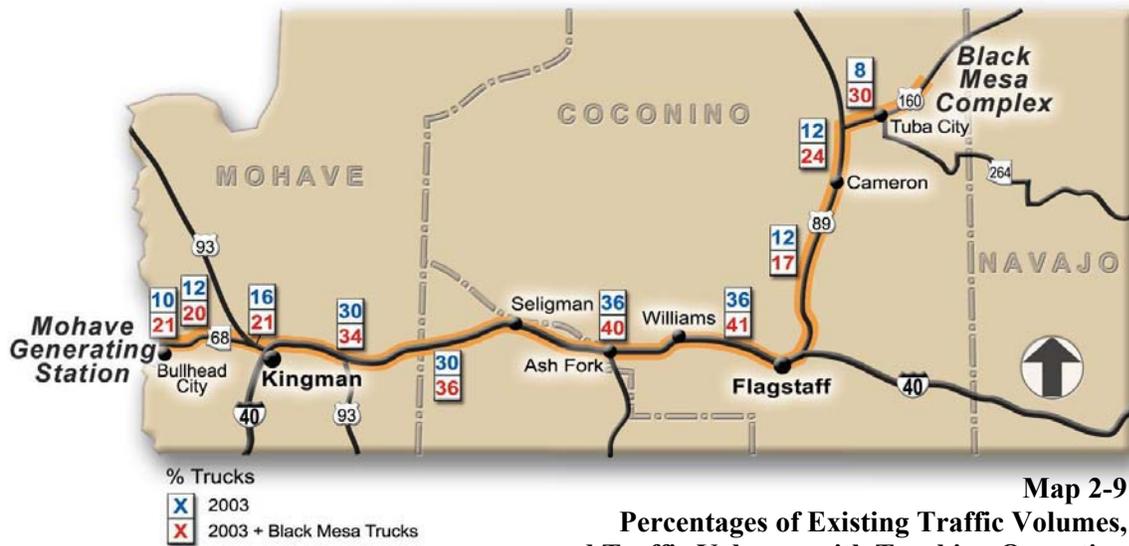
In response to public comments, OSM evaluated alternative means of transporting the coal from the Black Mesa Mine to the Mohave Generating Station, including truck and rail delivery, and alternatives to water as a medium for the slurry.

2.4.4.1 Truck Transportation

As an alternative to transporting coal from the Black Mesa mining operation via slurry pipeline, OSM examined the feasibility of trucking the coal over existing roads and highways. Based on the analysis of a conceptual operations plan, trucking as an option was determined to be economically and technically impractical, as summarized below.

Costs for this alternative were estimated based on an examination of the year-round over-the-road operations that would be necessary to haul 5.4 million tons of coal from the Black Mesa mining operation to the Mohave Generating Station; the route considered included U.S. Highway 89, I-40, and State Highway 68. It was determined that the operations would require 592 truckloads of coal to the generating station (including 592 return trips) over those roads per day. This would be the equivalent of adding about one truck almost every minute 24 hours a day, 7 days a week, in addition to the traffic that currently travels that route. Although the examination did not exhaustively investigate all conceivable costs involved, it did consider the potential impacts on communities along the route.

The truck volume that would be added to existing highways by the coal-haul operation was added to existing truck volumes to determine impacts on traffic (available from the 2003 Arizona Department of Transportation Highway Performance Monitoring System). A comparison of the percentage of existing traffic volumes to the percentage of traffic volumes with the trucking operation is presented in Map 2-9.



Map 2-9
Percentages of Existing Traffic Volumes, and Traffic Volumes with Trucking Operation

The comparison reveals that volumes would increase dramatically, especially on the two-lane highways at both ends of the route where percentages would increase by 25 to more than 100 percent. These increases would significantly alter the operational patterns of these highways, impacting public safety, road maintenance, and overall congestion.

Capital costs for the truck alternative, including upgrades to existing infrastructure and the acquisition of new equipment, would be approximately \$2,737.2 million. Annual operating costs were estimated at approximately \$271 million, and the annualized cost per ton of coal was estimated to be \$103.86 (URS Corporation 2005a).

A comparison of the estimated costs of trucking with the estimated costs for reconstruction of the coal-slurry pipeline reveals that the capital costs and the annual operation and maintenance costs for trucking would be significantly greater, as shown in Table 2-7. The estimated costs of the trucking alternative include those associated with making substantial changes to the Mohave Generating Station in order to accept, handle, and burn dry coal rather than wet coal. However, use of dry coal at the Mohave Generating Station would require the facility to undergo a PSD applicability determination that could result in the facility undergoing New Source Review under the Clean Air Act. This could result in a change of operations or the installation of additional air-pollution control equipment to meet best available control technology (BACT) emission standards. The costs of any such additional air-pollution control equipment or changes in operations required by air permitting activities have not been included in the cost estimates cited above. Financing costs also were not included.

**Table 2-7 Comparison of Estimated Costs for Transporting Coal
by Truck and by Coal Slurry**

Type of Cost	Trucking	Coal Slurry³
Capital cost (\$ Millions)	2,737.2	379.0-414.0
Power plant facilities conversion ¹ (\$ Millions)	216.5	NA
Annual operation and maintenance (\$ Millions)	271.0	27.18-30.0 ⁴
Annualized cost per ton of coal ²	103.86	13.47-14.67 ⁴

SOURCES: Black Mesa Pipeline, Inc. 2005; Southern California Edison Company 2005; URS Corporation 2005a

NOTES: ¹ Conversion of the Mohave Generating Station facilities to accept and burn dry coal.

² The annualized cost per ton of coal is calculated from the annualized capital and operation and maintenance costs divided by the annual coal tonnage.

³ Includes reconstruction of the coal-slurry pipeline, development of the C-aquifer well field, and water-supply pipeline. The range in costs represents the 108-mile-long eastern (and two pump stations) and 137-mile-long western (and four pump stations) water-supply pipeline routes, and the 6,000 af/yr and 11,600 af/yr alternatives.

⁴ Includes the coal-slurry pipeline (\$24 million), annual water royalties to the Hopi Tribe and Navajo Nation (\$5.4 million, 2006 dollars), and water-supply pipeline depending on the pipeline size and alternative route selected (\$3.18 to \$6 million).

NA = Not applicable

Finally, it should be recognized that, although not analyzed in detail, implementation of this alternative would entail serious adverse impacts such as disruption of local traffic patterns, traffic congestion particularly in commercial areas along the two-lane highways (U.S. 160 and 89) and in the Laughlin area, public safety, noise from diesel engines and engine braking systems, and emissions from diesel engines and fugitive coal dust that would affect local air quality near roadways.

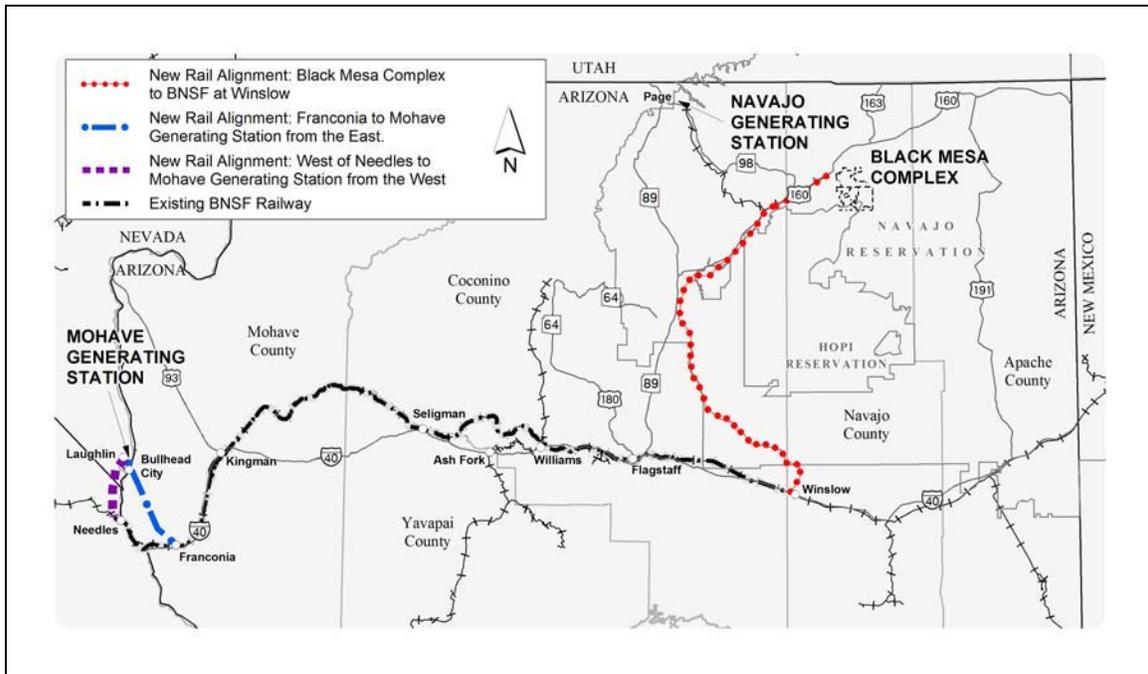
2.4.4.2 Rail Transportation

Over a period of more than a decade, a number of studies have addressed the feasibility of using rail to transport coal from the Black Mesa Complex to the Mohave Generating Station (OSM 1990; USDI 1992, 1993; SCE 1994; Peabody 1997, 2003). The feasibility of delivering 5.4 million tons of coal from the Black Mesa mining operation to the Mohave Generating Station by a common carrier railroad system—the BNSF Railroad, the nearest major U.S. east-west rail line—was examined further for this EIS (Appendix E, URS Corporation 2005b). This potential option was found to be economically and technically impractical and eliminated from further consideration as discussed below.

To reach the BNSF from the Black Mesa mining operations, a 164-mile-long rail spur south to Winslow, Arizona, would have to be constructed. The spur would run southwest along U.S. Highway 160, pass south of Tuba City, then follow the Little Colorado River southeast to Winslow Arizona. To reach the Mohave Generating Station from the BNSF main line also would require the construction of a rail spur north from the main line. Two options were analyzed: (1) an eastern approach of 35 miles from Franconia, Arizona, and (2) a western approach of 23 miles from west of Needles, California. The study identified and developed conceptual railroad spur alignments based on previous studies with revisions as needed (Map 2-10).

Capital costs for the railroad alternative include rail improvements, rail construction, rolling stock (i.e., locomotives, coal cars, etc.), and loading/unloading facilities at both ends of the rail line. Needed improvements to the BNSF Railroad 267-mile mainline from Winslow to the eastern approach at Franconia include 30 miles of new third main line track, side tracks, control points, interlockings, bridges, grade crossings, culverts, land for rights-of-way, etc., which are estimated to cost \$141.0 million. For the western approach (from the main line west of Needles) an additional cost of \$9.7 million would be added to the main line improvement costs.

Map 2-10 Conceptual Railroad Spur Alignments



Capital construction costs for new spurs are estimated to be \$821.1 million for the new Black Mesa to Winslow spur, \$230.1 million for the eastern approach spur from Franconia to the Mohave Generating Station, and \$156.6 million for the western approach spur from west of Needles to the Mohave Generating Station.

New facilities at Black Mesa include a new conveyor system from the mine to a new load-out facility that would include a new coal-storage silo, new loop track, and a new unit train loading facility. New facilities at the Mohave Generating Station include new unloading facilities, train servicing facilities, and conversion of the Mohave Generating Station to enable burning of dry coal. The new Black Mesa and Mohave Generating Station facilities costs would total \$397.3 million, including conversion of the plant to burn dry coal.

The alternative would require substantial changes to the Mohave Generating Station in order to accept, handle, and burn dry coal rather than wet coal. As a result, use of dry coal at the Mohave Generating Station would require the facility to undergo a PSD applicability determination that could result in the facility undergoing New Source Review under the Clean Air Act. This could result in a change of operations or the installation of additional air pollution control equipment to meet BACT emission standards. The cost of any such additional air pollution control equipment or changes in operations required by air permitting activities have not been included in the cost estimates cited above. Other capital start-up costs would include \$67.5 million for four train sets (based on volume of coal transported, current train technology, and terrain encountered) plus spares consisting of 19 diesel locomotives and 550 gondola coal cars. The total capital cost for the eastern approach to the Mohave Generating Station is \$1,636.5 million and for the western approach \$1,572.7 million.

Annual operating and maintenance cost estimates for each of the alternative approaches are based on: (1) an annual operating expense of \$0.015 per revenue ton-mile, (2) annual operating revenue to BNSF of \$0.0032 per revenue ton-mile (operating revenue of \$0.0185 per ton-mile minus operating expense of \$0.0153 per ton-mile) (based on cost data from the Association of American Railroads Railroad Fact,

2004 Edition). The total operation and maintenance cost for the alternative from the Black Mesa Complex to Mohave Generating Station from the east via Franconia is estimated at \$43.1 million, and for the alternative approach from the west is estimated at \$45.0 million.

The annualized cost per ton of coal, calculated from the annualized capital and operation and maintenance costs divided by the annual coal tonnage of 5.4 million tons, is estimated at \$40.07 for the Black Mesa Complex to Mohave Generating Station from the east via Franconia and \$39.18 for the alternative approach from the west.

A comparison of the estimated costs of delivering coal by rail with the estimated costs for reconstruction of the coal-slurry pipeline reveals that the costs for the rail option (without consideration of financing costs) are significantly greater, as shown in Table 2-8.

Table 2-8 Comparison of Estimated Costs for Transporting Coal by Rail and by Coal Slurry

Type of Cost	Western Approach Railroad	Eastern Approach Railroad	Coal Slurry
Capital cost			
Slurry pipeline reconstruction (\$ millions)	NA	NA	200.0
Water-supply system construction ¹ (\$ millions)	NA	NA	179.0-214.0
BNSF mainline improvements (\$ millions)	150.7	141.0	NA
New spur from Black Mesa to Winslow (\$ millions)	821.1	821.1	NA
New spur to Mohave Generating Station from either Franconia (eastern approach) or west of Needles (western approach) (\$ millions)	156.6	230.1	NA
Unit train equipment (four train sets and spares) (\$ millions)	67.5	67.5	NA
New facilities at load out and power plant including dry coal conversion (\$ millions)	397.3	397.3	NA
Total capital cost (\$ millions)	1,572.7	1,636.5	379.0-414.0
Annual operation and maintenance (\$ millions)	45.0	43.1	27.18-30.0²
Annualized cost per ton of coal³	50.18	51.15	13.47-14.67²

SOURCE: URS Corporation 2005b

NOTES: ¹ Includes well field, and the range represents the 108-mile-long eastern (and two pump stations) and 137-mile-long western alternative (and four pump stations) water-supply pipeline routes, and the 6,000 af/yr and 11,600 af/yr alternatives.

² Includes coal-slurry pipeline (\$24 million), annual water royalties to the Hopi Tribe and Navajo Nation (\$5.4 million), and water-supply system depending on the pipeline size and alternative route selected (\$3.18 to \$6 million).

³ The annualized cost per ton of coal is calculated from the annualized capital and operation and maintenance costs divided by the annual coal tonnage.

NA = Not applicable.

The examination of the railroad option also revealed technical challenges. For example, in several locations, the maximum railroad gradient would exceed the 1.5 percent maximum specified in the design criteria. This would present challenges that may or may not be resolved with engineering. Population growth in the area of Laughlin and Bullhead City has resulted in a substantial amount of residential and commercial development and more development is planned. This would present challenges in acquiring rights-of-way for the rail spur to the power plant. With these unknowns, the option was deemed to be technically infeasible as well.

Finally, it should be recognized that, although not analyzed in detail, implementation of this alternative would entail serious adverse impacts including impacts on safety, residential and commercial developments in the Laughlin and Bullhead City area, and nearby recreation areas; and impacts from noise and increased diesel-engine emissions and fugitive coal dust. Other issues associated with construction and operation of the rail spurs would include potential impacts on cultural resources including traditional cultural properties, wetlands, special status species, big game, and visual resources.

2.4.4.3 Other Media for Slurry

The use of methanol as a medium to transport coal to the Mohave Generating Station was suggested as an alternative to using water in the slurry. In a previous study, methanol, methane, and carbon dioxide were considered for this purpose (USDI 1992). Transporting coal mixed with any one of these has not been studied in detail and the technology remains unproven. For this reason, the use of methanol, methane, or carbon dioxide was determined to be technically infeasible at this time and eliminated from further study in this EIS.

No commercial pipelines employ these technologies, nor have tests of these technologies been conducted. A test project would have to be constructed and operated before one of these media could be considered as a replacement for the existing pipeline. Tests would be required to provide the operating and cost data needed to design and estimate the costs of commercial facilities with an accuracy acceptable to an investor.

Even without the benefit of tests, several issues make methanol, methane, and carbon dioxide operationally difficult and costly alternatives to water. Methanol could be produced at the mine by combining coal and water; however, making methanol would require more water than the coal-slurry pipeline uses (USDI 1992). Particulate pollution and the potential for explosion are other drawbacks to this option. Transporting the coal using methane or carbon dioxide would require that coal be ground into even finer particles than it is presently. Methane and carbon dioxide both would require special handling—coal preparation may have to be completed in an inert atmosphere, and similar handling could be required at the Mohave Generating Station. Also, the coal and methane combined could be subject to a potential for combustion or explosion. The existing use of water eliminates these problems (i.e., particulates, combustion or explosion hazard).

In addition, these three alternatives to water would require substantial modifications in coal preparation, pumping, pipeline design, dewatering, and the power plant facilities. They would require construction and operation of production and storage facilities at the mine. The pipeline would have to be designed to contain the pressure required for carbon dioxide. Provisions would have to be made for venting or selling carbon dioxide, a green-house gas, once that gas was separated from the coal at the power plant. Finally, Mohave Generating Station's fuel-handling equipment and boilers, at a minimum, would require substantial modification to burn coal conveyed by methanol, methane, or carbon dioxide.

Transporting coal with any type of gas would require substantially higher velocities than it does with water. As a result, the erosiveness of the coal-and-gas mixture could present a potential risk of pipeline failure due to erosion. The high velocities in the pipeline also could "grind" the coal into finer particles

making the ash after combustion more difficult to capture. Thus, there could be a potential for more particulate matter less than 10 microns in diameter emissions.

2.4.5 No Coal-Washing Facility

Comments received during scoping suggested that washing the coal before being mixed into slurry is a wasteful use of water and therefore the coal-washing facility should not be constructed.

As part of the LOM revision, Peabody would build a coal-washing facility to clean the coal mined from the Black Mesa mining operation to remove rock and mineral matter in order to meet coal-quality requirements for the Mohave Generating Station. Originally, the boilers at the Mohave Generating Station were designed to accept coal with 8.9 percent ash content. As the ash content increases, plant downtime and maintenance increase, resulting in decreased plant efficiency. For the past 19 years, the power plant has been burning coal with an ash content averaging 10.1 percent (an annual high of 10.43 percent and an annual low of 9.79 percent). The average ash content for the first 16 years of the LOM revision is projected to increase to 11.75 percent. For the power plant to operate in a manner that is efficient and economically feasible, the coal must be washed to maintain a 9 percent or less ash in order to conform to the plant's boiler specifications (Lehn 2005). Replacing the boilers to burn efficiently also would entail changing out all the other equipment such as pulverizers, air preheaters, etc. Also, the ash handling, ash disposal, foundations, etc., would have to be changes or modified to handle the high ash condition. Thus, the cost for this probably would be in the range of \$8 million to \$1 billion for this type of change.

The water recovered after washing the coal would be reused. Since the coal-ash content is reduced by the coal-washing process, the quantity of water required for delivering 9 percent ash coal to the Mohave Generating Station is less than delivering an equivalent Btu (British thermal unit) quality of 11.75 percent ash coal. Moving the same equivalent in a decreased usage of water estimated at about 100 to 150 af/yr of water.

The water on the recovered coal and refuse must be removed after washing to reduce handling problems and recover the water for conservation and reuse in the preparation plant. Initial start-up of the preparation plant would require approximately 330 acre-feet. Thereafter on an annual basis, water entering the plant as surface moisture on the 6.35 million tons of run-of-mine coal would be approximately 47 acre-feet. Water leaving the plant on the product coal (5.4 million tons) would amount to approximately 140 af/yr as surface moisture at 3.5 percent. Water leaving the plant as surface moisture on the coarse refuse (7.0 percent) and fine refuse (40.0 percent) would amount to approximately 226 af/yr. Due to more water leaving the preparation plant (processed coal and refuse) than entering (run-of-mine coal), this would result in a deficit of about 319 acre-feet of water. Therefore, make-up water demand on an annual basis for the preparation plant would be about 319 acre-feet plus an additional 5 acre-feet to offset losses due to evaporation, totaling 324 af/yr. In summary, some of this water would be lost to the atmosphere due to evaporation. However, the water not lost to evaporation would mean less water would be needed for the slurry. An annual water use of 500 af/yr for the coal-washing facility was estimated for this evaluation for the purpose of developing conservative water-use scenarios associated with groundwater modeling and impact projections.

2.4.6 Alternative Energy Sources and Energy Efficiency

Some participants in the Black Mesa Project scoping process pressed for consideration of energy conservation and development of alternative energy sources. Because this EIS is a response to Peabody's application to revise the mining plans for Kayenta and Black Mesa mining operations, these concerns are outside the scope of this EIS. However, the concerns have been addressed in a separate study conducted in accordance with California Public Utilities Commission Decision 04-12-016, issued on December 2,

2004. The study evaluates potential alternatives to, or complementary energy resources for, the Mohave Generating Station.

The Final Study Report, issued in February 2006, considered the following generation resources: (1) integrated coal gasification/combined cycle (with carbon dioxide capture and storage), (2) reflective solar dish, (3) wind, (4) natural gas-fired combined cycle, and (5) other renewable resources (e.g., biomass or photovoltaics). Energy efficiency also was considered as an option. The report is available from SCE and is posted on SCE's website and may be accessed at: www.sce.com/law/cpucproceedings.nfs/vwUFiling?SearchView&Query=A.02-05-046&Start=1&Count30.

2.5 COMPARISON OF ALTERNATIVES

Table 2-9, at the end of this chapter, is a summary of selected issues and concerns identified through the scoping process for the EIS and the magnitude of impacts that would occur under the three alternative actions. Given an understanding of the project actions proposed (see description of the project in Sections 2.1 and 2.2 and Appendix A) and the inventoried resource information reflecting the existing environment (Chapter 3), each resource was assessed to determine the impacts that could result from the project (Chapter 4). The levels of impacts summarized in Table 2-8 (and in Chapter 4) reflect the incorporation of measures that reduce and/or render the impacts less intense or severe. These measure include best management practices, conservation measures, and other mitigating measures, to which the applicants commit to employ, and are part of the project description and are described in Chapter 4 (see Section 4.18) and Appendix A.

2.6 AGENCIES' PREFERRED ALTERNATIVE

The lead and cooperating agencies' preferred alternative is Alternative A, which is approval of the LOM revision and all associated components of the Black Mesa Project, which includes the following:

- Approval of LOM revision for Black Mesa mine complex
 - approval of LOM revision application, including adding 18,984 acres to the permit area, the coal washing facility, increased coal production by the Black Mesa mining operation, revisions to the operation and reclamation plan, and reduced use of Navajo aquifer water in support of mining operations and as an emergency backup water supply
 - approval of changes to mining plan for the Navajo and Hopi coal leases
 - issuance of rights-of-way for the road corridor
 - approval of modification of NPDES permit
 - approval of modification of Title V air quality permit
- Approval of coal-slurry preparation plant permit application
- Approval of coal-slurry pipeline reconstruction along the existing alignment with realignments in Moenkopi Wash and a southern reroute around Kingman, Arizona
- Approval of C aquifer water-supply system along the eastern alignment, capable of delivering up to 11,600 af/yr, using directional drilling to cross under the Little Colorado River, and using the western alignment through Kykotsmovi

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
Landforms and Topography				
Impact on landforms and topographic diversity	Black Mesa Complex	Permanent for 13,529 acres, but the disturbance is mitigated by site restoration because of the new landscape constructed; minor long-term impact.	Permanent for 8,062 acres, but the disturbance is mitigated by site restoration because of the new landscape constructed; minor long-term impact.	Same as Alternative B.
	Coal-Slurry Pipeline	No short- or long-term impact where reconstruction would be in existing right-of-way; negligible to no short- or long-term impact along the Moenkopi Wash realignments and Kingman reroute.	NA	NA
	Project Water Supply	Negligible to no short- or long-term impact along the eastern route; minor short- and long-term impact along the western route where more topographic relief would be crossed (e.g., Red Rock Cliffs, Ward Terrace, Coal Mine Canyon).	NA	NA
Geology and Minerals				
Impacts on geological resources	Black Mesa Complex	Existing geology in upper 250 feet of mined areas (13,529 acres) would be disturbed permanently, but the disturbance is mitigated by site restoration because of the new landscape constructed; minor long-term impact.	Permanent for 8,062 acres, minor long-term impact.	Same as Alternative B.
	Coal-Slurry Pipeline	No impact on geological resources is anticipated (either route).	NA	NA
	Project Water Supply (infrastructure)	No impact on geological resources is anticipated (either route).	NA	NA
Impacts on mineral resources of economic value (coal, uranium and vanadium, oil and gas)	Black Mesa Complex	<i>Coal:</i> Coal resources in the Wepo Formation would be produced for economic purposes. No impact on coal resources below 250 feet (Toreva and Dakota Sandstone Formations). <i>Other minerals:</i> No impact on other mineral of economic value is anticipated.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	No impact (either route).	NA	NA

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
	Project Water Supply (infrastructure)	No impact (either route).	NA	NA
Impacts on paleontological resources	Black Mesa Complex	No impact on unique and important fossil specimens is anticipated.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	No impact on unique and important fossil specimens is anticipated (either route).	NA	NA
	Project Water Supply (infrastructure)	No impact on unique and important fossil specimens is anticipated (either route).	NA	NA
Soils				
Impacts on soil productivity	Black Mesa Complex	Permanent for 13,529 acres, improved productivity long term.	Permanent for 8,062 acres, improved productivity long term.	Same as Alternative B.
	Coal-Slurry Pipeline	Minor, short and long term (either route).	NA	NA
	Project Water Supply (infrastructure)	Minor, short and long term (either route).	NA	NA
Water Resources (Hydrology)				
Degradation of surface water quality from discharges and sediment contribution	Black Mesa Complex	Negligible; impacts would be infrequent and of a small magnitude.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	Negligible to no impact short term; no impact long term (either route).	NA	NA
	Project Water Supply (infrastructure)	Negligible to no impact short term; no impact long term (either route).	NA	NA
Changes in stream-channel morphology	Black Mesa Complex	Negligible; impacts of the mine drainage system on the natural stream patterns would be mostly temporary and confined to the Black Mesa Complex.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	Negligible impact short term; no impact long term.	NA	NA
	Project Water Supply (infrastructure)	Negligible impact short term; no impact long term.	NA	NA
Impacts on volume of stream flow	Black Mesa Complex	The change in stream flow is so small that it would be difficult to measure, leading to the conclusion that there would be negligible impact from surface-water diversion, impoundments, and sediment ponds on the Black Mesa Complex.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
	Coal-Slurry Pipeline	No impact, short and long term.	NA	NA
	Project Water Supply (infrastructure)	No impact, short and long term.	NA	NA
Impacts on the Wepo and alluvial aquifer levels and water quality	Black Mesa Complex	<ul style="list-style-type: none"> • Some minor impact on local groundwater levels in coal seam and shallow alluvial aquifers during mining; however, the impact would lessen after reclamation is complete. • Impact on shallow groundwater due to mine dewatering would be negligible. • Reduction in recharge would be immeasurable; therefore, negligible to no impact of the quantity of recharge on alluvial aquifers. • Chemical reaction of groundwater with spoil material could result in moderate to minor water-quality impacts on local wells, increasing levels of salinity and trace elements to a level that decrease usability. Peabody would be required to provide alternative water supplies to any wells rendered unusable. • Any poor-quality water discharges into streams would be diluted to negligible levels since streams generally flow only after precipitation events. • Negligible to no impact from infiltration of surface-water runoff; runoff from mine facilities using petroleum products and hazardous materials treated with stormwater pollution prevention structures (and SPCC plan in place) are not allowed to infiltrate groundwater. 	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	Negligible to no impact short and long term.	NA	NA
	Project Water Supply (infrastructure)	Negligible to no impact short and long term.	NA	NA
Impacts of groundwater pumping	C aquifer	<i>Pumping costs (6,000 af/yr):</i> Negligible impact short and long term. <i>Pumping costs (11,600 af/yr):</i> Negligible impact short and long term.	NA	NA

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
		<i>Reduction in aquifer thickness (6,000 af/yr):</i> Negligible during mining; no impact after mining. <i>Reduction in aquifer thickness (11,600 af/yr):</i> Negligible impact during and after mining.	NA	NA
		<i>Streams and springs (6,000 af/yr):</i> Negligible during mining; no impact after mining. <i>Streams and springs (11,600 af/yr):</i> Negligible during mining, negligible after mining.	NA	NA
		<i>Water quality (6,000 af/yr):</i> No impact during or after mining. <i>Water quality (11,600 af/yr):</i> No impact during mining; negligible after mining.	NA	NA
	N aquifer	<i>Pumping costs:</i> Negligible during mining, no impact after mining for 500 af/yr and 2,000 af/yr pumping scenarios. Minor impact during mining, no impact after mining for 6,000 af/yr pumping scenario.	Negligible short term, no impact long term.	Same as Alternative B.
		<i>Streams and springs:</i> Negligible during mining; no impact after mining.	Negligible short term, no impact long term.	Same as Alternative B.
		<i>Water quality:</i> No impact during mining for 500 af/yr and 2,000 af/yr pumping scenarios. Moderate impact during mining; no impact long term for 6,000 af/yr pumping scenario.	No impact short and long term.	Same as Alternative B.
	Climate			
Impacts on macroclimate and microclimate	Regional	Negligible, short term.	Same as Alternative A.	Same as Alternative A.
Air				
Impacts of particulate matter (PM) from mining activity; PM and gaseous air pollutant emissions from vehicle and equipment exhaust	Black Mesa Complex	Minor locally, negligible regionally.	Similar to Alternative A, but less mining activity (lower PM emissions).	Same as Alternative B.

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
Impacts of particulate matter (PM) from earthmoving; PM and gaseous air pollutant emissions from vehicle and equipment exhaust	Coal-Slurry Pipeline and Water-Supply System	Minor locally and negligible regionally during construction (2 years); negligible to no impact long term.	NA	NA
Vegetation				
Impacts on vegetation structure and composition	Black Mesa Complex	Major short term, major long term, generally beneficial.	Similar to Alternative A, but for smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	Major short term, minor long term, moderate long term for piñon/juniper woodland (either route).	NA	NA
	Project Water Supply	<i>C-aquifer well field</i> : Moderate to minor short term, minor long term. <i>Other C aquifer water-supply system infrastructure</i> : Major short term, minor long term (either route).	NA	NA
Impacts on species diversity	Black Mesa Complex	Minor short and long term.	Similar to Alternative A, but for smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	Minor to negligible short and long term.	NA	NA
	Project Water Supply (infrastructure)	Minor to negligible short and long term.	NA	NA
Impacts on culturally important species	Black Mesa Complex	Moderate during operations, minor to moderate (depending on how easily species re-establish) following reclamation.	Similar to Alternative A, but for smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	Minor short and long term.	NA	NA
	Project Water Supply (infrastructure)	Minor short and long term.	NA	NA
Impacts on riparian vegetation	Black Mesa Complex	Minor short term, negligible long term.	Similar to Alternative A, but for smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	Negligible short and long term (either route).	NA	NA
	Project Water Supply	<i>C-aquifer pumping (6,000 af/yr)</i> : No impact. <i>C-aquifer pumping (11,600 af/yr)</i> : No impact short term, minor long term	NA	NA

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
		<i>N-aquifer pumping</i> : Minor short and long term.		
		<i>C-aquifer water-supply system infrastructure (either route)</i> : Negligible short and long term.		
Impacts of noxious weeds and invasive species	Black Mesa Complex	Minor short and long term.	Similar to Alternative A, but for an area reduced in size.	Same as Alternative B.
	Coal-Slurry Pipeline	Minor short and long term (either route).	NA	NA
	Project Water Supply (infrastructure)	Moderate to minor short and long term (either route).	NA	NA
Impacts on threatened, endangered, and special status species	Black Mesa Complex	No impact.	No impact.	No impact.
	Coal-Slurry Pipeline	Minor to negligible short and long term (either route).	NA	NA
	Project Water Supply	Minor to no impact short and long term (either route).	NA	NA
Fish and Wildlife				
Impacts on terrestrial habitats and wildlife	Black Mesa Complex	<i>Woodland</i> : Major during operations, moderate following reclamation. <i>Nonwoodland</i> : Major short term, moderate and beneficial long term. <i>Rock outcrop</i> : Major short term, moderate to minor long term.	Similar to Alternative A, but for an area reduced in size.	Same as Alternative B.
	Coal-Slurry Pipeline	Major short term, moderate long term (either route).	NA	NA
	Project Water Supply (infrastructure)	Major short term, moderate long term (either route).	NA	NA
Impacts on game species and burros	Black Mesa Complex	No impact.	NA	NA
	Coal-Slurry Pipeline	Moderate to minor short term, negligible long term (either route).	NA	NA
	Project Water Supply (infrastructure)	No impact.	NA	NA
Impacts on bighorn sheep	Black Mesa Complex	NA	NA	NA
	Coal-Slurry Pipeline	Major to moderate short term, minor to negligible long term (either route).	NA	NA

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
	Project Water Supply (infrastructure)	NA	NA	NA
Impacts on raptors	Black Mesa Complex	<i>Woodland</i> : Minor short term, moderate to minor long term. <i>Open country</i> : Minor short term, moderate and beneficial long term.	Similar to Alternative A, but for smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	Minor short and long term (either route).	NA	NA
	Project Water Supply (infrastructure)	Minor short term and negligible long term (either route).	NA	NA
Impacts on riparian habitats and species	Black Mesa Complex	Minor to negligible short term.	Similar to Alternative A, but for smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	Negligible to no impact short and long term (either route).	NA	NA
	Project Water Supply (infrastructure)	Negligible to no impact short and long term (either route).	NA	NA
Impacts on aquatic habitats and species (including impoundments on Black Mesa Complex)	Black Mesa Complex	Beneficial short and long term.	Similar to Alternative A, but for smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	Minor to negligible short term, no impact long term (either route).	NA	NA
	Project Water Supply (infrastructure)	Minor short term, negligible long term (either pipeline route)	NA	NA
Impacts on threatened and endangered	Black Mesa Complex	Minor to no impact short and long term.	Similar to Alternative A, but for smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	Minor to no impact short and long term (either route).	NA	NA
	Project Water Supply	<i>C-aquifer pumping (6,000 af/yr)</i> : No impact. <i>C-aquifer pumping (11,600 af/yr)</i> : Minor short term, major long term on Little Colorado River spinedace and roundtail chub, minor to negligible on Southwest willow flycatcher. <i>N-aquifer pumping</i> : No impact short term, minor long term. <i>C-aquifer water-supply system infrastructure (either route)</i> : No impacts.	NA	NA

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
Impacts on other special status species	Black Mesa Complex	Minor to negligible short and long term.	Similar to Alternative A, but for smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	Moderate to no impact short term, negligible to no impact long term (either route).	NA	NA
	Project Water Supply	Moderate to no impact short term, negligible to no impact long term (either route).	NA	NA
Land Use				
Impacts on residential uses	Black Mesa Complex	Impacts from relocation of residents have potential to be major.	Similar to Alternative A, but fewer relocations.	Same as Alternative B.
	Coal-Slurry Pipeline	<i>Existing route:</i> Level of impact varies depending on population density. During construction, structures (residences or outbuildings) would be avoided, but temporarily impeded access and ground disturbance of properties could result in minor to no impacts. Route passes through dense land uses in Kingman and Laughlin areas. Negligible to no impact long term. <i>Existing route with realignments:</i> Impacts would be similar to the existing route except the Kingman reroute would avoid higher-density residential areas. The reroute would pass adjacent to three low- to moderate-density residential areas. Minor to no impacts short term. Negligible to no impact long term.	NA	NA
	Project Water Supply (infrastructure)	<i>Eastern route:</i> Minor to negligible short term, no impact long term. The Kykotsmovi subalternative that passes through Kykotsmovi would affect an area of greater density than the subalternative that bypasses Kykotsmovi. <i>Western route:</i> Generally the same as the eastern route.	NA	NA
Impacts on grazing and agriculture	Black Mesa Complex	Moderate due to relocations during mining activities and reclamation. Grazing improved after reclamation.	Similar to Alternative A, but fewer relocations and less land would be mined and reclaimed (loss of opportunity for improved grazing).	Same as Alternative B.
	Coal-Slurry Pipeline	Minor to negligible impacts would result from impeded access and property disturbance during construction. Negligible to no impact long term (either route).	NA	NA

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
	Project Water Supply	<i>Eastern route:</i> Minor short term. Negligible to no impact long term. <i>Western route:</i> Impacts would be similar to eastern route, but because the route is longer, more forage would be removed during construction. Minor short term, no impacts long term.	NA	NA
Impacts on commercial and industrial uses	Black Mesa Complex	No impact.	Same as Alternative A.	Same as Alternative A.
	Coal-Slurry Pipeline	<i>Existing route:</i> Minor to negligible impacts would result from impeded access and property disturbance during construction. Negligible to no impact long term. <i>Existing route with realignments:</i> Short-term impacts would be similar to existing route; negligible to no impacts long term.	NA	NA
	Project Water Supply (infrastructure)	No impact.	NA	NA
Cultural Resources				
Impacts on archaeological and historical resources	Black Mesa Complex	Minor.	No impact.	No impact.
	Coal-Slurry Pipeline	Moderate (either route).	NA	NA
	Project Water Supply	<i>Continued use of N aquifer (any volume):</i> No impact. <i>C-aquifer well field:</i> Minor. <i>Other C aquifer water-supply system infrastructure (either route):</i> Moderate.	NA	NA
Impacts on traditional cultural resources (including human burials)	Black Mesa Complex	<i>Coal mining:</i> Moderate. <i>Coal-haul road:</i> No impact.	Same as Alternative A.	No impact.
	Coal-Slurry Pipeline	Moderate (either alternative route).	NA	NA
	Project Water Supply	<i>Continued use of N aquifer (any volume):</i> No impact. <i>C-aquifer well field:</i> Minor. <i>Other C aquifer water-supply system infrastructure (either alternative route):</i> Moderate.	NA	NA

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
Social and Economic Conditions				
Impacts on employment and income	Black Mesa Complex	<ul style="list-style-type: none"> • Major beneficial short term (resumption of Black Mesa mining operation). • Major adverse long term (upon cessation of all mining). • Both short term and long term, other jobs and income that result from multiplier effects would be affected. • Minor beneficial, temporary (2 years), during the coal-washing facility construction phase. • Minor beneficial income effect from improved grazing forage yields on reclaimed land. 	<ul style="list-style-type: none"> • Major adverse long term (upon cessation of mining – Kayenta mining operation only). • Both short term and long term, other jobs and income that result from multiplier effects would be affected. • Minor beneficial (less than Alternative A) income effect from improved grazing forage yields on reclaimed land. 	Same as Alternative B.
	Coal-Slurry Pipeline	Beneficial, temporary (2 years) during construction. Major in the local area, moderate in the region.	NA	NA
	Project Water Supply	If C aquifer water-supply system constructed, beneficial, temporary (2 years) during construction. Major in the local area (either route), moderate in the region. If C aquifer water-supply system constructed, minor short term during operations.	NA	NA
Impacts on revenue to governmental entities	Black Mesa Complex	<ul style="list-style-type: none"> • Major beneficial short term (resumption of Black Mesa mining operation). • Major adverse long term (upon cessation of mining), especially to Hopi Tribe and Navajo Nation. 	Major adverse long term (upon cessation of mining – Kayenta operation only).	Same as Alternative B.
	Coal-Slurry Pipeline	Beneficial, temporary (2 years) during construction. Major impact, especially sales tax receipts.	NA	NA
	Project Water Supply	If C aquifer water-supply system is constructed, minor short term, right-of-way tax revenue during operations.	NA	NA

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
Impacts on economic development	Black Mesa Complex	Short term, the mining revenues and other jobs and income in local support services would have a minor beneficial effect on economic development. Long term, those services might support industries other than mining, a potential minor beneficial effect.	NA	NA
	Coal-Slurry Pipeline	No impact.	NA	NA
	Project Water Supply	If C aquifer water-supply system is constructed, major beneficial; lessen concern that N-aquifer water withdrawals for mining-related purposes interfere with water use for tribal economic development. Minor benefit from associated road improvements. If maximum N-aquifer water supply, major adverse impact, continuation of concern that water withdrawals for mining-related purposes interfere with water use for tribal economic development.	NA	NA
Environmental Justice				
	Black Mesa Complex	Moderate adverse impact on residents in or near mining complex who live a traditional lifestyle; continued mining including Black Mesa operation area now permitted continues adverse effects.	Same as Alternative A.	Moderate benefit to residents in or near Black Mesa Complex who live a traditional lifestyle; shutdown of mining within the unpermitted Black Mesa operation area ends its adverse effects.
	Coal-Slurry Pipeline	Negligible adverse short-term effect of construction on traditional economy and plants and animals important to Hopi and Navajo culture.	NA	NA
	Project Water Supply	Minor beneficial effect of associated road improvements.	NA	NA
Noise and Vibration				
Impacts from noise	Black Mesa Complex	Moderate to minor, depending on distance to mining operations.	Similar to Alternative A, but fewer persons affected than for Alternative A.	Moderate to minor, depending on distance to mining operations; fewer persons affected than in Alternative A or B.
	Coal-Slurry Pipeline	Moderate but very short term for a small number of residences (during construction).	NA	NA

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
	Project Water Supply	<i>C-aquifer well field</i> : Negligible to minor during construction, negligible for life of the mining operations. <i>Other C aquifer water-supply system infrastructure (either route)</i> : Negligible to minor during construction, negligible for life of the mining operations.	NA	NA
Impacts from vibration	Black Mesa Complex	Moderate to minor, temporary, for a small number of residences.	Moderate to minor, temporary, for a smaller number of residences than in Alternative A.	Moderate to minor, temporary, for a smaller number of residences than in Alternative A or B.
	Coal-Slurry Pipeline	Negligible to no impact (during construction), residences far enough away to prevent greater impacts.	NA	NA
	Project Water Supply	<i>C-aquifer well field</i> : Negligible to no impact short and long term. <i>Other C aquifer water-supply system infrastructure (either route)</i> : Major temporary impact if blasting is required during construction.	NA	NA
Visual Resources				
Impacts on scenic quality	Black Mesa Complex	Moderate to minor short term, negligible to no impact long term.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-Slurry Pipeline	Moderate to negligible for residential views during construction and reclamation. Negligible (except minor in small amount of Class A landscape area) long term.	NA	NA
	Project Water Supply	<i>C-aquifer well field</i> : Minor to negligible except moderate where view of water-storage tank detracts. <i>Other C aquifer water-supply system infrastructure (either route)</i> : Moderate long term where views of pump stations detract. Minor to no impact elsewhere.	NA	NA
Transportation				
Impacts on traffic and transportation	Black Mesa Complex	Negligible short and long term.	Same as Alternative A.	Same as Alternative A.
	Coal-Slurry Pipeline	Minor to no impact during construction.	NA	NA
	Project Water Supply	Minor to no impact during construction. Minor to negligible beneficial effects from new roads.	NA	NA

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
Recreation				
Impacts on recreation	Black Mesa Complex	Negligible short and long term.	Negligible short and long term.	Negligible short and long term.
	Coal-Slurry Pipeline	Negligible short and long term.	NA	NA
	Project Water Supply	Negligible short and long term.	NA	NA

NOTES: NA = Not applicable.

In Alternatives B and C, the coal-slurry pipeline would not be reconstructed and the C aquifer water-supply system would not be constructed.

Levels of impact intensity are negligible (at lower levels of detection), minor (detectable, but slight), moderate (readily apparent environmental effects), and major (severe adverse or exceptional beneficial environmental effects. Unless otherwise stated as a “beneficial” impact, the impacts described would be adverse.

Short term = For the Black Mesa Complex, the local short-term impacts are those that would occur from the beginning of mining through reclamation when vegetation is re-established; for the coal-slurry pipeline and C aquifer water-supply system, 5 years (construction and reclamation).

Long term = For the Black Mesa Complex, impacts that would persist beyond or occur after reclamation; for the coal-slurry pipeline and C aquifer water-supply system, beyond 5 years.

The terms *major, moderate, minor, negligible, or none* that follow, consider the anticipated magnitude, or importance, of impacts, including those on the human environment.

Major: Impacts that potentially could cause irretrievable loss of a resource; significant depletion, change, or stress to resources; or stress within the social, cultural, and economic realm. Degradation of a resource defined by laws, regulations, and/or policy.

Moderate: Impacts that potentially could cause some change or stress (ranging between significant and insignificant) to an environmental resource or use; readily apparent effects.

Minor: Impacts that potentially could be detectable but slight.

Negligible: Impacts in the lower limit of detection that potentially could cause an insignificant change or stress to an environmental resource or use.

None: No discernible or measurable impacts.

AFFECTED ENVIRONMENT

3.0 AFFECTED ENVIRONMENT

In accordance with NEPA regulations codified at 40 CFR 1502.15, this chapter presents a summary of the existing conditions of the human and natural environments in the areas that potentially could be affected. This information serves as the baseline from which the impacts that are anticipated to result from implementing the proposed Black Mesa Project or alternatives were assessed. The affected environment is characterized for the following resources, land uses, and social and economic conditions:

- | | |
|-----------------------------------|-------------------------------------|
| 3.1 Landforms and Topography | 3.11 Social and Economic Conditions |
| 3.2 Geology and Mineral Resources | 3.12 Environmental Justice |
| 3.3 Soil Resources | 3.13 Indian Trust Assets |
| 3.4 Hydrology | 3.14 Noise |
| 3.5 Climate | 3.15 Visual Resources |
| 3.6 Air Quality | 3.16 Transportation |
| 3.7 Vegetation | 3.17 Recreation |
| 3.8 Fish and Wildlife | 3.18 Health and Safety |
| 3.9 Land Use | |
| 3.10 Cultural Resources | |

These topics were selected based on Federal regulatory requirements and policies, concerns of the lead and cooperating agencies, and/or issues expressed by agencies and the public during scoping.

The existing conditions of the environment are described based on the most recent data available—primarily literature, published and unpublished reports, and agency databases. Field reconnaissance verified data gathered for land use, visual resources, vegetation, and fish and wildlife. Intensive field surveys were conducted to inventory cultural resources along the coal-slurry and water-supply pipeline routes. Field visits and interviews were conducted to identify traditional Hopi, Hualapai, and Navajo lifeways and traditional cultural resources.

The areas where different project components are or would be located were examined with varying degrees of scrutiny and at different scales for each resource. For example, air quality or socioeconomic conditions remain the same over broader areas, while other analyses focus on more specific resource areas, such as a stream, a view, or an archaeological site. In areas of broader focus, specific project components are not necessarily addressed, or are addressed as a group.

3.1 LANDFORMS AND TOPOGRAPHY

The project study area is located within two areas having distinct topographic and geological characteristics—the Colorado Plateau and the Basin and Range physiographic provinces. The provinces are separated by a transition zone that has some of the characteristics of both provinces (Map 3-1). The Colorado Plateau is defined by an abrupt change in elevation, coincident with uplifted and gently folded sedimentary layers internal to the plateau, and steep-sided valleys that incise the plateau perimeter. The Colorado Plateau province is higher in elevation than surrounding provinces, with elevations generally between 5,000 and 7,000 feet above mean sea level (MSL). The Arizona part of the province also is drained by the Little Colorado River.

West and southwest of the study area the Colorado Plateau descends to the Basin and Range province, an area characterized by lower elevations and steeper relief. The steep mountains are formed by fault-blocked and tilted basement rocks and sedimentary formations. The intermontane valleys are deep sedimentary basins filled with alluvial deposits. Mountain elevations range from 4,000 to 5,000 feet above MSL, while the valleys range from 3,000 to a low of 500 feet above MSL at Davis Dam on the Colorado River.

The Colorado Plateau and the Basin and Range provinces are separated by a transition zone that has intermediate physiographic and geologic properties. The transition zone is not a formal province, but an area where the steep drop-off in elevation is concentrated. In the study area, the transition zone first becomes obvious at the Aubrey Cliffs near Seligman, Arizona. The western boundary of the transition zone might be defined by the Grand Wash Cliffs and the adjacent Hualapai Valley, northeast of Kingman. This is reflected in the change of elevation between Seligman (at 5,250 feet above MSL) and Kingman (at 3,336 feet above MSL).

3.1.1 Black Mesa Complex

Black Mesa is a massive highland in northeastern Arizona within the Colorado Plateau covering approximately 2.1 million acres. It rises abruptly in a 1,200- to 2,000-foot-high uneven wall along its northern boundary, then slopes southwestward through gently rolling hills toward the Little Colorado River. The maximum elevation at the northern rim of the mesa is approximately 8,200 feet above MSL.

The Black Mesa Complex is located on the northern portion of Black Mesa, south of Kayenta. Elevations of the Black Mesa Complex range from about 7,200 feet above MSL on the northeast to 6,100 feet above MSL on the southwest. The topography is characterized by gently rolling hills on a relatively flat mesa that slopes to the southwest at a gradient of about 70 feet per mile. Four major steep-sided, deep washes cut the Black Mesa Complex from the northeast to the southwest and direct surface drainage to the southwest: Yellow Water Canyon and Coal Mine Wash on the north, Moenkopi Wash in the center, and Dinnebito Wash to the south. The steep canyons cut by the washes are narrow, with several small terraces developed only in the wider portions of the washes in the southwestern part of the Black Mesa Complex. There is generally minor accumulation of alluvial material in those washes. Coal exposed on the steep sides of those washes in several locations has burned in place to form outcrops of massive baked shale that is called clinker or scoria and is resistant to erosion. Weathering of the less resistant surrounding rock has formed steep rounded buttes of hard shale and clinker material in the area of the Black Mesa Complex.

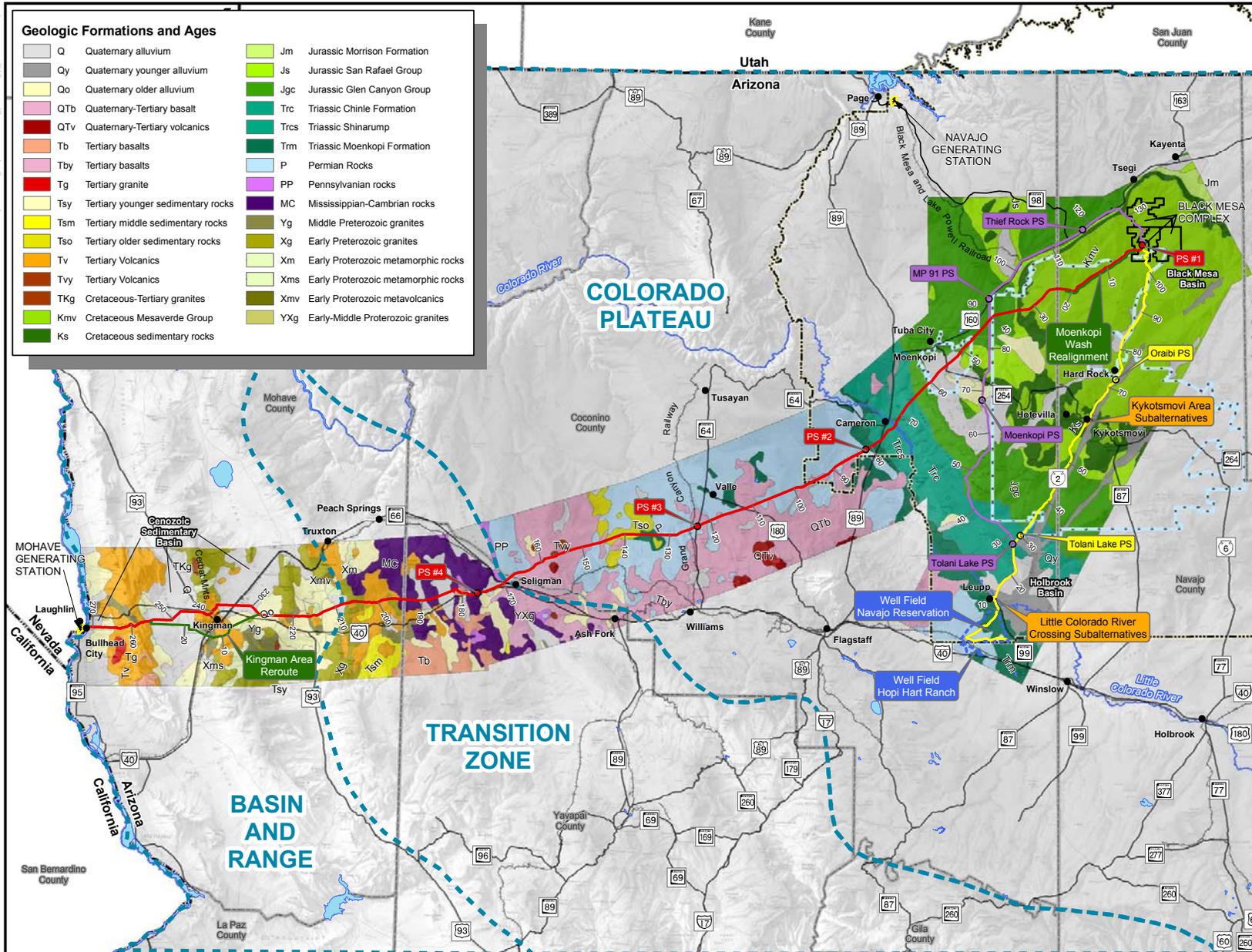
In the coal-mining areas within the Black Mesa Complex, surface mining of overburden and subsurface coal resources has removed up to 250 feet of rock and effectively destroyed the structure and sedimentary layers, to near the base of the Wepo Formation. Mining also has altered topographic features, such as slope gradient and surface drainage patterns. Through 2005, approximately 14,940 acres had been disturbed by the Kayenta mining operation and 6,965 acres had been disturbed by the Black Mesa mining operation. Restoration of mining sites to the approximate original contour is required by SMCRA. Mined areas are backfilled and graded to approximate the original topographic relief. The approximate original contour restoration is designed to re-establish the drainage pattern to approximate original conditions and to blend in with the surrounding unmined areas. Restored areas generally have smoother contours with less topographic relief than the original topography, and no pronounced landforms (e.g., no cliffs, steep buttes, or narrow canyons).

Map 3-1 Geology

Black Mesa Project EIS

Geologic Formations and Ages

Q	Quaternary alluvium	Jm	Jurassic Morrison Formation
Qy	Quaternary younger alluvium	Js	Jurassic San Rafael Group
Qo	Quaternary older alluvium	Jgc	Jurassic Glen Canyon Group
QTB	Quaternary-Tertiary basalt	Trc	Triassic Chinle Formation
QTV	Quaternary-Tertiary volcanics	Trcs	Triassic Shinarump
Tb	Tertiary basalts	Trm	Triassic Moenkopi Formation
Tby	Tertiary basalts	P	Permian Rocks
Tg	Tertiary granite	PP	Pennsylvanian rocks
Tsy	Tertiary younger sedimentary rocks	MC	Mississippian-Cambrian rocks
Tsm	Tertiary middle sedimentary rocks	Yg	Middle Proterozoic granites
Tso	Tertiary older sedimentary rocks	Xg	Early Proterozoic granites
Tv	Tertiary Volcanics	Xm	Early Proterozoic metamorphic rocks
Tvy	Tertiary Volcanics	Xms	Early Proterozoic metamorphic rocks
TKg	Cretaceous-Tertiary granites	Xmv	Early Proterozoic metavolcanics
Kmv	Cretaceous Mesaverde Group	YXg	Early-Middle Proterozoic granites
Ks	Cretaceous sedimentary rocks		



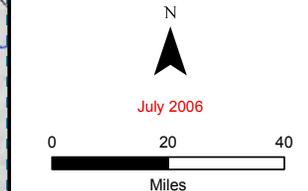
LEGEND

- Coal-Slurry Pipeline**
 - Existing Route
 - Realignments (Existing route with realignments is applicant's preferred alternative)
- Proposed Water-Supply Pipeline**
 - Eastern Route (Applicant's Preferred Alternative)
 - Subalternatives (Along Preferred)
 - Western Route
- Other Project Features**
 - C-Aquifer Well Field
 - PS = Pump Station
 - Peabody Lease Area
- Geology**
 - Physiographic Province

General Features

- River
- Lake
- Navajo Reservation Boundary
- Hopi Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route

SOURCES:
URS Corporation 2005
Arizona Geologic Survey 2003



Prepared By:
URS

3.1.2 Coal-Slurry Pipeline

3.1.2.1 Coal-Slurry Pipeline: Existing Route

The existing pipeline route traverses the widely diverse topography of the Colorado Plateau and Basin and Range provinces, as described above. Beginning in the Black Mesa Complex, the existing pipeline route passes through the gently rolling hills of Black Mesa. At about CSP Milepost 4, it enters the steep-sided, 250-foot-deep Moenkopi Wash—the wash cuts through the mesa in a northeast to southwest direction, directing surface drainage to the southwest. Small terraces appear in the wider portions of the wash. There is generally minor development of alluvial material in the wash, and the massive shale outcroppings described above discourage erosion at several wash locations. The pipeline exits Moenkopi Wash at Black Mesa Wash near CSP Milepost 19 and traverses the mesa downslope to the west. Elevations range from about 6,900 feet above MSL at the Black Mesa Complex to 5,700 feet above MSL at the southwestern edge of the mesa.

Leaving Black Mesa south of Tonalea, the pipeline route turns southwest and crosses Moenkopi Plateau. The topography of the Moenkopi Plateau region consists of low mesas up to 300 feet high, incised by dry washes and separated by relatively flat alluvial plains with localized sand dunes. Near Cameron, the pipeline route crosses the flat plain of the Painted Desert and the Little Colorado River drainage at about 4,100 feet above MSL, then climbs westward onto the Coconino Plateau. Along the route, the Colorado Plateau is at about 6,000 feet above MSL in elevation and characterized by generally flat terrain covered with lava flows and abundant volcanic cinder cones.

Near CSP Milepost 169 and Seligman, the existing route drops off the Colorado Plateau into the transition zone, an elevation change of about 1,000 feet. Elevations in the transition zone range from about 6,000 feet above MSL in the Juniper and Cottonwood Mountains to about 4,000 feet above MSL at the base of the Cottonwood Cliffs near CSP Milepost 208. In the transition zone, the existing route traverses rolling hills separated by nearly flat alluvial plains at lower elevations.

The route crosses the Basin and Range province from about CSP Milepost 208 to the Colorado River. Elevations range from highs of about 6,900 feet above MSL in the Cerbat Mountains near Kingman and the Black Mountains east of Bullhead City to lows of 2,600 feet in the Sacramento Valley and 300 feet above MSL at the river. In the mountains, the pipeline is buried in rugged mountainous topography separated by nearly level alluvial plains in the valleys.

3.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignments (Agencies' Preferred Alternative)

The Moenkopi Wash realignments would be within the wash but outside the active channel, generally within 200 feet of the existing route.

The Kingman reroute would depart the existing pipeline route near CSP Milepost 228 in the Hualapai Valley and continue southwest across a gently northward sloping alluvial plain. It then would cross the Hualapai Mountains, and then turn west to traverse the flat Sacramento Valley alluvial plain before meeting the existing pipeline route near CSP Milepost 255. The elevation range is almost the same as for the existing route. This reroute would traverse rugged mountains and nearly level alluvial plains of the Basin and Range province.

3.1.3 Project Water Supply

3.1.3.1 C Aquifer Water-Supply System (Agencies' Preferred Alternative)

3.1.3.1.1 Well Field

The site for the proposed C-aquifer well field is located in a flat area within the Colorado Plateau province and Little Colorado River drainage. Few landform features are found in this area that gently slopes to the northeast and the Little Colorado River. Elevations range from about 5,300 feet above MSL at the west end to 4,800 feet above MSL at the east end.

3.1.3.1.2 C Aquifer Water-Supply Pipeline

Both the eastern and western routes of the C aquifer water-supply pipeline would cross the Little Colorado River and continue northeast through the western Painted Desert. The western Painted Desert is an area of multicolored hills and escarpments that should not be confused with the eastern Painted Desert located in and around Petrified Forest National Park 60 miles east of Leupp, Arizona. Elevations range from about 4,700 feet above MSL at the river up to 5,100 feet above MSL on Newberry Mesa. This area slopes southwest toward the Little Colorado River and generally has low relief until it reaches the low escarpment of Newberry Mesa. The eastern and western routes separate near WSP Milepost 27.

3.1.3.1.2.1 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

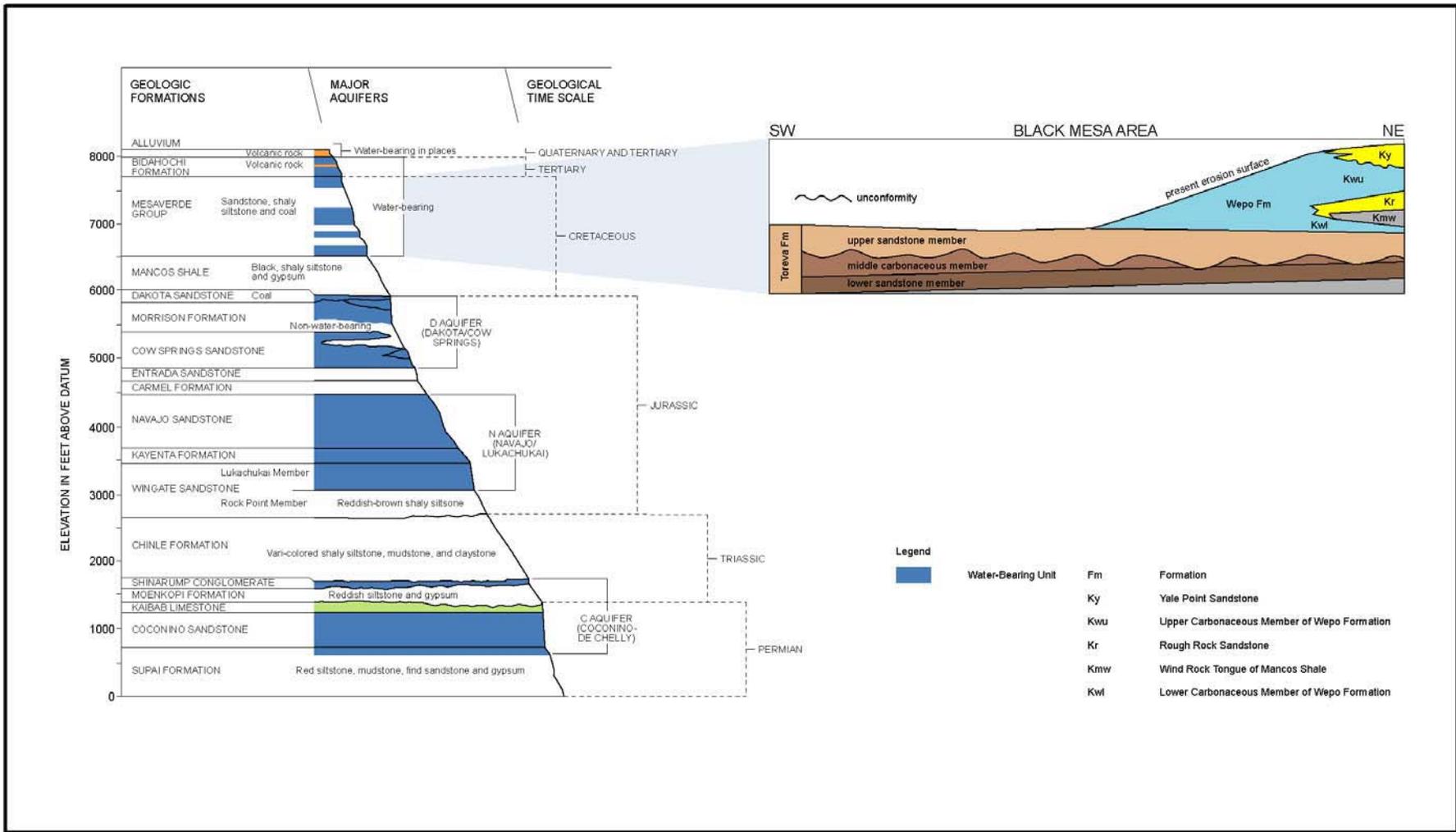
The eastern route would trend northeast from WSP Milepost 27, roughly paralleling Oraibi Wash, and pass through the community of Kykotsmovi. The area is characterized by low mesas with approximately 100-foot-high escarpments and flat, featureless plains that gently slope to the south and southwest. Oraibi Wash has cut a channel into the plain about 60 feet deep. Elevations range from about 5,100 feet above MSL on Newberry Mesa up to about 5,700 feet above MSL at WSP Milepost 76 in Oraibi Wash. The route then would turn north and continue past a 200-foot-high sandstone escarpment onto Third Mesa, then continue up the gently sloping Black Mesa and crossing a 6,800-foot-high ridge to the coal-slurry preparation plant, located at an elevation of about 6,400 feet above MSL. The route would follow the trend of Dinnebito Wash but for the most part would be outside that drainage. The canyon cut by the wash is narrow and steep-sided, with small terraces developed only in the wider portions of the wash.

3.1.3.1.2.2 C Aquifer Water-Supply Pipeline: Western Route

The western route would turn northwest from WSP Milepost 27 and then north along the top of Newberry Mesa and Ward Terrace at an elevation of about 5,000 feet above MSL. It would continue over the Adeii Eechii (Red Rock) Cliffs and across the low mesas, dry washes, and flat alluvial plains with localized sand dunes of the Moenkopi Plateau at an elevation of about 5,800 feet above MSL. South of Tonalea the route would meet and parallel U.S. Highway 160 northeast through the flat Red Lake and Klethla Valleys. Near WSP Milepost 127, it would turn southeast and continue over Black Mesa and cross a 7,300-foot-high ridge to the coal-slurry preparation plant. Two additional pump stations would be required along the western route to accommodate the longer distance and higher elevation encountered.

3.2 GEOLOGY AND MINERAL RESOURCES

The Colorado Plateau physiographic province is characterized by relatively flat-lying and laterally continuous Paleozoic and Mesozoic sedimentary formations, highlighted by coal-bearing rocks deposited in the Black Mesa Basin that dominate the Black Mesa mining operation (Figure 3-1). The Basin and Range physiographic province is characterized by folded and block-faulted mountains of Tertiary volcanic and sedimentary deposits, often with a central core of Precambrian metamorphic and/or granitic



SOURCE: Modified from ADWR, 1989; Nations et. al., 2000

Figure 3-1 Stratigraphic Column of Black Mesa Area

rocks, separated by thick alluvium-filled sedimentary basins. The transition zone has geologic characteristics of both provinces (refer to Map 3-1).

The topography of the Colorado Plateau province in northern Arizona is the result of relatively gentle structural folding caused by northerly trending uplifts. The Black Mesa Basin is a broad synformal structure trending northwest to southeast. It is bounded on the southeast and east by the Defiance Uplift, on the north by the Monument and Piute Uplifts, and on the west by the Echo Cliffs and Kaibab Uplifts. The Preston Mesa-Mount Beautiful anticline and the Tuba City-Howell Mesa syncline extend along the southwestern side of the basin. The Defiance Anticline bounds the basin to the northeast and east. These folds have very gentle dips even though their axial traces extend for miles. The north and northwest basin boundary is formed by the Comb Ridge Monocline and Organ Rock Monocline that dip down to the southeast. These monoclinical folds comprise the northwestern hydrologic barrier of the N aquifer in the Black Mesa Basin.

Faulting is less extensive than folding in the study area. Normal faulting associated with fold axes is the most common type found. None of these faults are considered significantly active, and there is no indication that any recent volcanism, such as occurred in the San Francisco Peaks, ever extended to the Black Mesa Basin. Although the Colorado Plateau has experienced only minor Holocene seismic activity, the margins of the Plateau, including the western Grand Canyon, do exhibit some minor level of earthquake hazard. Several of the recorded earthquakes have measured between 5 and 6 magnitude on the Richter scale. Farther south, within the study area, the seismicity drops off, but occasional earthquakes in the Flagstaff area in the 4 to 5 magnitude range have occurred. The region between Flagstaff and the Colorado River has experienced very little Holocene seismic activity. In general, the earthquake hazards in the study area are minor.

3.2.1 Black Mesa Complex

3.2.1.1 Geologic Environment

The geology of the Black Mesa Complex area is dominated by relatively flat-lying sedimentary rocks with minor structural deformation by local folding and faulting. The rock units of Black Mesa are primarily undeformed and oriented in roughly horizontal beds. The Oljeto Syncline is a prominent fold that cuts north-south across the area, and lesser folds, such as the Maloney Syncline, are roughly parallel to it. Most faults are oriented east-west and have displacement less than 40 feet.

Coal rank, quality, and thickness vary among Peabody's designated coal reserve areas in the Black Mesa Complex. Geological data from the individual coal reserve areas were collected as part of Peabody's various permit application packages, including the LOM revision. In 1977, exploration drill holes revealed specific aspects of the Black Mesa geology that contributed to the original and subsequent mine plans. Coal seams were found to be thicker in the synclinal folds and thinned by erosion on the anticlines. In the southeast part of the Black Mesa Complex area, all seven of the coal horizons are present at varied depths. These depths are controlled by northwest-southeast trending fold belts and small-displacement, high-angle normal faults. In the southern part of the Black Mesa Complex (coal resource area J-07), the Oljeto Syncline controls the depth and location of the four minable coal horizons. The Oljeto Syncline also is present along the Joint Use Boundary (coal resource areas J-01, N-06 [refer to Map 2-1 or Map A-1]). In the northern part of the Black Mesa Complex (N-14, N-10, N-11), structural disturbance is less pronounced and only two of the coal horizons are minable. Outcrops of coal typically have been burned to form resistant clinker material.

The Yale Point Sandstone is a medium- to coarse-grained quartz sandstone. It is interbedded with the underlying Wepo Formation and can exceed 200 feet of thickness in the outcrop on the northeastern edge

of Black Mesa. The Yale Point Sandstone contains only a minor coal seam or two and is not considered economic to mine.

3.2.1.2 Geologic Natural Areas

There are no existing or proposed geologic natural areas in the Black Mesa Complex designated to preserve and protect unique or valuable geologic resources.

3.2.1.3 Mineral Resources

The Black Mesa Basin has proven coal reserves that have been mined for use by local communities as well as commercially. Economic coal reserves occur in the Toreva Formation, Wepo Formation, and Dakota Sandstone.

Coal beds in the Dakota Sandstone are present throughout the region, mostly in the middle carbonaceous shale member. The USGS estimates 9.6 billion tons of inferred coal resources in the Dakota Formation at Black Mesa. Historically, the Dakota coal beds have been mined at three locations on Black Mesa outside the Black Mesa Complex for local use as fuel. Coal beds in other sedimentary basins produce economic quantities of coal-bed methane gas from the Dakota Formation. The Dakota Sandstone is stratigraphically below the Wepo Formation and not affected by mining activities.

The carbonaceous middle member of the Toreva Formation contains several coal beds up to 7 feet thick. The USGS estimates 6 billion tons of inferred coal resources in the Toreva Formation. The Toreva Formation has been mined near Keams Canyon, which is outside the Black Mesa Complex. The Toreva Formation is stratigraphically below the Wepo Formation.

Economic reserves of coal are found in the Wepo Formation. In 2004, more than 13 million tons of coal were extracted by the Kayenta and Black Mesa mining operations. Through 2002, 290 million tons of coal had been mined under existing OSM permits. The USGS's estimates of the inferred total coal resource in the Wepo Formation exceed 4.8 billion tons.

No other mineral resources of economic value (either metallic nor nonmetallic) are present in abundance. Minor quantities of the mineral material scoria (volcanic cinders) are present; it is often used for road maintenance and in reclamation.

3.2.1.4 Paleontological Resources

The Cretaceous coal-bearing strata being mined in the Black Mesa Basin contain abundant plant and animal fossils and have high potential for yielding paleontological resources. The strata are laterally extensive and outcrop at many localities that have allowed collection and examination of the fossil assemblages that occur at the Black Mesa Complex. The paleontological resources contained in these rocks are common throughout Black Mesa.

3.2.2 Coal-Slurry Pipeline

3.2.2.1 Coal-Slurry Pipeline: Existing Route

More than half of the existing coal-slurry pipeline, from the Black Mesa Mine to about Seligman (including the Moenkopi Wash realignments), is within the Colorado Plateau physiographic province. The existing pipeline route traverses the transition zone from about Seligman to Kingman and the Basin and Range province from Kingman (including the Kingman reroute) to the terminus.

3.2.2.1.1 Geologic Environment

The existing pipeline route begins at Black Mesa and extends southwest to the Little Colorado River near Cameron. The geology of this area includes surface exposures of the Upper Cretaceous Toreva Formation, Wepo Formation, and Yale Point Sandstone (all part of the Mesaverde Group); and Mancos Shale. The Toreva Formation and Mancos Shale are exposed in several washes that down-cut through the Wepo Formation. The more established washes (Wepo, Oraibi, and Dinnebito) contain Quaternary alluvium. Several geologic structures with subtle folding and faulting characterize the Black Mesa area. These structures include the Oraibi Monocline, Wepo Syncline, Cow Springs Anticline, and Black Mesa Syncline.

Continuing west to Cameron and on to Seligman, the existing route traverses surface exposures of relatively flat-lying Jurassic, Triassic, and Permian sedimentary rocks. Between CSP Mileposts 65 and 79, the pipeline route crosses the Chinle Formation, which contains swelling clays and expansive soil that potentially can affect pipeline structural stability. Uranium, and localized waste piles from historical uranium mining having potentially high levels of radiation, could be present in that area of the Chinle Formation. The pipeline route crosses the inactive Mesa Butte Fault about 23 miles southwest of Cameron between CSP Mileposts 99 and 100. Between Cameron and Seligman the surface geology consists primarily of Permian sedimentary rocks and Quaternary volcanic rocks and basalt flows.

From Seligman westward, the existing route traverses surface exposures of transition zone rocks that include Precambrian granites, Paleozoic limestones, Tertiary volcanic and basaltic rocks, and Quaternary alluvium in streambeds. Several inactive faults are present in this area, including the Grand Wash-Cottonwood Fault at about CSP Milepost 210, which defines the boundary between the transition zone and Basin and Range province.

West of the Cottonwood Fault, the route traverses mountain ranges and valleys of the Basin and Range province and encounters surface exposures of Precambrian granitic and metamorphic rocks, Tertiary volcanics, and Quaternary alluvium. Several inactive faults are crossed at the fault-block boundaries of mountain ranges east and west of Kingman and west of the Sacramento Valley.

3.2.2.1.2 Geologic Natural Areas

There are no existing or proposed geologic natural areas along the existing route designated to preserve and protect unique or valuable geologic resources.

3.2.2.1.3 Mineral Resources

The existing pipeline begins on Black Mesa where it is buried within coal-bearing sedimentary rocks at a width and depth that has not affected near-surface coal resources.

There are no known noncoal mines or mineral deposits of economic value in the segment of the existing pipeline route corridor that traverses the Colorado Plateau. The pipeline route crosses the Cameron mineral district that historically has been mined for uranium and vanadium; however, the Navajo Nation has banned uranium mining on tribal land.

The segment of pipeline route from Kingman to Laughlin crosses several mining districts with numerous mines and mining claims. These include the Wallapai silver-gold-lead-zinc district in the Cerbat Mountains north of Kingman, the Union Pass gold-silver-beryllium district in the Black Mountains, and the San Francisco gold-silver-fluoride district and Oatman gold-silver-lead district, both in the Black Mountains southeast of Bullhead City.

The existing route encounters no active or inactive mineral material pits as it traverses the Colorado Plateau or transition zone. Southeast of Kingman, it traverses an existing mineral material pit in the foothills of the Hualapai Mountains.

3.2.2.1.4 Paleontological Resources

Surface exposures of Paleozoic and Mesozoic rocks occur along the Colorado Plateau and transition zone segments of the existing route. Cretaceous coal-bearing strata that contain abundant plant and animal fossils are found on Black Mesa. The paleontological resources contained in these rocks are common throughout Black Mesa.

Paleozoic sedimentary rocks, including limestones equivalent to the Mississippian-age Redwall Limestone and the Devonian-age Temple Butte Limestone, outcrop in the western Colorado Plateau and transition zone. These limestones have high potential for yielding paleontological resources; however, the paleontological resources contained in these rocks are common throughout the Colorado Plateau.

From the Kingman area west, the existing pipeline crosses Precambrian granitic rocks and Tertiary volcanic rocks in the Hualapai Mountains, and Quaternary alluvium in the Hualapai and Sacramento Valleys. None of these rock types are considered fossil-bearing.

3.2.2.2 Coal-Slurry Pipeline: Existing Route with Realignment (Agencies' Preferred Alternative)

3.2.2.2.1 Geologic Environment

The Moenkopi Wash realignments would be entirely within the Colorado Plateau province and traverse surface exposures of the Upper Cretaceous Wepo and Toreva Formations, and Mancos Shale on Black Mesa. Portions of Moenkopi Wash contain Quaternary alluvium.

The Kingman reroute would traverse mountain ranges and valleys of the Basin and Range province and encounter surface exposures of Precambrian granitic and metamorphic rocks, Tertiary volcanics, and Quaternary alluvium. Inactive faults are present at the fault-block boundaries of mountain ranges east and west of Kingman.

3.2.2.2.2 Geologic Natural Areas

There are no existing or proposed geologic natural areas along the realignments that are designated to preserve and protect unique or valuable geologic resources.

3.2.2.2.3 Mineral Resources

The Moenkopi Wash realignments would traverse coal-bearing sedimentary rocks on Black Mesa. There are no known mineral deposits or mineral districts along this realignment. No active or inactive mineral material pits are in this area, and the realignments would be outside any mineral district.

There are no known mineral deposits of economic value reported along the Kingman reroute. The reroute would pass through one mining district south of the town of McConnico. The mines of the McConnico District—past producers of gold and silver—were discovered in the early 1900s and did not produce beyond 1950. The reroute also would pass through an existing mineral materials pit southeast of Kingman.

3.2.2.2.4 Paleontological Resources

The Moenkopi Wash realignments would traverse a geologic area comparable to that of the existing route. Cretaceous coal-bearing strata that contain abundant plant and animal fossils are found on Black Mesa. The paleontological resources contained in these rocks are common throughout the Black Mesa Basin. The Kingman reroute would traverse outcrops of Precambrian granitic rocks and Tertiary volcanic rocks in the Cerbat Mountains.

3.2.3 Project Water Supply

3.2.3.1 C Aquifer Water-Supply System (Agencies' Preferred Alternative)

3.2.3.1.1 Well Field

The proposed C-aquifer well field is located within the Colorado Plateau province and the Little Colorado River drainage. Other than small areas of stream alluvium in creeks and washes, rocks exposed at the surface include the Permian Kaibab Limestone and Triassic Moenkopi Formation. The surface geology and structural geology are shown on Map 3-2.

No subsurface economic mineral resources are known to exist in the well field area. There are no existing or proposed geologic natural areas in the well field area. There are no known mineral deposits of economic value in the well field area. No active or inactive mineral material pits are located in the well field area. The paleontological resources contained in the fossil-bearing Kaibab Limestone and Moenkopi Formation are common throughout the Colorado Plateau.

3.2.3.1.2 C Aquifer Water-Supply Pipeline

At the well field, the pipeline route is underlain by the Kaibab Limestone. As the route progresses toward the coal-slurry preparation plant it crosses successively younger geologic units. Heading north from the well field, it would traverse surface exposures of relatively flat-lying Permian, Triassic, and then Jurassic sedimentary rocks. At the Little Colorado River crossing, the two subalternatives would be on Quaternary alluvium. Between CSP Mileposts 24 and 34, the pipeline would cross the Chinle Formation, which contains swelling clays and expansive soil that can affect pipeline structural stability. Deposits of uranium and localized waste piles from historical mining of uranium, with potentially high levels of radiation, could be present in that area of the Chinle Formation. The two alternative routes separate near CSP Milepost 27. Both the eastern and western pipeline routes would cross the major geologic units present in the Black Mesa Basin area.

3.2.3.1.2.1 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

The eastern route would begin traversing Cretaceous sedimentary rocks near Kytotsmovi. The two subalternative routes through the Kytotsmovi area would be on Dakota Sandstone. The remainder of the eastern route would be on alluvium or surface exposures of the Wepo and Toreva Formations. On Black Mesa, the route would traverse coal-bearing sedimentary rocks. Cretaceous coal-bearing strata on Black Mesa contain abundant plant and animal fossils. The paleontological resources contained in these rocks are common throughout the Black Mesa Basin.

There are no existing or proposed geologic natural areas along the eastern route. There are no known noncoal mines or mineral deposits of economic value along the eastern pipeline route, nor are there any mineral material pits.

3.2.3.1.2.2 *C Aquifer Water-Supply Pipeline: Western Route*

The western route would traverse surface exposures of Triassic, Jurassic, and Cretaceous sedimentary rocks, and alluvium in washes and on the Moenkopi Plateau. The remaining 10 miles of the western route would be on surface exposures of the Wepo and Toreva Formations on Black Mesa. The route would traverse coal-bearing sedimentary rocks on Black Mesa. Cretaceous coal-bearing strata on Black Mesa contain abundant plant and animal fossils. The paleontological resources contained in these rocks are common throughout Black Mesa Basin.

There are no known existing or proposed geologic natural areas along the alternative route. There are no known noncoal mines or mineral deposits of economic value along the western route. There are no mineral material pits along the western route.

3.3 SOIL RESOURCES

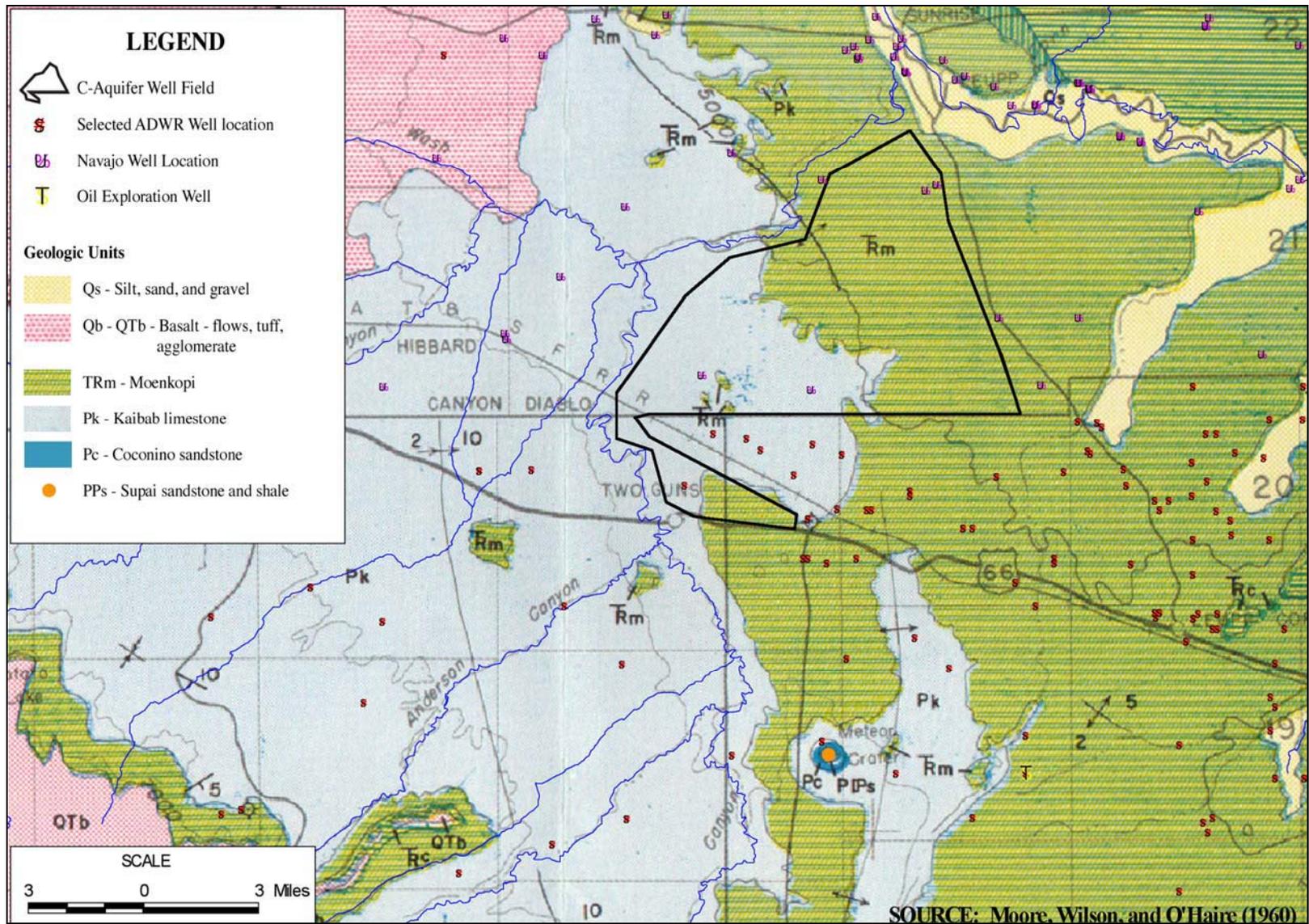
3.3.1 Black Mesa Complex

The soils on the plateaus, mesas, hillsides, and fan terraces of the Colorado Plateau range from very shallow (a few inches) to deep (5 feet) and generally are well drained. Many have formed in basalt and pyroclastics and are very cindery. The water erosion potential is usually slight to moderate, but may be high in areas with steeper slopes. Wind erosion potential is often moderate to severe. Many portions of the Colorado Plateau are subject to high wind and water erosion due to sparse vegetation cover and soil type.

Soils within the Black Mesa Complex are derived primarily from the Cretaceous Mesaverde Group, a series of sedimentary sandstones, siltstones, and mudstones. In 1979, 1983, 1985, 2000, and 2003, site-specific soil surveys were conducted by private contractors in the Black Mesa Complex area, along with the surrounding areas, to provide detailed soil taxonomy. The surveys identified 14 soils in and surrounding the area. These soils were predominantly very fine- to fine-grained sandy loams with minor smectitic clayey soils. The smectite clays, also referred to as “swelling clays,” can undergo as much as a 30 percent volume change due to wetting and drying. Soils in the area can be characterized generally as well drained with moderate shrink-swell potential (with the exception of the smectitic clayey soils) and slightly susceptible to wind erosion.

On reclaimed surface mines, topsoil is essential for re-establishing native vegetation and forage. Subsoil and weathered rock overburden beneath the topsoil supply additional nutrients and moisture for plant growth. The removal and replacement of all topsoil is required by SMCRA unless it is demonstrated that selected subsoil or spoil is better suited for growing plants. Topsoil is removed as a separate layer before mining and is either spread on nearby regraded areas or, if necessary, temporarily stockpiled. Topsoil is spread to the appropriate depths for the approved post-mining land use.

By definition, topsoil means the A and E soil horizon layers of the four master soil horizons (30 CFR Part 701.5). The soils of the Black Mesa Complex have A horizons that range in thickness between 0 to 1 inch and 0 to 4 inches, depending on the soil. The topsoil is of insufficient quantity to salvage as a separate layer and must be salvaged together with suitable subsoil and suitable unconsolidated material below the subsoil to provide a topsoil mixture suitable for reclamation. When topsoil material requirements to support the reclamation plan so demand, Peabody salvages the residual soils unless their depth makes salvage impractical. The soil surveys assessed residual soils’ unsuitability for restoration based on four conditions: selenium concentration, sodic zones, pH, and acid-forming spoils.



Map 3-2 Surface Geology and Structure Proposed C-Aquifer Well Field

Soils developed from coal-bearing Mesaverde Group parent rock have the potential for higher than normal selenium concentrations. Native vegetation that bioaccumulates selenium on these soils can create a level of toxicity in the forage high enough to affect cattle. For this reason, Peabody has conducted geobotanical studies on the disturbed areas in support of the topsoil material suitability assessments.

The geobotanical studies demonstrated that selenium-accumulating plant populations are common locally in certain subhabitats in the area. The selenium accumulators occurred on the shallow soils associated with wooded ridges and disturbed areas, and were absent from the broad sagebrush valleys and wash terraces where the deeper soils occur. Based upon the results of selenium analysis in plants and soils at a representative cross section of sites where accumulator plants were found, the soils in which they were growing are not seleniferous. No selenium poisoning of livestock has been reported in or surrounding the Black Mesa Complex.

Overburden material, which could be used to provide soil, also was evaluated for this problem. Initial results indicated the probability of suspect concentrations of plant-available selenium occurring in re-graded spoils. The overburden assessment for 13 mining areas concluded that there was suspect selenium potential of occurring in seven areas. Most values that exceeded the suspect level of 0.26 parts per million (ppm) approved by OSM were less than 0.3 ppm. More recent analysis of re-graded spoil selenium levels in comparison to selenium blood levels in cattle grazing on reclaimed areas indicate that the selenium levels present in the re-graded spoil do not pose a threat to livestock. No selenium monitoring in the re-graded spoil is currently required.

Sodium adsorption ratios (SAR) greater than 18 or 22, depending on soil texture, are indicative of elevated sodium in soil. The overburden assessment for 11 mining areas concluded that there was potential for sodic zones to occur in 10 areas at or near the surface of regraded soils.

Alkaline and acidic soils are typical in coal seams and in deeper subsurface soils. Overburden materials having elevated SAR also may have unsuitable pH values: either alkaline pH values greater than 8.8, or acidic pH values less than 5.5. However, acidic soils may not be a significant issue because of excess alkalinity measured in many core samples.

Negative acid-base account potential values indicate a potential for acid-forming zones that make spoil unsuitable for use as replacement soil in reclamation areas. Negative acid-base accounting has been detected at unsuitable levels in about 10 percent of the total samples of spoil collected and analyzed. Acidic or acid-forming spoils are not anticipated in most areas.

3.3.1.1 Prime Farmland Determination

The soils that occur are predominantly in the Natural Resource Conservation Service (NRCS) land capability Classes VI and VII. Soils in Classes VI and VII have severe to very severe limitations that make them unsuitable for cultivation and limit or restrict their use largely to pasture, range, woodland, or wildlife habitat. Soils in these groupings are used primarily for livestock grazing. The land in the Black Mesa Complex area has received a negative determination as prime farmland from the NRCS (Peabody 1985, 1986).

3.3.2 Coal-Slurry Pipeline

As stated previously, the existing coal-slurry pipeline crosses two physiographic provinces—the Colorado Plateau and the Basin and Range, with a transition zone between the two. In the Basin and Range province and the transition zone, the soils in the valleys generally have formed from mixed alluvium. The soil depths range from very shallow to deep and are typically gravelly, sandy, or loamy with caliche in the

subsurface. The erosion potential is slight to moderate, typically increasing with greater slope. In the floodplains, terraces, and alluvial fans of the Colorado River area, the soils have formed in alluvium derived from igneous and sedimentary rocks. They are deep soils and are sandy, loamy, or gravelly on the surface. Caliche is typical in the subsurface of soils developed on the terraces and alluvial fans. The erosion potentials are slight to moderate, increasing with greater slope.

Between CSP Mileposts 65 and 79 the existing route crosses soil derived from the Chinle Formation, which contains swelling clays and expansive soil that can affect pipeline structural stability. Deposits of uranium and localized waste piles from historical mining of uranium, with potentially high levels of radiation, could be present in that area of the Chinle formation.

Both the Moenkopi Wash realignments and the Kingman reroute are located within the same general areas as the existing route and would cross the same soil types.

Although there is no prime and unique farmland along the existing route, American Farmland Trust identified high-quality farmland on private and State Trust Land near Seligman, Arizona (between CSP Mileposts 170 and 180).

3.3.3 Project Water Supply

3.3.3.1 C Aquifer Water-Supply System

3.3.3.1.1 Well Field

Soils in the area of the well field are considered to be well-drained, with a clay content of less than 20 percent, and a low shrink-swell potential. The wind erodibility for soils in this area is high due to sparse vegetation. Susceptibility for soil-induced corrosion of concrete is low. Susceptibility for corrosion of uncoated steel is high throughout most of the well field area, with the exception of a small area in the southwestern corner of the well field characterized as holding moderate potential.

3.3.3.1.2 C Aquifer Water-Supply Pipeline

Soils along the eastern alternative route can be described generally as either well-drained or somewhat excessively drained. The shrink-swell potential is generally low; however, minor areas along the middle and approximately the last 10 miles of the eastern route have moderate shrink-swell potential. The majority of soils along the western route are characterized as excessively drained. Two small transects in the middle of the route and approximately the last 20 miles to the coal-slurry preparation plant are well-drained. The shrink-swell potential of the soils along the route is generally low, with the exception of two small transects in the middle of the route, where soils have high shrink-swell potential.

As discussed in Section 3.3.1.1, soils that occur in the project area are predominantly unsuitable for cultivation. There is, however, limited agriculture along the proposed C aquifer water-supply pipeline (eastern) route. Small farm plots on the order of 1 acre typically may be located within the major washes on the relatively flat terraces where more soil has accumulated. Although the farm plots are sited adjacent to drainage channels, there are no flood irrigation features such as dikes, diversions, or canals to water the crops. The availability and quality of surface water is uncertain and unreliable. Instead, moisture for the crops is provided by infrequent and available rainfall events. These farm plots are established on an opportunistic and intermittent basis because they depend on sufficient rainfall for a successful crop. For these reasons, Peabody considers the farm plots as “kitchen gardens” used to augment the household food supply and does not include them as an established land use requiring reclamation.

3.4 WATER RESOURCES (HYDROLOGY)

Surface drainage of northern Arizona is a consequence of the topography of the Colorado Plateau physiographic province in the east and the Basin and Range physiographic province in the west. The Black Mesa Complex and the C aquifer water-supply system are entirely within the Colorado Plateau, while the coal-slurry pipeline is within both the Colorado Plateau province and the Basin and Range province.

The Colorado Plateau is a region of low relief overall, punctuated by erosional plateaus; steep-sided, river-cut canyons; and isolated volcanic landforms. The area stands high in elevation, relative to surrounding parts of Arizona. Drainage is controlled by the perennial Colorado River flowing from the northeast to the west, and by the Little Colorado River, running from the south near the White Mountains to its junction with the Colorado River downstream from Page, Arizona. The Little Colorado River is intermittent (flowing certain times of the year) from Holbrook, Arizona, to the Colorado River. To the west and southwest, the Colorado Plateau gives way to the Basin and Range province, characterized by lower elevations and steeper relief. The Basin and Range comprises north to northwest trending, discontinuous, steep-sided mountain ranges interspersed with deep alluvial valleys. Major watersheds are shown on Map 3-3.

Black Mesa is a major physiographic feature of the Colorado Plateau. Washes, including Moenkopi, Dinnebito, Oraibi, Polacca, and Jeddito, drain Black Mesa to the southwest and join the Little Colorado River, as shown on Map 3-4. Laguna Creek and Chinle Wash drain to the north and join the San Juan River. All of the washes draining Black Mesa are intermittent. None of the tributaries or washes is a reliable source of water for irrigation or potable use.

Tributaries that are fed by springs, potentially affected by N-aquifer groundwater pumping or by mining operations, include Moenkopi, Dinnebito, Oraibi, Coal Mine, and Yellow Water Canyon washes and Laguna Creek on Black Mesa (refer to Map 3-4). Streams potentially impacted by C-aquifer pumping are shown on Map 3-5 and include lower Clear and Chevelon creeks near Winslow.

Numerous springs are found across and adjacent to the Hopi and Navajo Reservations, some of which have important cultural value to either or both tribes. Lower Moenkopi Village, on the Hopi Reservation, obtains water from a spring near Moenkopi Wash. There are more than 200 other springs on the Hopi Reservation with cultural or water-supply value to the community. Many of these springs are local and not associated with the major regional aquifers. Four of the larger and/or consistent springs have been monitored by the USGS since at least 1995. These include Moenkopi School (19 af/yr in 2005), Pasture Canyon (54 af/yr in 2005), Burro Springs (0.3 af/yr in 2005), and Unnamed Spring near Dinnehotso (35 af/yr in 2005) in the unconfined portion of the N aquifer. These springs have shown fluctuations but no long-term trends are apparent (USGS 1985-2005). Since these springs occur where the N aquifer is at or near the ground surface, a portion of the spring flow may be due to the infiltration of rain water. Fluctuation in spring flow may be due, in part, to variations in precipitation.

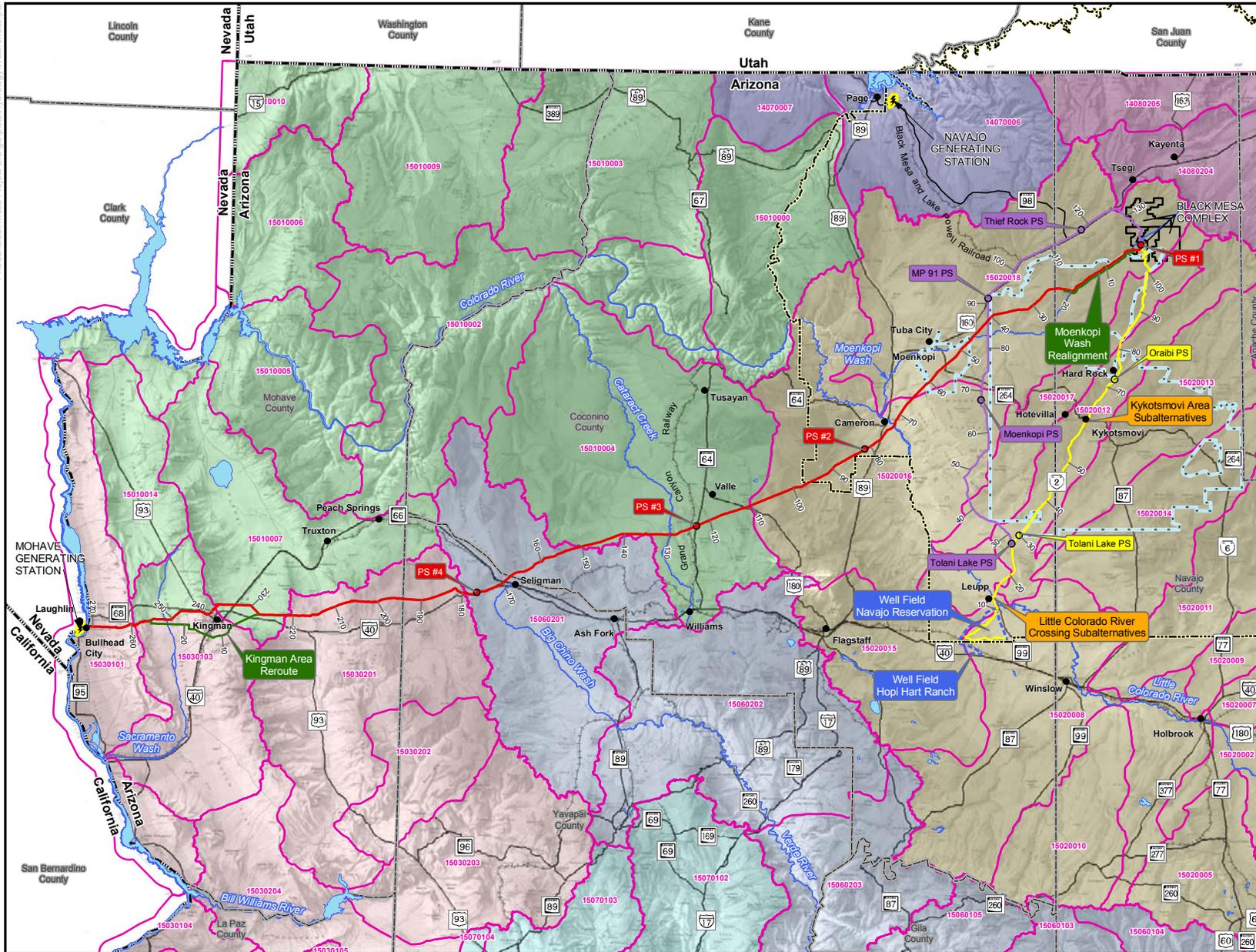
Blue Springs (long-term average 164,000 af/yr) is the discharge point for most C-aquifer water flowing north from the Mogollon Rim. Blue Springs is a series of springs located in the Little Colorado River gorge upstream from the river's confluence with the Colorado River mainstem.

There are several groundwater sources within the project area, each of varying water quality, water-yielding capability, and accessibility. Figure 3-1 (refer to Section 3.2) identifies the significant water-bearing units in the study area. Significant water-bearing formations and associated aquifers include the following, in descending order:

- The alluvial system, composed of gravel, sand and silt, associated with stream channels that occur in the vicinity of the Black Mesa area (OSM 2006). This system is local and varies greatly in size and extent depending on the nature of the stream channels.
- Water-bearing formations of the Mesa Verde Group, specifically the Wepo Formation containing siltstone, mudstone, sandstone, and coal beds. There are no developed Wepo water use locations on the leasehold (Peabody 1986, revised 2003). The Wepo aquifer is discontinuous across the leasehold and does not constitute a regional aquifer.
- The D aquifer, which includes the Dakota Sandstone, portions of the Morrison Formation, and the Cow Springs Sandstone (ADWR 1989); the D aquifer is confined (groundwater in the aquifer is under pressure and will rise above the level at which it is encountered by a well) by the overlying Mancos Shale.
- The N aquifer is named for the Navajo Sandstone and includes the Navajo Sandstone, the Kayenta Formation, and the Lukachukai Member of the Wingate Sandstone; the N aquifer is confined by the overlying Carmel Formation.
- The C aquifer is named for the Coconino Sandstone and includes the Kaibab Limestone, the Coconino Sandstone, and the upper part of the Supai Formation; in some areas the C aquifer is confined by the overlying Moenkopi and Chinle Formations.
- The Muav-Redwall aquifer (R aquifer) is comprised of the Muav-Redwall limestones that underlie the C aquifer. Over most of the study area the Muav-Redwall limestones are separated from the overlying C aquifer by the relatively impermeable silts and clays of the Supai Formation. However, in the area west of Cameron, water from the C aquifer is thought to move downward through faults and fractures in the Supai Formation into the R aquifer before discharging at Blue Springs.

The relationships among these units in the project area is shown on Figure 3-2. The extent of the regional aquifers is shown on Maps 3-4, 3-5, and 3-6 (the R aquifer does not outcrop in the study area and is not shown on the surface maps). The regional aquifers (D, N, C, and R) extend over large areas and are controlled by the regional northern dip of the rocks and the basin structure beneath Black Mesa. The R aquifer is deeply buried throughout the study area. Water from Blue Springs is nonpotable (3,000 milligrams per liter [mg/L] of total dissolved solids) and no wells in the study area produce water from the R aquifer. The C aquifer is at the surface south of the Little Colorado River but is buried beneath more than 5,000 feet of sedimentary rocks under the area of the Kayenta and Black Mesa mines. With the exception of the southeast portions of the D and N aquifers and the C and R aquifers west of Cameron, there is little interconnection among the major water-bearing units. It should be noted that, for convenience of presentation, the vertical exaggeration on Figure 3-2 is large (26 times) giving the impression of much greater structural relief than actually exists.

Of principal interest to this project are the N and C aquifers, which are the current and proposed sources, respectively, of water supply for mining operations and transportation of coal via the coal-slurry pipeline. These aquifers also are the major sources of potable water for municipal use. Until December 2005 when mining ceased, the N aquifer was the primary source of water supply for the coal-slurry pipeline. The



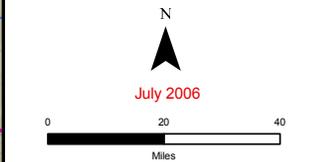
Map 3-3 Major Watersheds

Black Mesa Project EIS

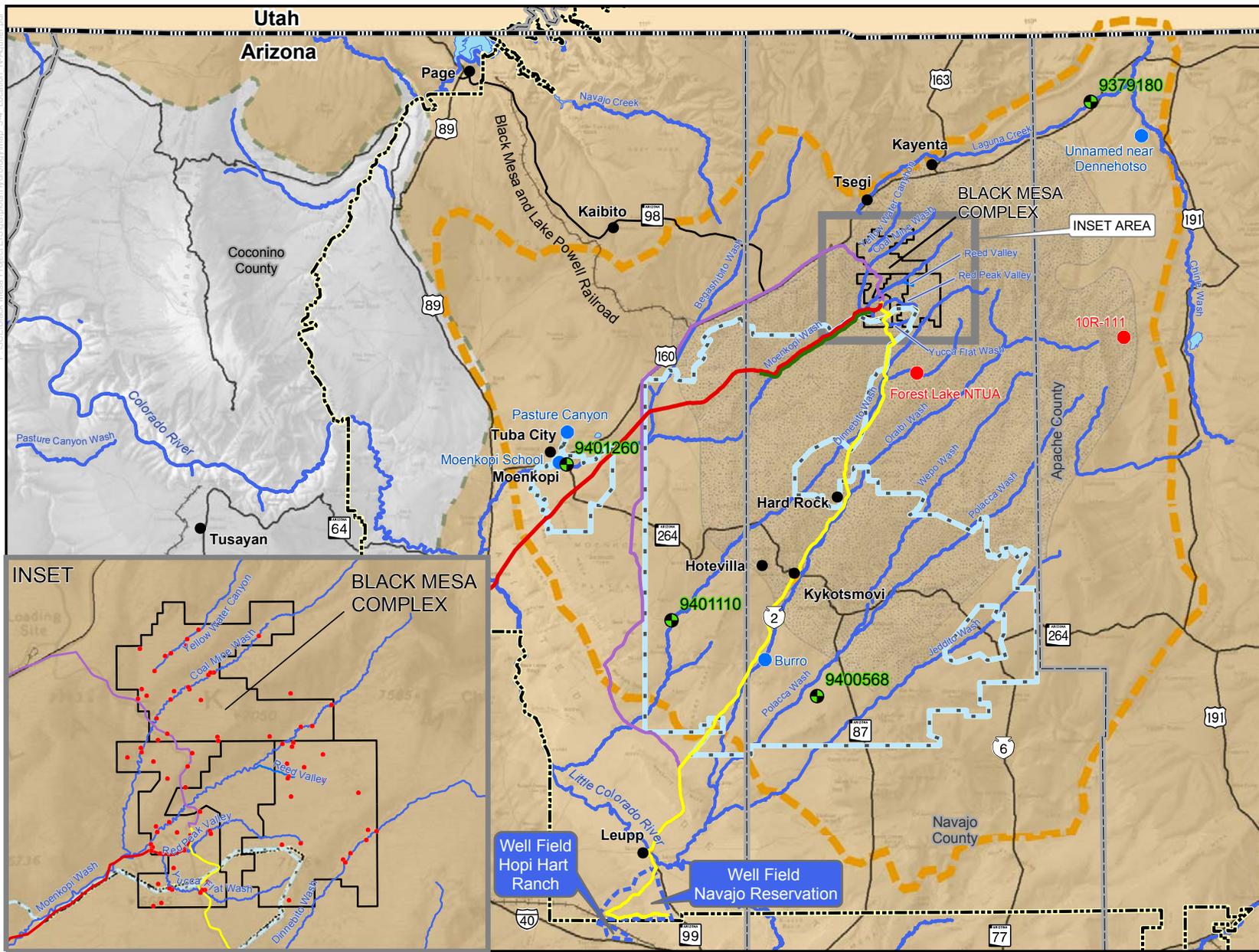
LEGEND

- Coal-Slurry Pipeline
- Existing Route
- Realignments
(Existing route with realignment/reroute is the preferred alternative)
- Proposed Water-Supply Pipeline**
- Eastern Route (preferred alternative)
- Subalternatives (preferred alternative)
- Western Route
- Other Project Features**
- - - C-Aquifer Well Field
- PS = Pump Station
- Peabody Lease Area
- Watersheds**
- Bill Williams River
- Lower Colorado River - Lake Mead
- Upper Colorado River - Dirty Devil
- Little Colorado River
- Lower Gila River
- Lower San Juan River
- Verde River
- Sub-watershed Boundary and Hydrologic Unit Number
- General Features**
- River
- Lake
- Navajo Reservation Boundary
- Hopi Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route

SOURCES:
 URS Corporation 2005
 Arizona State Land Department 2005
 Arizona Department of Water Resources 2004
 - Modified by URS 2005



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Map 3-4
Location of Surface Drainages on Black Mesa and Key N-Aquifer Features
 Black Mesa Project EIS

LEGEND

Coal-Slurry Pipeline

- Existing Route
- Realignments (Existing route with realignment/reroute is the preferred alternative)

Proposed Water-Supply Pipeline

- Eastern Route (preferred alternative)
- Subalternatives (preferred alternative)
- Western Route

Other Project Features

- C-Aquifer Well Field
- Peabody Lease Area
- Streams
- Well
- Spring
- Stream Gage

Aquifers

- C-Aquifer
- N-Aquifer
- Confined Area of N-Aquifer (Southeast edge is limit of the model)

General Features

- Lake
- Navajo Reservation Boundary
- Hopi Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route

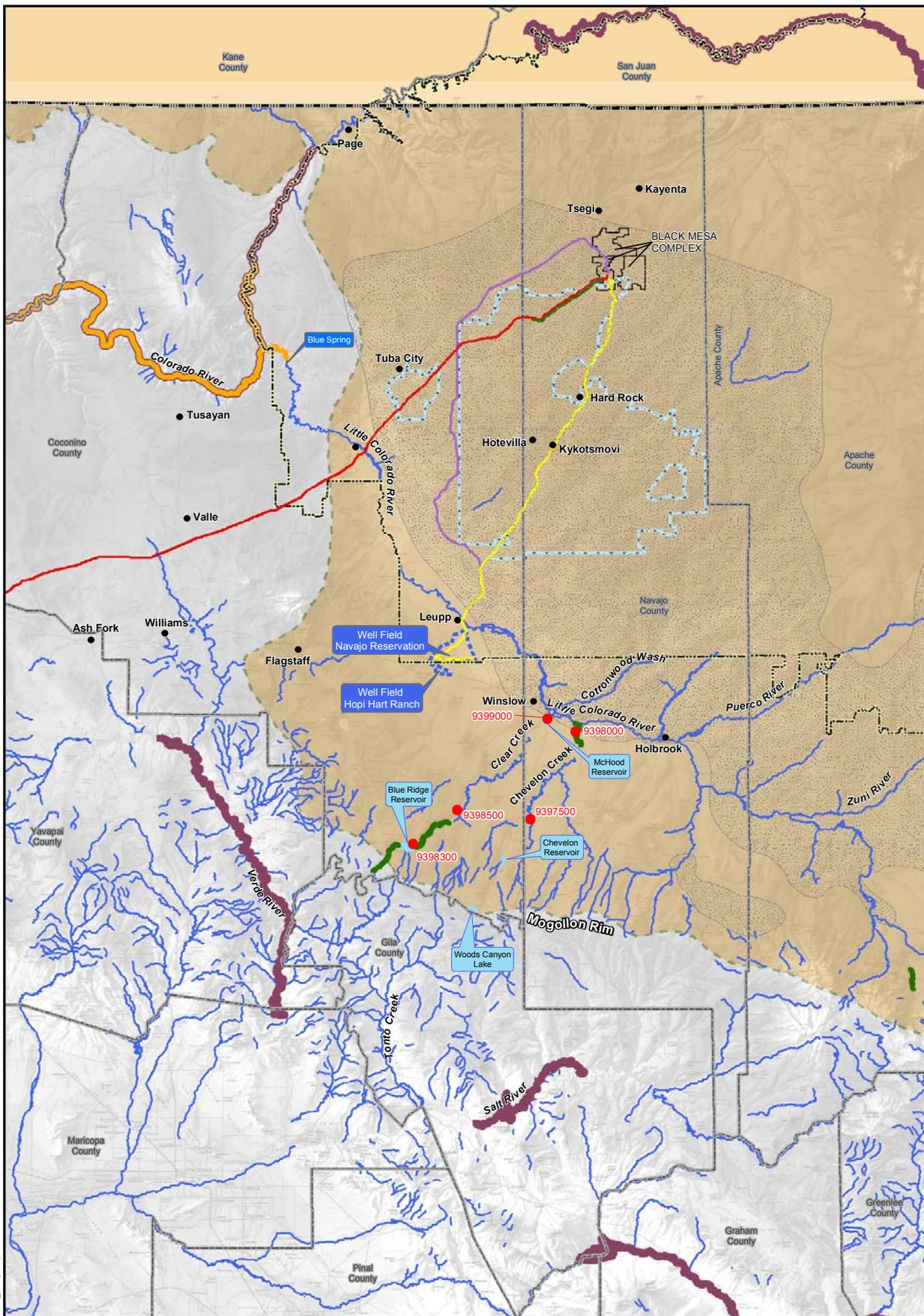
SOURCES:
 URS Corporation 2005
 USGS 2005
 USGS Water Resources 2006
 Bureau of Reclamation 2005

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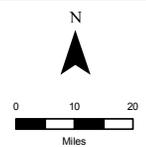
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URS



SOURCES:
URS Corporation 2005
USGS 2005
USGS Water Resources 2005
Bureau of Reclamation 2005
U.S. FWS Critical Habitat Portal 2005

LEGEND

- Coal-Slurry Pipeline**
 Existing Route
 Realignments
 (Existing route with realignment/reroute is the preferred alternative)
- Proposed Water-Supply Pipeline**
 Eastern Route (preferred alternative)
 Subalternatives (preferred alternative)
 Western Route

- Other Project Features**
 C-Aquifer Well Field
 Peabody Lease Area
 Steam Gage Station
 Stream Reaches
- Critical Habitat**
 Humpback Chub
 Little Colorado Spinedace
 Razorback Sucker

- Aquifers**
 C-Aquifer Boundary
 Confined Area of C-Aquifer (Northern edge is limit of the model)
- General Features**
 Navajo Reservation Boundary
 Hopi Reservation Boundary
 State Boundary
 County Boundary

Map 3-5

Location of Surface Drainages South of Black Mesa and Key C-Aquifer Features

September 2006

Black Mesa Project EIS

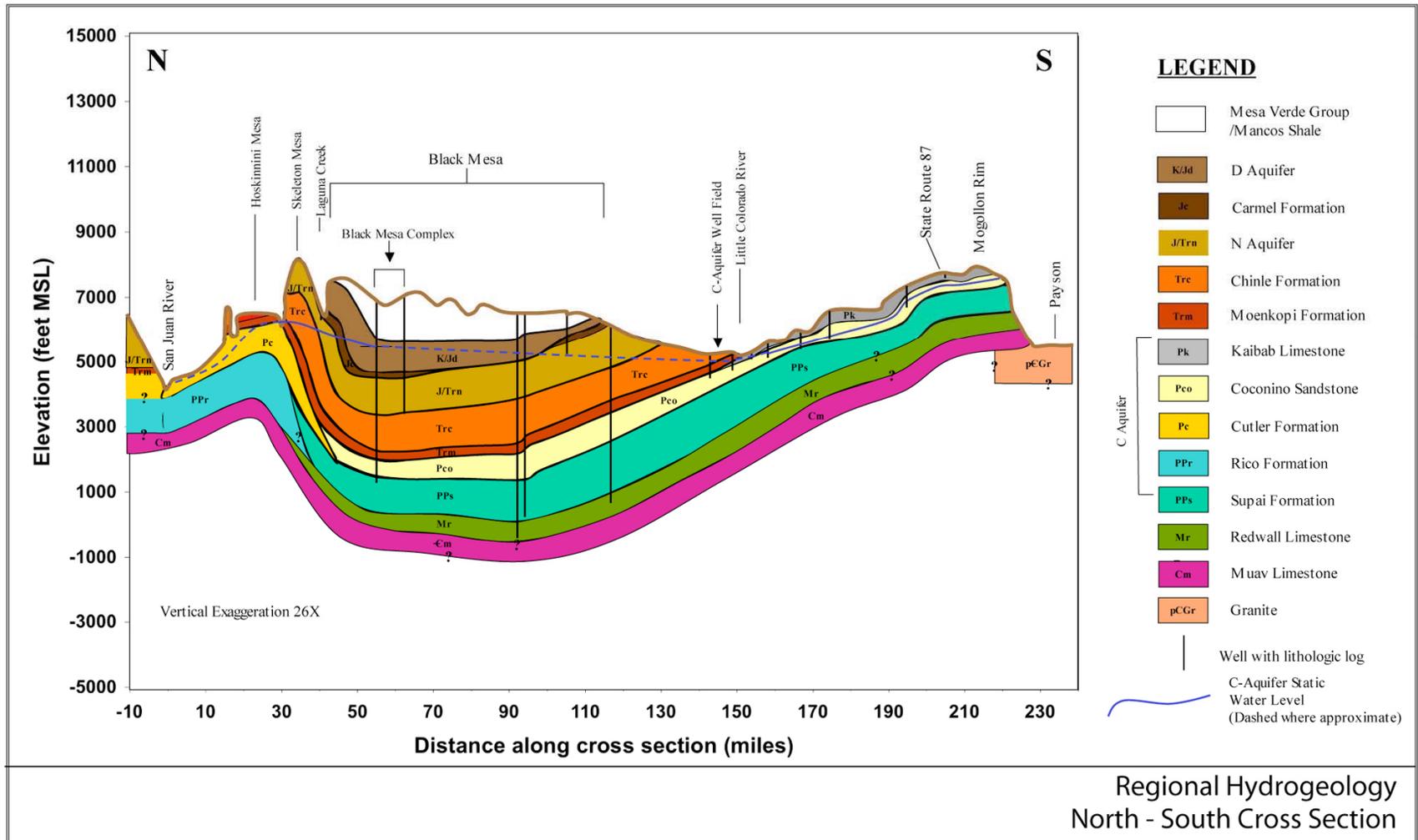
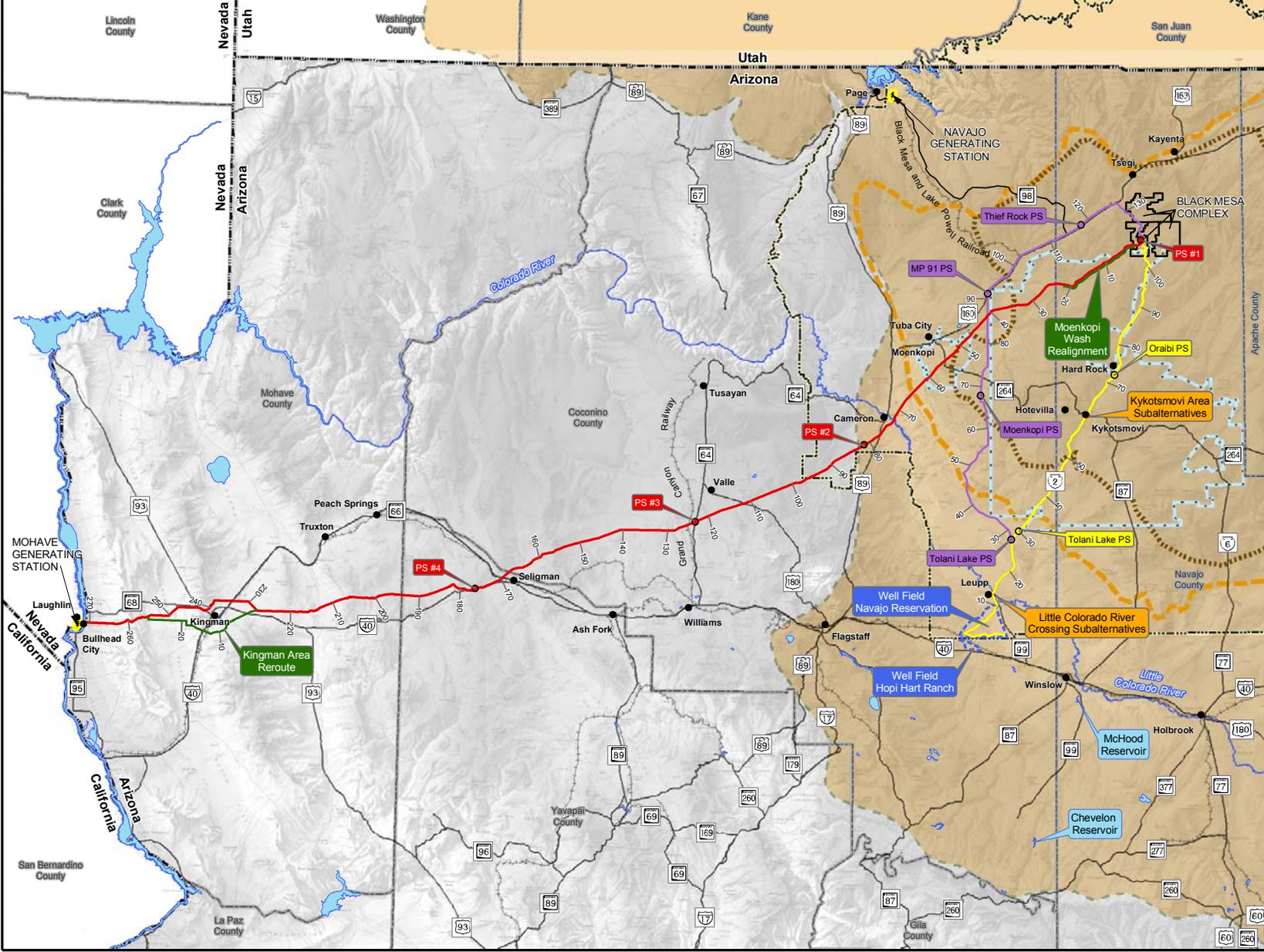


Figure 3-2 Regional Hydrology



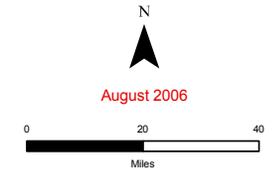
Map 3-6 Extent of Regional Aquifers

Black Mesa Project EIS

LEGEND

- Coal-Sturry Pipeline**
 - Existing Route
 - Realignments

(Existing route with realignment/reroute is the preferred alternative)
 - Proposed Water-Supply Pipeline**
 - Eastern Route (preferred alternative)
 - Subalternatives (preferred alternative)
 - Western Route
 - Other Project Features**
 - C-Aquifer Well Field
 - PS = Pump Station
 - Peabody Lease Area
 - Aquifers**
 - C Aquifer
 - D Aquifer
 - N Aquifer
 - General Features**
 - River
 - Lake
 - Navajo Reservation Boundary
 - Hopi Reservation Boundary
 - State Boundary
 - County Boundary
 - Interstate/U.S. Highway/State Route
- SOURCES:
URS Corporation 2005, 2006
Bureau of Reclamation 2005



N aquifer can be characterized as a low transmissivity, sandstone aquifer that is confined beneath the leasehold, the central portion of the Navajo Reservation, and the northeast portion of the Hopi Reservation. The confined area of the N aquifer is shown on Map 3-4. The Peabody well field is in the confined portion of the aquifer. The aquifer is unconfined in the area of Moenkopi and Tuba City where significant springs occur. The C aquifer is characterized as a moderately transmissive sandstone aquifer and generally is unconfined south of the Little Colorado River and in the southwestern corner of the Navajo Reservation. It is deep and confined under Black Mesa and beneath the Hopi Reservation. The aquifer in the area of the proposed C-aquifer well field is unconfined.

The N and C aquifers are large aquifer systems; water in storage is estimated to be 166 and 413 million acre-feet, respectively (ADWR 1989; Eychaner 1983). Recharge is from precipitation and is estimated to be approximately 13,000 af/yr for the N aquifer and 319,000 af/yr for the C aquifer, or approximately 0.008 and 0.08 percent of the water in storage (Eychaner 1983; Hart et al. 2002). Because the annual recharge is small compared to the volume of water in storage, aquifer water levels do not fluctuate significantly in response to typical wet and dry cycles of precipitation.

3.4.1 Black Mesa Complex

Water resources in the Black Mesa region, particularly the eastern portion of the area where the existing and planned water production facilities are located, have been studied for many years. Peabody has conducted extensive surface water and groundwater studies in support of its permit applications and associated regulatory requirements.

These studies include sedimentation and streamflow measurements, as well as detailed groundwater modeling of the N and D aquifers, and are referenced throughout this section of the EIS. OSM prepared a Cumulative Hydrologic Impact Analysis (CHIA) of the coal lease area in 1989 (USDI 1989). The purpose of the CHIA is to evaluate the potential for damage to the hydrologic balance outside the Black Mesa Complex. The hydrologic balance is the relationship between the quality and quantity of water inflow to, and water outflow from, a hydrologic unit such as a drainage basin or aquifer. The CHIA currently is being updated to include information from additional water resource studies available since the first CHIA report and to determine potential mining-related hydrologic impact on the existing and foreseeable water uses. Existing hydrologic conditions, including the ongoing mining operations, are described in the following subsections.

3.4.1.1 Surface Water

Four major drainages convey runoff and spring discharge from the Black Mesa Complex including Coal Mine Wash, Moenkopi Wash, Dinnebito Wash, and Yellow Water Canyon (refer to Map 3-4). The three washes are intermittent and discharge to the Little Colorado River system. Additionally, three relatively large washes feed Moenkopi Wash on the mine leasehold—Yucca Flat, Red Peak Valley, and Reed Valley washes. Yellow Water Canyon is intermittent and discharges to the San Juan River system.

Flows are highly variable and primarily consist of storm runoff. As is typical of the area, runoff from storm events can range from a few cubic feet per second (cfs) to more than 10,000 cfs, depending on the location, intensity, and duration of a storm. Perennial reaches (flowing continuously at that point) are the result of saturated rock units at the surface and the discharge of alluvial aquifers holding stormwater bank storage. This flow is referred to as base flow and is generally synonymous with the low flow of the stream. When base flow occurs, Peabody measures flows in each of the washes within the Black Mesa Complex. Base flow is generally low and ranges from 0.020 to 0.29 cfs for Coal Mine Wash, 0.09 to 0.17 cfs for Moenkopi Wash, 0.002 cfs for Dinnebito Wash, 0.08 cfs for Reed Valley Wash, 0.071 cfs for

Red Peak Valley Wash, and 0.027 cfs for Yellow Water Canyon Wash. Not all stream reaches within the permit area have periods of base flow.

The USGS monitored streamflow on Coal Mine Wash (three locations) and Moenkopi Wash (two locations) sporadically throughout the 1970s within the permit and adjacent area. After 1980, all on-site streamflow monitoring was performed by Peabody. Peabody surface-water monitoring has occurred at 14 locations within the permit area, and includes all major drainages and tributary drainages.

Monitoring of surface water is a routine permit requirement for Peabody. Peabody categorizes surface-water quality data based on three sources of surface water monitored—rainfall (stormwater), snow melt, or base flow. Water quality analyses indicate a variety of water types, mostly calcium/magnesium sulfate and calcium/magnesium bicarbonate waters. Stormwater generally has less contact time with salt-containing materials that results in less concentration after evaporation. Therefore, total dissolved solids (TDS) concentrations tend to decrease as runoff increases. Mean concentration of stormwater is given in Table 3-1.

Table 3-1 Mean Concentrations of Chemical Parameters in Stormwater, Stream Monitoring Sites by Site Number (Period of Record 1986-2002)

	Dinnebito Wash		Reed Valley Wash	Yellow Water Wash		Yazzie Wash	Coal Mine Wash			Red Peak Valley Wash		Moenkopi Wash	
	34	78	37*	50	15	157	16	18**	25	14	155	35	26
<i>PH</i>	8.1	8.0	8.0	8.0	8.0	8.2	8.1	8.0	8.0	8.3	8.3	8.1	8.0
<i>TDS</i>	1,170	1,489	1,485	755	686	231	471	1,335	1,538	268	316	292	1,109
<i>Alk</i>	91	87	121	86	85	111	80	123	119	92	88	68	107
<i>SO₄</i>	740	937	694	437	398	122	242	810	977	109	128	118	660
<i>Ca</i>	166	194	162	125	127	50	87	165	168	46	43	52	152
<i>Mg</i>	70	98	105	44	34	8	19	80	97	12	12	11	66
<i>Na</i>	75	98	100	19	16	4	13	104	141	15	31	5	83
<i>Cl</i>	17	22	213	17	10	3	8	26	20	10	11	4	38

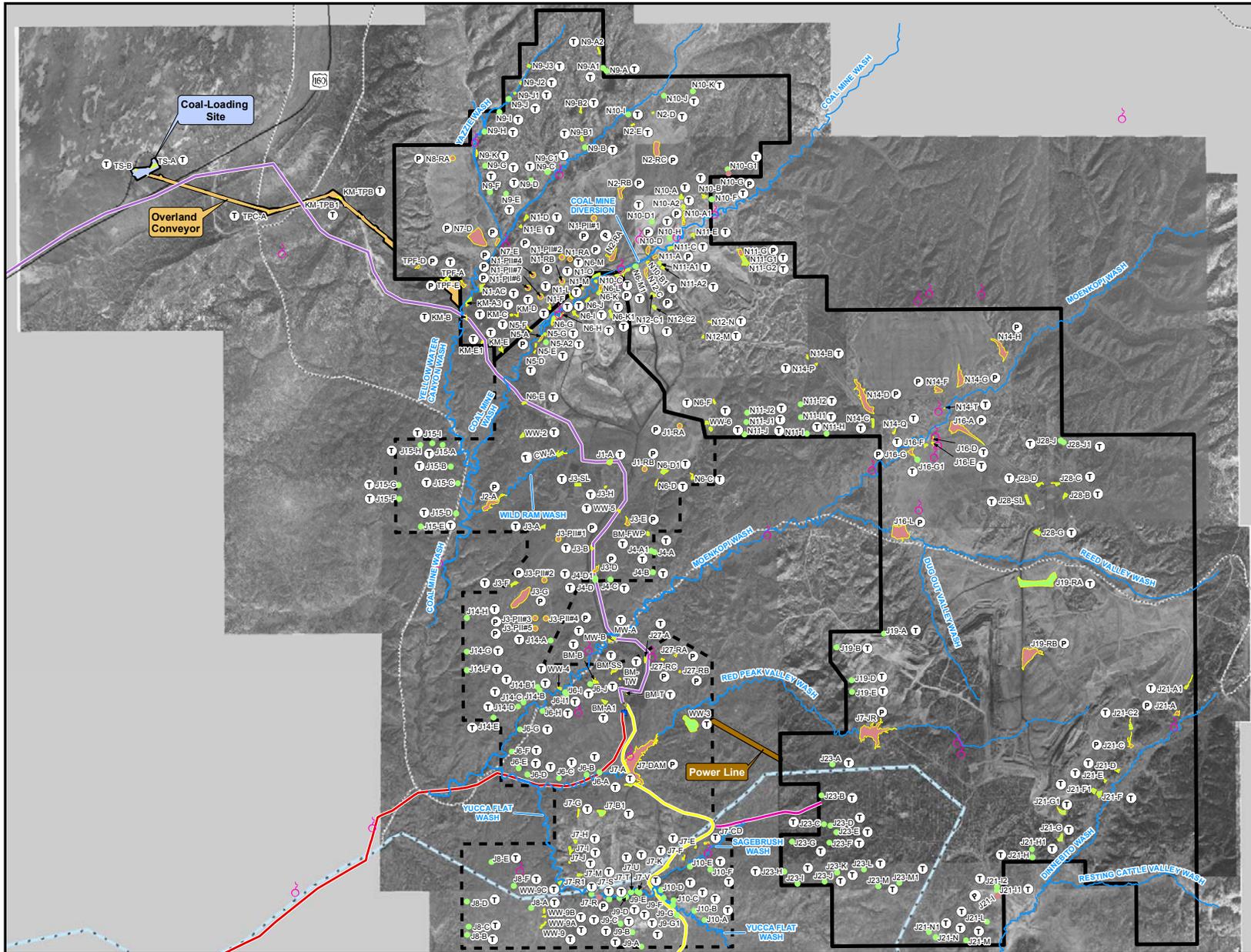
SOURCE: Peabody Western Coal Company 1986

NOTES: *Excludes chemical data for two samples that were influenced by magnesium chloride spills, upgradient of this monitoring site.

**Includes chemical data from sub-sites FLUM18 and CG18.

pH = acidity, TDS = total dissolved solids, Alk = alkalinity, SO₄ = sulfate, Ca = calcium, Mg = magnesium, Na = sodium, Cl = chloride.

Peabody's LOM application indicates 158 impoundments to exist in 2005 under SMCRA to control sediment transport from mined areas into the washes. A total of 51 impoundments are proposed to be permanent (left as part of the post-mining landscape). Location of these impoundments, along with other water features on the permit area, are shown on Map 3-7.



Map 3-7

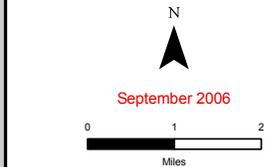
Temporary and Permanent Impoundments

Black Mesa Project EIS

LEGEND

- Black Mesa Complex**
- Kayenta Mining Operation Area, including Coal-Loading Site, Overland Conveyor, and Power Line (permanent permit area)
 - Black Mesa Mining Operation Area (currently unpermitted area)
- Coal-Slurry Pipeline**
- Existing Route
- (Existing route with realignment/reroute is the preferred alternative)
- Proposed Water-Supply Pipeline**
- Eastern Route (preferred alternative)
 - Western Route
 - Proposed Coal-Haul Road
- Impoundments**
- Existing Permanent Impoundment (P)
 - Existing Temporary Impoundment (T)
 - Proposed Permanent Impoundment (P)
 - Proposed Temporary Impoundment (T)
 - Stream
 - Spring
- General Features**
- Navajo Reservation Chapter Boundary
 - Hopi Reservation Boundary
 - Interstate/U.S. Highway/State Route

SOURCES:
 URS Corporation 2005, 2006
 Peabody Energy 2006
 DigitalGlobe Incorporated 2003



Prepared By:

Permanent internal impoundments on the mining operation areas also have been monitored for water quality (Table 3-2). Most, but not all, values fall within the draft livestock watering standards established by the USEPA, Hopi Tribe, and Navajo Nation. With the exception of Impoundment Site #N2-RA, the quality of water in these impoundments is similar in range to natural stormwater flow, with TDS, sulfate, calcium, magnesium, sodium, and chloride lower than natural drainages. Reclaimed areas have generated runoff that is similar in water-quality composition.

Table 3-2 Mean Concentrations of Chemical Parameters, Permanent Internal Impoundments by Site Number (Period of Record 1986-2002)

	116	124	118 ^a	N1-RA	122 ^a	123 ^a	112 ^a	113 ^a	119 ^a	N7-D	N2-RA	N2-RB	N2-RC	N8-RA
<i>pH</i>	8.2	7.8	8.6	9.5	8.0	7.5	7.8	7.9	7.9	8.1	8.5	8.1	8.6	8.0
<i>TDS</i>	459	205	144	424	143	177	281	603	165	939	11,944	566	227	133
<i>Alk</i>	84	100	105	145	96	102	109	205	116	74	301	113	97	56
<i>SO₄</i>	225	68	16	180	15	21	98	252	25	595	8,280	297	79	34
<i>Ca</i>	63	44	24	34	25	26	24	46	28	155	451	108	44	26
<i>Mg</i>	25	13	11	23	9	9	12	21	12	56	549	34	12	4
<i>Na</i>	29		5	69	4	7	44	117	9	41	2414	12	6	2
<i>Cl</i>	10		5	7	5	6	4	8	2	20	54	6	4	4

SOURCE: Peabody Western Coal Company 1986

NOTES: ^aPre-law area ponds.

pH = acidity, TDS = total dissolved solids, Alk = alkalinity, SO₄ = sulfate, Ca = calcium, Na = sodium, Cl = chlorine.

In compliance with NPDES Permit No. AZ0022179, Peabody conducts regularly scheduled inspections of impoundments to monitor and assess conditions including seepage from impoundments and potential effects on livestock drinking water. Several of the seeps found during the 2005 inspections downstream of impoundments with outfalls permitted under the NPDES permit (NPDES impoundments) have the potential to be accessed and used by livestock as a source of drinking water.

The Hopi Tribe and Navajo Nation have proposed, but have not formally adopted, water-quality standards for livestock. The Arizona Department of Environmental Quality (ADEQ) has established standards for agricultural livestock watering for the Little Colorado River below Lyman Lake, which is upstream of the Navajo Indian Reservation. Constituents for which livestock standards have been established include arsenic, cadmium, chromium, copper, lead, mercury, selenium, zinc, and pH. The National Academy of Sciences has recommended livestock standards for other constituents including aluminum, boron, fluoride, nitrate, nitrite, TDS, and vanadium.

Sediment structures are earthen embankments constructed by digging key-ways into the sides and bottoms of drainages, and building dams on top of the key-ways from earthen materials excavated locally using standard engineering and construction methods. At some locations, water impounded by the dams may persist in large enough amounts and durations to cause seepage through the bottom of the dam or through more permeable geologic formations near the embankment, eventually emanating downstream of the structure. Peabody terms these downstream emanations seeps. The seeps range from damp areas at the embankment toe to water flowing at low rates in the channel for limited distances below the structure. Most of the seeps are ephemeral, and those that do flow more persistently do so at rates no greater than several gallons per minute (gpm).

The water impounded by the dams usually carries low dissolved chemical loads, but commonly features high concentrations of suspended solids due to the natural process of sediment entrainment during rainfall runoff events. After the suspended solids settle out of the water impounded above the dam, seepage through the embankment or surrounding geology (e.g., thin coal seams) can react with constituents that

naturally occur in the materials used to build the embankments or the more permeable geologic formations in the vicinity. These reactions between water from the impoundment and surrounding materials can result in elevated concentrations of select water quality parameters such as pH, nitrate, aluminum, selenium, iron and other trace elements. On occasion, these parameters have exceeded water quality standards. However, the seepages and chemical reactions are not prevalent at the sediment-control structures built by Peabody.

Seeps below NPDES impoundments were identified as features of concern by the USEPA during the late 1980s and early 1990s. As a result, Peabody monitored the seeps, and conducted a comprehensive study during 1995. The study (Brogan-Johnson 1996) concluded that “The evaluation of major ion chemistry, deuterium and oxygen isotope data, relationships between water levels and seep discharges, and geology, indicate that the chemistries of the impoundments are variable, and the geochemical relationships between impoundments and their seeps are complex. All exceedences of the effluent limitations appear to be attributable to natural processes, and/or the geologic material within the study area. The chemistry of the seeps and natural springs in the Wepo Formation appear to be controlled by similar geochemical processes.” Nevertheless, the presence of the impoundments creates a source of water that feeds the seeps and, in some cases, results in discharges that exceed water quality standards for some parameters.

Based on the study results, Peabody developed a Seepage Management Plan to manage seeps below NPDES-permitted sediment control structures. The plan was approved by USEPA and subsequently incorporated in the Kayenta and Black Mesa Mine NPDES permit in March 1999, and remains an NPDES permit requirement today. Peabody routinely inspects select NPDES sediment ponds that have seeps, conducts monitoring at the seeps for flow and water quality at least annually and in some cases more frequently, and assesses the data with respect to livestock water-quality standards and potential impacts on the hydrologic balance. Peabody submits an annual Seepage Monitoring and Management Report to USEPA and other agencies (Hopi Tribe, Navajo Nation, and OSM) that incorporates seep inspection summaries, flow and water-quality data, assessments of the data with respect to livestock water quality standards and impacts on the hydrologic balance, and summaries of management activities that have been conducted during the year. To date, Peabody has submitted seven annual Seepage Monitoring and Management Reports.

Peabody samples seeps that have pooled or have sufficient flowing water to allow sampling on an annual basis. Water-quality parameters measured in the field in 2005 included electrical conductivity, pH, temperature, and salinity. A total of 41 water samples were collected from NPDES and non-NPDES seeps. Thirty-eight samples were analyzed for iron (total and dissolved), selenium (total and recoverable), and nitrogen (nitrate and nitrite), while three samples were further analyzed for the full suite of chemical parameters (Peabody 2006).

Analysis indicated that livestock drinking-water standards were exceeded in samples collected in 2005 from 6 of 28 seep-sampling sites (seeps BM-A1-S1, BM-A1-S2, N6-F-S1, J16-A-S1, J21-A1-S1, and J19-D-S1) (Table 3-3). These 6 sites are below 5 separate ponds. The measurements are similar to previous years, with the exception of the high total recoverable selenium value measured at a seep below one pond (seep below Pond J3-D). No results outside the acceptable range for livestock drinking water were measured at the remaining 22 sites that were sampled.

Table 3-3 Seep Water Samples not Meeting Livestock Drinking Water Standards

Seep Monitoring Site	Water-Quality Parameters	Livestock Drinking-Water Standards	Measured Values	Impacts on Livestock Drinking Water and Prevailing Hydrologic Balance
BM-A1-S1	Field pH	6.5-9.0 standard units (S.U.)	4.86 to 5.18 S.U.	<p>Measurements outside of pH range recommended for livestock, indicating seep water is unsuitable for livestock. Levels of elevated nitrate principally due to animal waste. Limited channel reach below Pond BM-A1 indicates this is not a significant source of drinking water for livestock.</p> <p>Proposed (pending USEPA approval) passive treatment system and rock placed along limited reaches to prevent livestock accessing seep water.</p> <p>Data collected from 1999 through 2004 indicate no detrimental impacts on the hydrologic balance have occurred down gradient in terms of increasing trends in nitrate or aluminum, or lowering of pH.</p>
	Nitrate	100.0 mg/L	64.9 to 85.6 mg/L	
	Total recoverable aluminum	5.0 mg/L	13.4 mg/L	
BM-A1-S2	Field pH	6.5-9.0 S.U.	3.42 to 4.25 S.U.	Measurements outside of pH range recommended for livestock, indicating seep water is unsuitable for livestock. Proposed (pending USEPA approval) passive treatment system and rock placed along limited reaches to prevent livestock accessing seep water.
N6-F-S1	Field pH	6.5-9.0 S.U.	3.89 TO 4.18 S.U.	Measurements outside of pH range recommended for livestock, indicating water is unsuitable for livestock. Additional fencing added in 2005 to prevent access by livestock.
J21-A1-S1	TDS	6,999 mg/L	8,610 mg/L	New seep, only sampled once. May be laboratory error, but likely to be near the standard.
N14-D-S1	Field pH	6.5-9.0 S.U.	3.60 S.U.	Seep unsuitable for livestock use. Fenced to prevent livestock access.
N14-P-S1	Field pH	6.5-9.0 S.U.	5.3 to 5.57 S.U.	New seep. Downstream impact small due to buffering by alkaline soils and concurrent snowmelt.
	Total recoverable aluminum	5 mg/L	5.42 mg/L	

SOURCE: Peabody Western Coal Company 2006

NOTES: pH = acidity or alkalinity of a solution, S.U. = standard units, mg/L = milligrams per liter, µg/l = micrograms per liter

Evaluation of water-quality data collected in 2005 indicates that impact of these seeps is localized. The pH of the water controls the solubility and transport of metals. Other than at the immediate area of the seeps, the pH of surrounding groundwater and surface water is alkaline. Most metals, dissolved in low-pH water, are rapidly lost to a solid (precipitation) as the seep water flows a short distance downgradient. Some of the values of the constituents of concern are already as high or higher in the natural system. In addition, seep flow rates and total chemical loads are relatively small in comparison to the flow rates and chemical loads typically measured in downgradient shallow groundwater (alluvial aquifer) and streamflow (Peabody 2004).

The results of the analyses of seeps on surface-water quality indicate that increases in chemical concentration would be minimal or immeasurable if seep water with high levels of nitrate, sulfate, TDS, selenium, or aluminum mixed directly with conservatively low rates of stormwater runoff in receiving streams. Thus, impacts of seeps on surface water are limited to the immediate areas of the seeps below the NPDES ponds. Information regarding the results of seep inspections and analyses conducted in 2005 are presented in the 2005 Seepage Monitoring and Management Report prepared by Peabody (2006).

3.4.1.2 Groundwater

Within Black Mesa, groundwater in the region can be found in the alluvium, Mesa Verde Group, D-aquifer system, N-aquifer system, and C-aquifer system. The alluvial and Mesa Verde Group aquifer systems are discussed below. The D-, N-, and C-aquifer systems are discussed in Section 3.4.3.

The alluvial-aquifer system represents alluvium (stream deposits) and colluvium (original rocks and debris) that occur as a substantial volume within and along principal washes in the study area. These washes include Dinnebito, Reed Valley, lower Coal Mine, and lower Moenkopi. The saturated portions of these washes range from 900 to 40,000 square feet in area (OSM 2006). Transmissivity values are reported to range from 21 gallons per day per foot (gpd/ft) to 5,100 gpd/ft (Peabody 2006). The alluvial aquifer is recharged from infiltration of surface-water runoff, and from the intersection of the alluvial channels with saturated portions of the Mesa Verde Group, including the Toreva and Wepo Formations (OSM 2004b).

Alluvial-aquifer water quality is highly variable and dependent upon the water quality and quantity of the contributing source. TDS range from 628 mg/L (Coal Mine Wash) to 62,000 mg/L (Moenkopi Wash). Nitrate is a concern in the alluvium, ranging up to 540 mg/L in some samples. Water quality in alluvial wells up-gradient of all mining activities (groundwater flow before reaching the mine area) has a median TDS ranging from 540 mg/L (Coal Mine Wash) to 4,276 mg/L (Dinnebito Wash). Sulfate concentrations in up-gradient background alluvial monitoring wells have a median concentration ranging from 220 mg/L (Coal Mine Wash) to 2,774 mg/L (Dinnebito Wash). Therefore, background alluvial water is marginally suitable for livestock watering based on Hopi Tribe and Navajo Nation proposed sulfate livestock watering limits of 1,000 mg/L. Of the 32 alluvial wells sampled in 2005, six wells potentially were suitable for livestock use (Peabody 2005).

The Mesa Verde Group yields small amounts of water to wells and springs on Black Mesa. This group is the source of water for springs located on the Hopi Reservation and is of local significance as a shallow source of water supply. The Mesa Verde Group includes the Wepo Formation that is mined for coal at the Black Mesa Complex. This Formation is separated from the underlying D aquifer by the relatively impermeable Mancos Shale.

Water levels in the Wepo aquifer range from zero to 212 feet below ground surface (bgs) across the permit area (Peabody 1986, revised 2004). The aquifer is confined in some areas and is not present continuously across the project area. Recharge occurs in the unconfined and exposed surface areas of broken and burned coal clinker material. The direction of groundwater flow is generally west to southwest across the Black Mesa Complex. Tests on wells drilled into the Wepo aquifer indicate transmissivity values of between 0.07 and 1,990 gpd/ft. Reported storage coefficients for the Wepo aquifer are between 1.9×10^{-5} and 1.45×10^{-4} , indicating confined or delayed yield conditions in the area of the test wells.

The LOM revision application evaluated the hydrogeology of water flow to the open pits from the Wepo aquifer. Aquifer testing indicated that some flow in the Wepo aquifers was confined and that coal beds acted as confining layers in some sequences. In general, however, groundwater modeling assumed that

the alluvial and Wepo aquifers were connected and upon excavation, groundwater flow would be in the direction of the face of the mine pits. Maximum inflow (Pit N-14) was estimated to be about 23 gpm. The computer predicted impact on Wepo aquifer water levels was as much as 65 feet. However, actual observation of both pit water inflow and water level change in Wepo wells suggests that groundwater modeling overestimates both these numbers (Peabody 1986, revised 2004).

To date, two Wepo windmill wells have been removed by mining and one additional windmill well will be removed in the future. Peabody has committed to replacing all three wells. Peabody has installed two water stands that provide free potable (N aquifer) water to the public on a 24-hour, 7-day basis.

Groundwater from the Wepo aquifer is highly variable in chemical quality. Water from sandstone units is generally calcium bicarbonate. Coal water is calcium/magnesium sulfate and water from shale units is sodium/potassium sulfate. Wepo-aquifer water from background wells located a significant distance from the area disturbed by mining indicates median sulfate concentrations may be as high as 1,100 mg/L. Therefore, Wepo aquifer water is marginally suitable for livestock watering based on Hopi Tribe and Navajo Nation proposed surface-water-quality standards for livestock (sulfate limit of 1,000 mg/L).

3.4.2 Coal-Slurry Pipeline

3.4.2.1 Surface Water

A number of watercourses are traversed by the existing coal-slurry pipeline. The pipeline crosses the following:

- Coal Mine Wash
- Moenkopi Wash
- Black Mesa Wash
- Little Colorado River
- Cedar Wash
- Miller Wash
- Spring Valley Wash
- Red Lake Wash
- Cataract Creek
- Martin Dam Draw
- Big Chino Wash
- Muddy Creek
- Knight Creek
- Tuckayou Wash
- Sacramento Wash
- Colorado River

In addition to these larger named washes and water bodies, the existing pipeline route crosses many smaller, unnamed washes. Of these watercourses, only the Colorado River is perennial; the rest are intermittent or, most commonly, ephemeral (flowing in direct response to precipitation). None are unique waters, as defined by ADEQ. The Colorado River is one of the most regulated streams in the West. Where the existing coal-slurry pipeline crosses the Colorado River, the river's flow is controlled by Davis Dam. The rest of these washes or streams are largely unregulated.

The major, nonperennial streams include Moenkopi Wash, Little Colorado River, Cataract Creek, Big Chino Wash, and Sacramento Wash. Median annual peak surface-water flows recorded at USGS stream gauging stations vary widely and are reflective of local rainfall, the period of record for the stream gauging station, and how much of the watershed is upstream of the location. From these data, it is likely that Moenkopi Wash, the Little Colorado River, and Sacramento Wash would provide the largest potential flood flows.

Beneficial uses of the streams not on tribal land have been designated only for Cataract Creek, Sacramento Wash, and the Little Colorado River (Table 3-4). The remaining nontribal streams are all designated for aquatic-and-wildlife ecological and partial body contact recreational uses. On the Navajo Reservation, surface-water quality is the responsibility of the Navajo Nation EPA and USEPA. On the

Navajo Reservation, Begashibito Wash and the Little Colorado River are designated for Secondary Human Contact, Ephemeral Warm Water Habitat and Livestock and Wildlife Watering. Moenkopi Wash has the same designations plus Agricultural Water Supply (Navajo Nation 1999).

Table 3-4 State-Designated Use, as declared by AZ Rule R18-11, Appendix B

Listed Streams							
Stream	Stream Segment	State Designated Uses					
Cataract Creek	Below 1 km downstream of Williams WWTP outfall to confluence of Red Lake Wash	A&Wc	FBC	FC			AgL
Sacramento Wash	Tributary to Topock Marsh at 34°43'48"/114°29'13"	A&We	PBC				
Little Colorado River	Below confluence with Puerco River	A&Ww	FBC	DWS	FC	AgL	
Colorado River	Lake Powell to Topock	A&Wc	FBC	DWS	FC	AgI	AgL
Tributary Rule Streams							
Stream	Basis of Use	State Designated Use					
Miller Wash	Ephemeral Tributary to Cataract Creek	A&We	PBC				
Spring Valley Wash	Ephemeral Tributary to Cataract Creek	A&We	PBC				
Red Lake Wash	Ephemeral Tributary to Cataract Creek	A&We	PBC				
Martin Dam Draw	Ephemeral Tributary to Partridge Creek	A&We	PBC				
Big Chino Wash	Ephemeral Tributary to the Verde River	A&We	PBC				
Muddy Creek	Ephemeral Tributary to Big Chino Wash	A&We	PBC				
Tuckayou Wash	Ephemeral Tributary to Knight Creek	A&We	PBC				
Knight Creek	Ephemeral Tributary to the Big Sandy River	A&We	PBC				

SOURCE: Arizona Department of Environmental Quality 2003a

NOTES: Use abbreviations: A&Wc = aquatic and wildlife (cold water), A&We = aquatic and wildlife (ephemeral), AgI = agricultural irrigation, AgL = agricultural livestock watering, DWS = domestic water source, FBC = full-body contact, FC = fish consumption, km = kilometer, PBC = partial-body contact, WWTP = waste-water treatment plant.

In the hydrologic environment, there is very little difference between the eastern route and the western route. The routes are both entirely within the Little Colorado River watershed. The eastern route would cross Dinnebito Wash, Oraibi Wash, Little Colorado River, and Yucca Flat Wash. In addition to these larger washes, many smaller unnamed washes that also may qualify as waters of the U.S. may be involved. All of these stream courses are intermittent or ephemeral. None supply a reliable source of drinking or irrigation water.

The western route would avoid the integrated channels of Oraibi and Dinnebito Washes but would cross Moenkopi Wash near Blue Canyon. This reach of Moenkopi Wash has a number of springs and seeps that are fed by the N aquifer. The western route also would follow the washes of Kletha Valley, which are not encountered by the eastern route.

3.4.2.2 Groundwater

Map 3-6 shows the pipeline route and major groundwater aquifers. In the western portions of the route (west of Cameron) the pipeline crosses primarily alluvial aquifers of the Basin and Range province. These aquifers are comprised of unconsolidated and semi-consolidated clay, silt, sand and gravel. Groundwater depths range from a few feet to several hundred feet bgs. In most areas, however, the water table is below the excavation depth of the pipeline trench. East of Cameron the coal-slurry pipeline crosses the outcrops of the N aquifer, D aquifer, and Wepo and alluvial aquifers. These aquifers are described in other sections of this chapter.

3.4.3 Project Water Supply

3.4.3.1 C Aquifer Water-Supply System

3.4.3.1.1 *Surface Water*

As discussed previously, with the exception of the Colorado River most streams in the study area are intermittent or ephemeral. There are, however, portions of some drainages that are perennial. These reaches exist where groundwater discharges to the stream channel. These stream reaches may be affected by groundwater pumping from the C aquifer. The two streams of most concern for possible impacts due to pumping at the C aquifer well field are lower Clear and Chevelon Creeks. Location of the proposed C-aquifer well field, Clear Creek, Chevelon Creek, and other C-aquifer features are shown on Map 3-5.

The Clear Creek watershed (sub-watershed of the Little Colorado River watershed) drains approximately 600 square miles above (south of) the City of Winslow before the confluence with the Little Colorado River. Clear Creek is composed of both perennial reaches, fed by baseflow, and ephemeral sections, supplied by flood-flow periods during snowmelt and runoff events. ADWR estimated an average depleted flow (streamflow after diversions and evaporation) of 61,860 af/yr for Clear Creek (ADWR 1994).

The headwaters of Clear Creek are on the Mogollon Rim, at about 7,500 feet above MSL (refer to Map 3-5). The stream flows 25 miles in a generally northeasterly direction to its junction with the Little Colorado River at about 4,900 feet above MSL. Blue Ridge Reservoir, located on one of the Clear Creek headwater tributaries, has a storage capacity of 19,500 acre-feet. About 0.5 mile south of the confluence with the Little Colorado River, Clear Creek is impounded to form McHood Reservoir. McHood Reservoir currently stores between 200 and 500 acre-feet.

June is traditionally the period of lowest rainfall and surface flow runoff in the region. It would be the monthly average most indicative of base flow conditions and flow minima. There are two USGS stream gauging stations in the Clear Creek watershed: USGS station 09398500 below Willow Creek with a period of record from 1947 to 1991, and farther downstream, USGS station 09399000 near Winslow, with a period of record from 1906 to 1982. These data, while not necessarily reflective of current conditions, show the climate variations that include high streamflow pulses early in the calendar year followed by a summer dry period and increase over the monsoonal months of August and September. Fall/winter frontal storms also are reflected in the streamflow data. As of the summer of 2005, the Winslow station was re-activated and now serves as a real-time stream gauge.

A field investigation was conducted between June 30 and July 5, 2005, and consisted of visual inspection of the perennial reaches of lower Chevelon and lower Clear Creeks, along with measurement of flow, salinity (specific conductance), and retrieval of water samples for laboratory analysis. The work was performed by staff from the USGS, Arizona Water Science Center, in Flagstaff, Arizona.

Perennial flow in Clear Creek begins about 10 miles upstream from the Little Colorado River. Flow in Clear Creek was about 2.5 cfs 0.5 mile above McHood Reservoir (approximately 2 miles upstream from the confluence with the Little Colorado River). At the entrance to the reservoir the flow increased to 3.2 cfs. Seeps from the Coconino Sandstone were observed in the canyon walls at the reservoir. Immediately below the dam, the creek bed was dry. However, springs began appearing directly below this section of the creek. Flow increased to about 5.4 cfs over this interval. Flow in the Little Colorado River above Clear Creek was about 0.06 cfs and increased to 3.2 cfs below where Clear Creek and the Little Colorado River join.

Chevelon Creek is located to the southeast of Clear Creek and is broadly similar in surface-water hydrology (refer to Map 3-5). The Chevelon Creek watershed drains approximately 800 square miles south of the City of Winslow and empties into the Little Colorado River. Chevelon Creek is characterized by streamflow patterns similar to Clear Creek, with distinct perennial reaches sustained by springs and seeps. ADWR estimated an average depleted (after all diversions) flow of 40,680 af/yr (ADWR 1994).

Streamflow patterns in Chevelon Creek are similar to those in Clear Creek. There are two USGS stream gauging stations: USGS station 09397500 below Wildcat Canyon, with a period of record from 1947 to present, and station 09398000 near Winslow, with a period of record from 1906 to 1972. The period of record is the time period that daily values of approved, quality-assured data were collected. Seasonality of runoff is similar to that of Clear Creek, although of slightly higher discharge on Chevelon Creek. June median flows from the periods of record on Chevelon Creek are 0.063 cfs at Wildcat Canyon and 5.02 cfs at Winslow.

Perennial flow in Chevelon Creek starts about 12 miles upstream from its confluence with the Little Colorado River. During the field investigation, observed flow in Chevelon Creek ranged from 0.36 to 0.50 cfs in the reaches above Chevelon Reservoir (about 5 miles above the confluence with the Little Colorado River). Seeps from the Coconino Sandstone were observed in this same section. Along the shores of the reservoir a spring discharges about 0.1 cfs. Flow over the Chevelon Reservoir dam was 2.2 cfs, which increased to 2.7 cfs downstream of the dam. One-half mile upstream of the confluence with the Little Colorado River, the flow measured 2.6 cfs, and at the confluence, 1.6 cfs. Thus, it appears that the stream was gaining at the reservoir and immediately downstream began losing to the streambed and evaporation.

The USGS has taken several samples for standard water-quality analysis on both Chevelon and Clear Creeks. These data indicate generally good quality water with low values for typical problem constituents in southwestern streams (i.e., boron, fluoride, nitrate, pH, etc.). TDS range from about 500 to 3,600 mg/L.

The C aquifer underlies most of the eastern half of northern Arizona and includes an area of approximately 27,000 square miles (refer to Map 3-6). Most recharge to the C aquifer occurs along the Mogollon Rim and in the San Francisco Peaks where precipitation is high. Additionally, recharge occurs on the slopes of the Defiance Uplift (near Ganado) where precipitation also is elevated. C-aquifer recharge is estimated to be 319,000 af/yr. Of this amount, 173,280 af/yr flow north into the study area. Most of this water (164,000 af/yr) eventually discharges at Blue Springs in the Little Colorado River gorge. Recharge that does not flow north into the Little Colorado River basin flows south into the Verde and Salt River basins (Hart et al. 2002). The total volume of groundwater in storage in the C aquifer within the Little Colorado River Watershed has been estimated at 413 million acre-feet (ADWR 1989). Groundwater usage in the Little Colorado River basin portion of the C aquifer in 2000 is estimated at about 100,000 af/yr (Reclamation 2005)

Approximately 1,500 square miles of the C aquifer along the western edge of the Navajo Reservation is considered to be dry (water level is below the bottom of the Coconino Sandstone). In this area, groundwater is thought to move downward through faults and fractures in the Supai Formation into the limestone of the R aquifer (Hart et al. 2002). Over much of the rest of the study area, the C aquifer generally is separated from the underlying R aquifer by the low-permeability units of the middle and lower Supai Formation. The saturated thickness of the C aquifer varies from 0 to more than 900 feet and averages 400 feet within the watershed.

The C aquifer is unconfined south of the Little Colorado River (refer to Map 3-5). North of the river, beneath the Hopi and Navajo Reservations, the aquifer generally is confined by the overlying Moenkopi and Chinle Formations (Leake et al. 2005).

For Reclamation, USGS drilled three test wells and six observations wells at three sites within the proposed well field for the project water supply. Location of the test wells and other wells in the area of the well field are shown on Map 3-8. Depths of the test wells range from 1,096 to 1,134 feet. These wells were pumped and tested to investigate lithologic, structural, and water-quality conditions and to estimate aquifer parameters. The results of these tests are presented in Table 3-5 and Table 3-6.

Table 3-5 Aquifer Parameters for C Aquifer Well Field

Parameter	Site 1	Site 2	Site 3
Specific capacity (gpm/ft)	2.0	7.5	2.4
Transmissivity (gpd/ft)	52,400	134,700	40,400
Hydraulic Conductivity (ft/day) – Coconino (Ss)	28	42	11
Hydraulic Conductivity (ft/day) – Schnebly Hill Formation	NA	0.5	0.2
Hydraulic Conductivity (ft/day) – Upper Supai Formation	0.1	NA	0.2
Effective hydraulic conductivity ¹ (ft/day)	14	24	6
Specific yield (dimensionless)	0.06	0.08	0.05
Specific storage (1/ft)	2 x10 ⁻⁶	2 x10 ⁻⁶	2 x10 ⁻⁶
Vertical anisotropy (dimensionless)	0.5	0.2	0.2

SOURCE: U.S. Bureau of Reclamation 2005

NOTE: ¹Weighted hydraulic conductivity of the entire aquifer thickness.
ft/day = feet per day

Table 3-6 Test Well Selected Inorganic Water Quality Parameters, in mg/L except As (Arsenic µg/L)

Site	Well Number	TDS	Na	Ca	Mg	NO ₃	SO ₄	Cl	F	As	Formation	Depth Interval (feet)
1	PW-1A	837	54.9	121	567	0.4	383	64.7	0.2	0.3	C/S-H	837-1077
	OW-1	838	58.2	121	58.4	0.4	386	65.2	0.2	0.4	C/S-H	686-1086
2	PW-2B	592	27.6	96.1	41.7	0.3	257	20.9	0.3	0.7	C	577-715
											C/S-H	715-977
	OW-2B	594	27.6	99.2	43.1	0.2	255	21.7	0.3	0.2	C	698-740
											C/S-H	740-998
3	PW-3	770	85.1	100	52.1	0.2	253	121	0.8	0.7	C	696-740
											S-H	740-1000
	OW-3C	773	80.1	107	50.7	0.2	253	129	0.2	1.0	C	1000-1076
											Supai	1150-1170
	05T-320	606	26.1	107	45.5	0.2	265	21.7	0.2	0.5	-	-

SOURCE: U.S. Bureau of Reclamation 2005

NOTES: As = arsenic, Ca = calcium, Cl = chlorine, F = fluoride, Mg = magnesium, Na = sodium, NO₃ = nitrate, SO₄ = sulfate, TDS = total dissolved solids, C = Coconino Sandstone, S-H = Schnebly Hill Formation.

There are 166 known wells located within 10 miles of the proposed C-aquifer well field. Average well depth is 669 feet bgs and average depth to water is 310 feet bgs. Well yields in the vicinity of the proposed well field are reported to be between 5 and 1,700 gpm. Most of the wells in the area are small-diameter stock wells and are not designed to produce large volumes of water. Five wells produce more than 200 gpm; these are larger-diameter irrigation wells and indicate that properly designed wells can produce significant volumes of water. Reclamation pumped the test wells between 450 and 795 gpm. The

ability to install moderate to large capacity wells in the C aquifer is further supported by reported well yields at large industrial facilities that use C-aquifer water. The closest of these facilities is the APS Cholla Power Plant, located approximately 30 miles to the east (Figure 3-3). This facility has been in operation since the late 1960s and has 21 production wells in the C aquifer. The average pumping rate of these wells is 500 gpm (HDR 2003).

Water quality in the C aquifer is generally good south of the Little Colorado River, but degrades north of the river. South of the Little Colorado River, TDS are generally less than 500 mg/L. North of the river the TDS content ranges from 3,000 to greater than 10,000 mg/L (ADWR 1989).

Selected inorganic water-quality parameters for the C aquifer well-field test wells are given in Table 3-6. The water is moderately hard and has a pH of about 7.6. TDS range from 592 to 838 mg/L, which is above the secondary, nonmandatory drinking water standard of 500 mg/L. Nitrate, arsenic, and fluoride are well below the drinking-water standards for these parameters; however, sulfate is slightly above the secondary, nonmandatory drinking water limit of 250 mg/L.

3.4.3.1.2 Infrastructure

3.4.3.1.2.1 Well Field

The three test well sites are individually located 10 miles south of Leupp, 8 miles southwest of Leupp, and 10 miles southwest of Leupp, as shown on Map 3-8. The proposed well field area is within the 1,200-square-mile watershed of Canyon Diablo. Canyon Diablo is an ephemeral stream with few uses or sources of potential pollution.

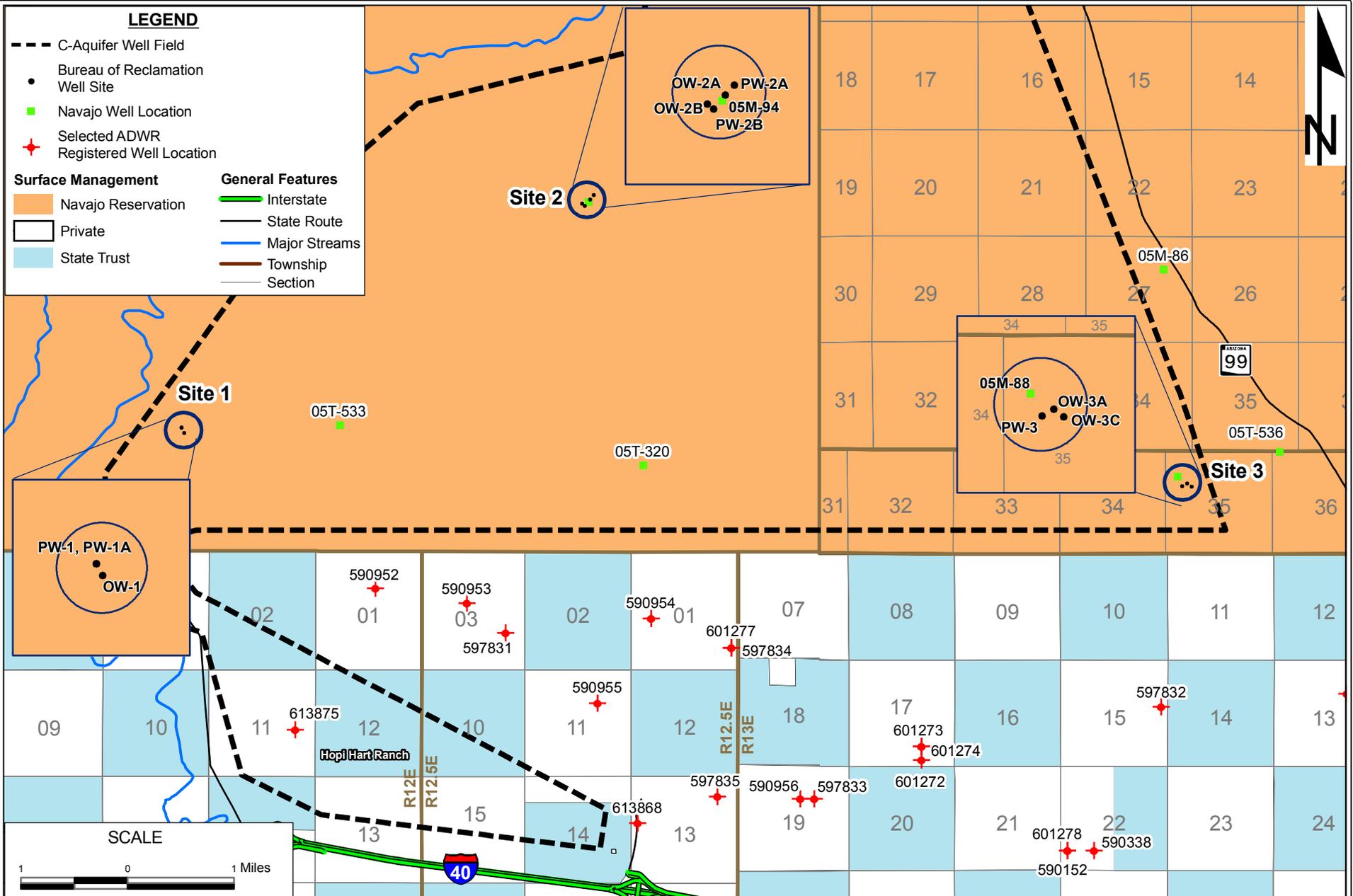
The test wells and proposed well field are underlain entirely by the C aquifer. Depths of the test wells range from 1,096 to 1,134 feet bgs. Depth to water ranges from 226 to 615 feet bgs. The proposed well field is estimated to have up to 12 production wells drilled to approximately 1,100 feet bgs. Well spacing would be approximately 1 mile.

3.4.3.1.2.2 C Aquifer Water-Supply Pipeline Routes

In the hydrologic environment, there are some differences between the eastern route and the western water-supply pipeline routes. The routes are both entirely within the Little Colorado River watershed. The eastern route would cross Dinnebito Wash, Oraibi Wash, Little Colorado River, and Yucca Flat Wash. In addition to these larger washes, many smaller unnamed washes that also may qualify as waters of the U.S. may be involved. All of these stream courses are intermittent or ephemeral. None supply a reliable source of drinking or irrigation water.

The western route would avoid the integrated channels of Oraibi and Dinnebito Washes but would cross Moenkopi Wash near Blue Canyon. This reach of Moenkopi Wash has a number of springs and seeps that are fed by the N aquifer. The western route also would follow the washes of Kletha Valley, which are not encountered by the eastern route.

Because the pipeline would be constructed near land surface, construction and operation would not affect existing groundwater in the D, N, or C aquifers. On the leasehold, the pipeline would cross the Wepo and alluvial aquifers.



SOURCES:
 Arizona Department of Water Resources 2005
 Navajo Nation Department of Water Resources 2005
 Bureau of Reclamation 2006

Map 3-8 C-Aquifer Test Wells and Other Nearby Wells

3.4.3.1.3 Water Withdrawal

Current groundwater use in the C aquifer is estimated to be on the order 100,000 af/yr. Of this about 60,000 af/yr are pumped by the four major industrial users in the study area, 16,000 af/yr are pumped by irrigators, and the remaining 24,000 af/yr are pumped mostly by municipalities (Reclamation 2005).

Most communities in the eastern portion of the study area use the C aquifer for both municipal and irrigation uses. Communities within the area of the proposed C-aquifer well field include Leupp-Dilkon and Cameron on the Navajo Reservation, and Joseph City, Holbrook, and Winslow off the reservation. Three large regional power plants use water from the C aquifer; however, only one (Cholla, operated by APS) is located near the well field area. In addition, the Abitibi Consolidated Paper Mill near Snowflake, Cholla Ready Mix in Holbrook, and several agricultural users all extract groundwater from the C aquifer within the study area. Estimated 2010 groundwater use for these entities is given Table 3-7 (Reclamation 2005). Location of these users are shown on Figure 3-3.

Table 3-7 Estimated 2010 Groundwater Uses

User	Annual Use (af/yr)
Leupp-Dilkon	456
Cameron	25
Holbrook	948
Winslow	2,195
Holbrook Agriculture	1,500
Joseph City Agriculture	1,600
Winslow Agriculture	300
Cholla Power Plant	15,000
Cholla Ready Mix	100
Abitibi Paper Mill	18,000

SOURCE: S.S. Papadopulos and Associates 2005

While the C aquifer is experiencing water-level declines in areas of intensive development, the USGS concluded that “the cones of depression have not reached the boundaries of the aquifer or caused a decline in springs or base flow along the periphery of the C aquifer” (Hart et al. 2002).

3.4.3.2 N and D Aquifer Water-Supply System

The N aquifer includes the Navajo Sandstone, sandstones of the Kayenta Formation, and the Lukachukai member of the Wingate Formation. The N aquifer comprises 4 million acres within the Little Colorado River system. The aquifer is composed of fine-grained sandstone alternating with siltstone and ranges in thickness from a few feet to 1,300 feet thick (Farrar 1979). The average thickness of the aquifer is approximately 400 feet (Eychaner 1983), and the storage coefficient is estimated to average 0.10, with a range of 0.00022 to 0.008 for the confined areas and 0.10 to 0.15 for the unconfined areas. The total water in storage has been estimated at 166 million acre-feet for this aquifer (Eychaner 1983). Transmissivity values range from 560 to 2,600 gpd/ft (Peabody 2004).

Recharge to this system generally occurs in the north-central part of the aquifer, north and west of Kayenta, where aquifer units are exposed at the land surface and precipitation is relatively high. Some N-aquifer groundwater flows to the northeast, where it discharges into Laguna Creek, to the northwest where it discharges into Navajo Creek, and to the southwest where it discharges into Moenkopi Wash. All three of these streams have perennial reaches of varying lengths supported by discharge from the N aquifer. The N aquifer also discharges to springs along the aquifer boundary (ADWR 1989) (refer to

Map 3-4). These perennial stream reaches and springs may potentially be affected by groundwater pumping from the N aquifer. Areas of groundwater discharge that have been modeled to assess potential impacts due to pumping include:

- Chinle Wash
- Laguna Creek
- Pasture Canyon
- Moenkopi Wash
- Dinnebito Wash
- Oraibi Wash
- Polacca Wash
- Jaidito Wash
- Begashibito Wash/Cow Springs

There is little or no downward leakage of groundwater from the N aquifer into the underlying C aquifer because they are separated by approximately 1,000 feet of the relatively impermeable Chinle and Moenkopi Formations (ADWR 1989).

Groundwater from the N aquifer is considered to be of good to excellent quality and is suitable for most uses. Generally the groundwater contains less than 500 mg/L of TDS and rarely exceeds 1,000 mg/L. Fluoride concentrations are generally less than the recommended average concentration for drinking water.

The USGS has been monitoring N-aquifer water levels since 1981 and currently uses a groundwater-monitoring network of 34 wells to track annual water-level changes. Specifically, six non-pumping observation wells, identified as BM1 through BM6, are used to evaluate the regional hydrologic condition of the N aquifer. BM1 through BM6 have been monitored since the 1970s and are currently equipped with continuous recording devices, collecting a water-level measurement every 15 minutes. BM6 has the largest measured regional drawdown compared to prepumping conditions in 1965. In BM-6 the depth to groundwater had increased 155 feet by 2004 (USGS 1985-2005). The USGS groundwater monitoring also indicates that although drawdown has occurred in the N aquifer, measured water levels have not dropped below the top of the N aquifer within the confined basin. Since the aquifer remains confined, groundwater in wells has continued to be above the top of the aquifer. Therefore, the saturated thickness (thickness of aquifer containing groundwater) of the confined N aquifer is unchanged at the monitored locations.

The potential for induced leakage from the D aquifer due to groundwater pumping in the N aquifer is less in the area where the N aquifer is confined by the Carmel Formation than in areas where the Carmel Formation is thin or sandy (refer to Figure 3-2). The thickness and lithology of the Carmel Formation are factors influencing groundwater leakage between the aquifers. Areas where the Carmel Formation is less than 120 feet thick coincide with areas where water from the overlying D aquifer has historically (over thousands of years) mixed with underlying N-aquifer water (Truini 2005).

The D aquifer includes the Dakota Sandstone, the water-bearing portions of the Morrison Formation, and the Cow Springs Sandstone (refer to Figure 3-1). The D aquifer is overlain by the Mancos Shale and is confined over most of the area (ADWR 1989).

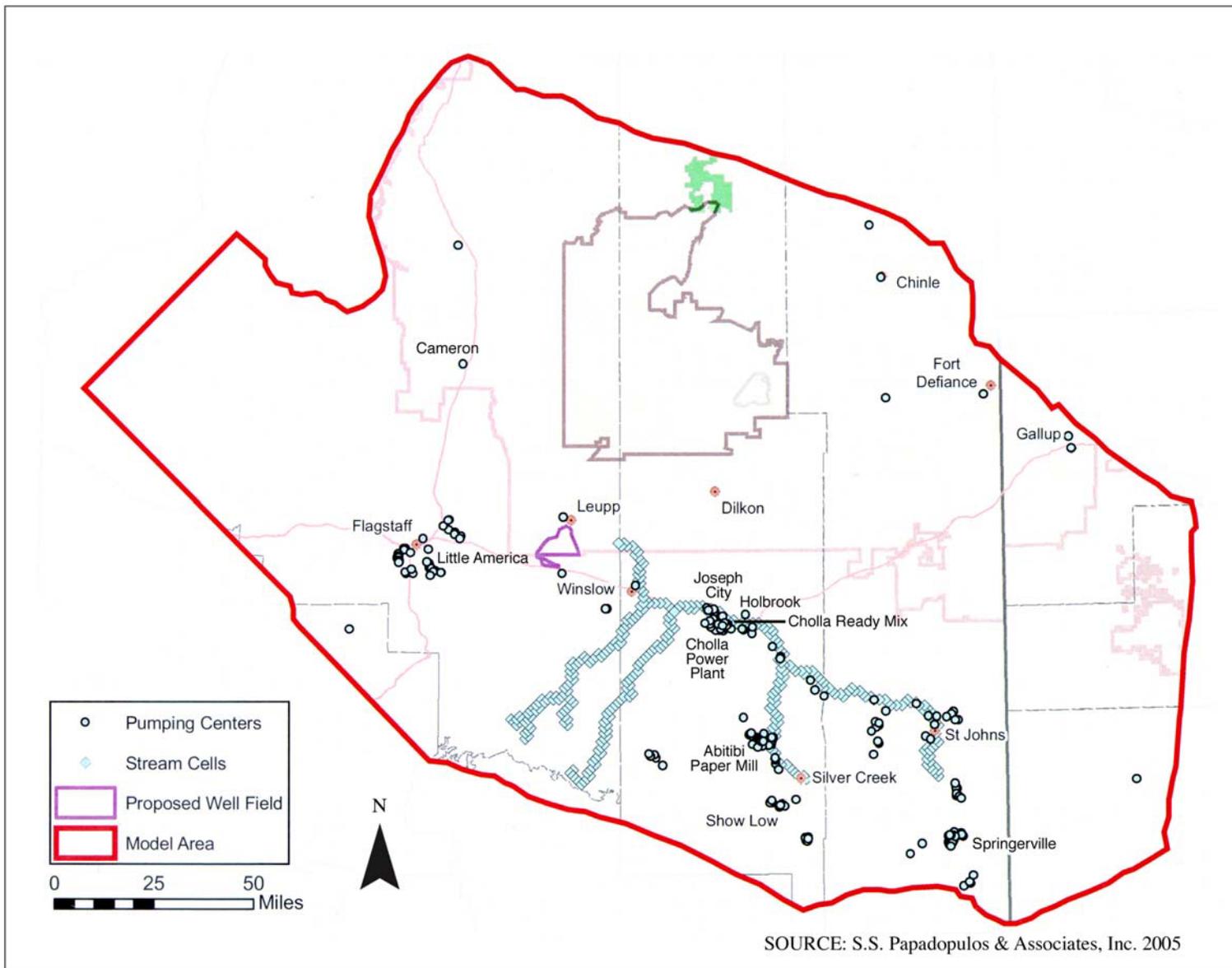


Figure 3-3 Historic and Proposed C Aquifer Pumping Centers

Recharge generally occurs from precipitation along the eastern boundary of the D aquifer. Groundwater flows south, west, and north and discharges into springs on the eastern and northern edges of the aquifer and into the alluvium of Polacca, Oraibi, and Dinnebito Washes along the southwest aquifer boundary, and Moenkopi Wash to the west. This discharge is consumed by plants or lost to evaporation and is not seen as surface flow.

The estimated saturated thickness of the D aquifer is roughly 500 feet; however, this also may include some unsaturated units within the Dakota and Morrison Formations. The storage coefficient was estimated to be 0.015 based upon core samples adjusted to compensate for the nonwater-bearing units included in the thickness (Cooley 1969). The total amount of water in storage is estimated to be 15 million acre-feet (ADWR 1989).

Groundwater quality in the D aquifer is marginal to unsuitable for domestic use, although it may be acceptable for other uses. TDS concentrations range from 190 to 4,410 mg/L, generally exceeding the recommended limit of 500 mg/L for drinking water. Fluoride concentrations range from 0.2 to 9.0 mg/L and often exceed the maximum contaminated levels concentration of 4 mg/L. Water quality improves slightly in the southern portion of the aquifer (ADWR 1989).

3.4.3.2.1 Infrastructure

3.4.3.2.1.1 Peabody Well Field

The N aquifer currently supplies the water for the mining operations at the Black Mesa Complex. The Peabody well field consists of eight wells used for mining operations and the coal-slurry pipeline which currently is not in operation. Wells are located on the leasehold (refer to Map 3-4) and range in depth from 3,417 feet bgs to 3,733 feet bgs. Static (nonpumping) water levels in 2005 ranged from 945 to 1,374 ft bgs.

3.4.3.2.1.2 Community Well Fields

The BIA, Navajo Tribal Utility Authority (NTUA), and Hopi Tribe operate about 70 N-aquifer wells that are combined into 28 well systems to supply several communities on Black Mesa. Closest communities to the Peabody well field are Forest Lake, Kitsillie, Chilchinbito, and Kayenta. Largest water users are Tuba City, Kayenta, and Shonto (Truini 2005). Well depths range from 475 feet bgs (Tuba City) in the unconfined area to 2,600 feet bgs (Forest Lakes and Kitsillie) in the confined area. Depth to water in 2004 was between 30 feet bgs (Tuba City) and 1,316 feet bgs (Kitsillie) (USGS 1985-2005).

3.4.3.2.2 Water Withdrawal

The N aquifer currently supplies the majority of the water for the mining operations at the Black Mesa Complex. It also is used extensively by the Hopi and Navajo tribes as a public drinking supply. Total withdrawals from the N aquifer increased from about 70 to 8,000 af/yr from 1965 to 2002, with the major increase due to industrial use by the eight wells used for mining operations and the coal-slurry pipeline, which currently is not in operation. About 270 windmills produce N-aquifer water, primarily for stock watering. In total these windmill wells produce about 65 af/yr. In 2003, 5,800 acre-feet were withdrawn from the confined N aquifer, of which 4,450 acre-feet were attributed to operations at the Black Mesa Complex (USGS 1985-2005). The remainder is community water use.

Groundwater pumpage has occurred historically in the D aquifer. While approximately 124 D-aquifer wells are located within the study area and provide a reliable source of water to local residents, most of the pumping is outside of the study area. Until the Black Mesa mining operation shut down in late 2005, Peabody withdrew approximately 130 af/yr of groundwater from this aquifer through its production wells

that are screened in both the N aquifer and D aquifer. Community pumping of the confined D aquifer accounts for an annual withdrawal of approximately 100 af/yr.

3.5 CLIMATE

3.5.1 Region

The study area lies within two separate climatic regions—the eastern region and the western region. The eastern region includes the plateau and mountainous areas that are predominant from the Grand Canyon National Park and Sycamore Canyon eastward. The western region includes the valley and low mountainous regions located in portions of northwestern Arizona, southern Nevada (Clark County), and eastern California (San Bernardino County) (Map 3-9). Meteorological conditions recorded at sites within the eastern and western regions of the study area are summarized in Table 3-8.

Table 3-8 Meteorological Conditions of the Study Area

Monitor	Winter Average	Spring Average	Summer Average	Fall Average	Annual Average
Eastern Region					
Mean Monthly Temperature Average (°F)^a					
Betakin	31.5	47.5	69.6	51.3	50.0
Tuba City	35.3	54.4	75.0	55.9	55.1
Winslow Airport	35.4	53.9	75.1	56.0	55.1
Flagstaff	30.3	43.1	63.2	47.1	45.9
Mean Monthly Precipitation Average (inches)^a					
Betakin	3.08	2.19	3.32	3.32	11.91
Tuba City	1.50	1.20	1.83	2.02	6.54
Winslow Airport	1.55	1.19	3.00	2.09	7.84
Flagstaff	6.13	4.20	5.85	5.32	21.50
Mean Monthly Snowfall Average (inches)^a					
Betakin	31.5	12.4	0.0	7.7	51.6
Tuba City	4.2	0.8	0.0	1.5	6.5
Winslow Airport	8.0	2.2	0.0	1.2	11.4
Flagstaff	54.1	33.6	0.0	12.6	100.3
Average Wind Speed (miles per hour)^b					
Winslow Airport	6.7	9.5	8.6	6.7	7.9
Flagstaff	6.1	7.0	5.6	5.2	6.0
Western Region					
Mean Monthly Temperature Average (°F)^c					
Bullhead City	55.7	72.6	93.5	74.8	74.2
Yucca	49.9	64.7	86.7	68.7	67.5
Mean Monthly Precipitation Average (inches)^c					
Bullhead City	2.70	1.22	1.07	1.29	6.29
Yucca	2.64	1.52	1.73	1.76	7.66
Average Wind Speed (miles per hour)^b					
Kingman Airport	7.8	10.2	10.6	8.1	9.2

SOURCES: Western Regional Climate Center 2005a, 2005b

NOTES: ^aFor mean monthly temperature, mean monthly precipitation, and mean monthly snowfall, the period used for Betakin is 1948-2005, for Tuba City it is 1900-2005, for the Winslow Airport it is 1898-2005, and for Flagstaff it is 1950-2005.

^bFor average wind speed values, averages are based on data collected between 1992 and 2002.

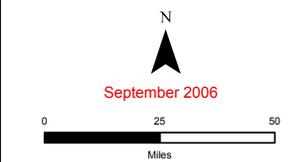
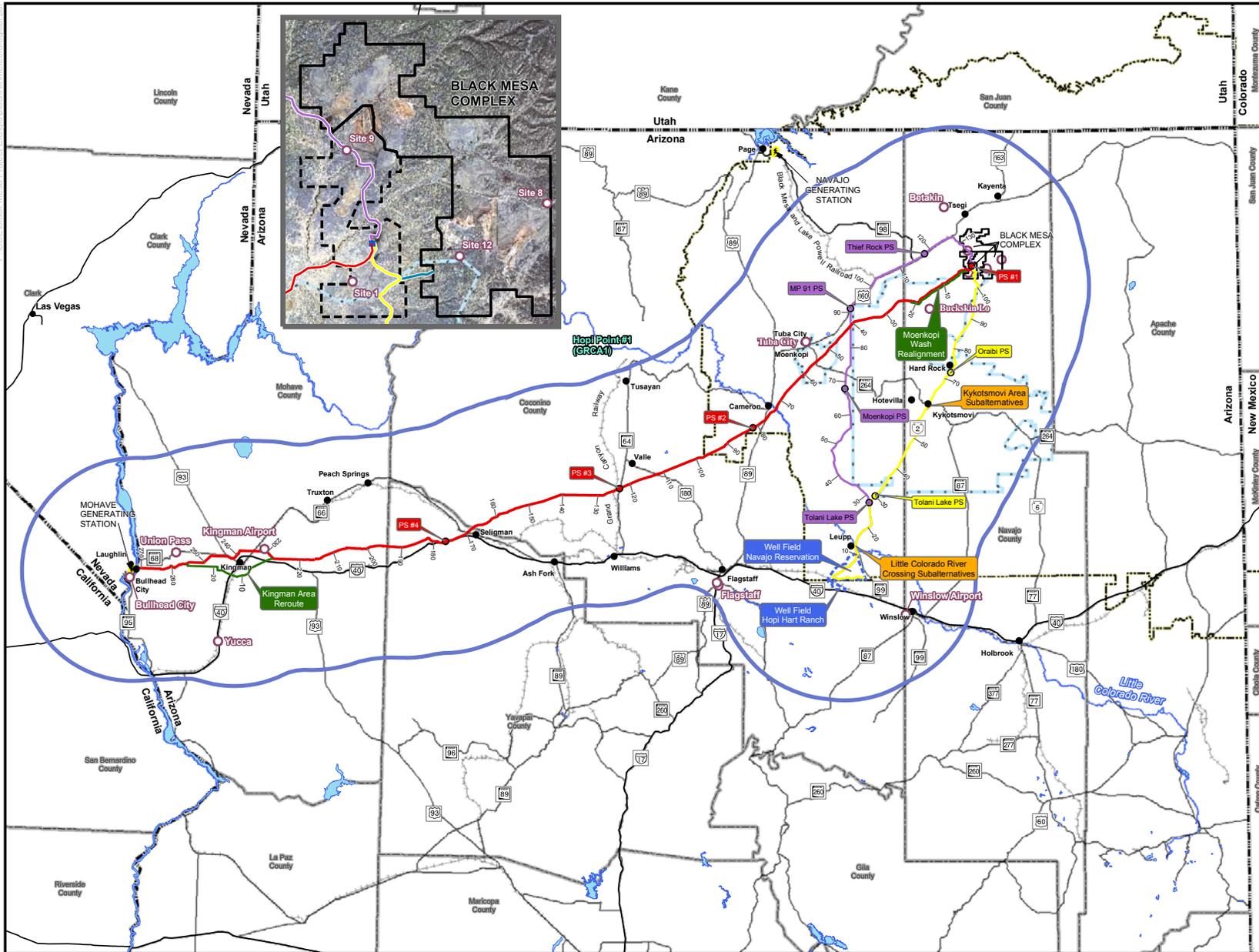
^cFor mean monthly temperature and mean monthly precipitation averages, the period used for Bullhead City is 1977-2005 and for Yucca it is 1950-2005.

Map 3-9 Meteorological Monitoring Stations

Black Mesa Project EIS

LEGEND

- Coal-Slurry Pipeline**
 - Existing Route
 - Realignments
 - (Existing route with realignment/reroute is the preferred alternative)
 - Proposed Water-Supply Pipeline**
 - Eastern Route (preferred alternative)
 - Subalternatives (preferred alternative)
 - Western Route
 - Other Project Features**
 - C-Aquifer Well Field
 - PS = Pump Station
 - Black Mesa Complex**
 - Kayenta Mining Operation Area, including Coal-Loading Site, Overland Conveyor, and Power Line (permanent permit area)
 - Black Mesa Mining Operation Area (currently unpermitted area)
 - Proposed Coal-Haul Road
 - Climatic Data Locations**
 - Climate Study Area
 - Meteorological Monitoring Station
 - General Features**
 - River
 - Lake
 - Navajo Reservation Boundary
 - Hopi Reservation Boundary
 - State Boundary
 - County Boundary
 - Interstate/U.S. Highway/State Route
- SOURCES:
Peabody Energy 2006
URS Corporation 2005, 2006
Arizona State Land Department 2005



Prepared By:
URS

Three remote automatic weather-station (RAWS) monitors provide data that best represent the prevalent wind patterns within the study area (Western Regional Climate Center [WRCC 2005c]). These data were evaluated to determine wind patterns in the Black Mesa, Flagstaff, and Union Pass areas. Based on wind patterns recorded at the Betakin RAWS monitor (near the Black Mesa Complex), the Flagstaff RAWS monitor, and the Union Pass RAWS monitor (near Bullhead City), winds are predominantly from the southwest (approximately 30 to 40 percent of the year) with the remaining winds being somewhat evenly distributed.

3.5.2 **Black Mesa Complex**

Peabody operates a meteorological network consisting of four meteorological tower systems and five rain-gauge sites (Figure 3-4). Conditions recorded at these meteorological towers are summarized in Table 3-9.

Table 3-9 Meteorological Conditions at the Black Mesa Complex

Parameter	Site 1	Site 8R	Site 9	Site 12
Temperature Conditions				
Mean Temperature (°F)	49.7	49.6	49.5	50.4
Maximum Temperature (°F)	89.5	86.0	88.3	87.5
Minimum Temperature (°F)	0.7	9.2	6.0	8.4
Precipitation				
Total Annual Rain/Precipitation (inches)	8.18	NA	8.27	5.77
Wind Speed				
Mean Wind Speed (meters per second)	3.7	4.1	3.3	4.0
Maximum Wind Speed (meters per second)	20.0	16.7	15.4	16.5
Minimum Wind Speed (meters per second)	0.2	0.4	0.2	0.2

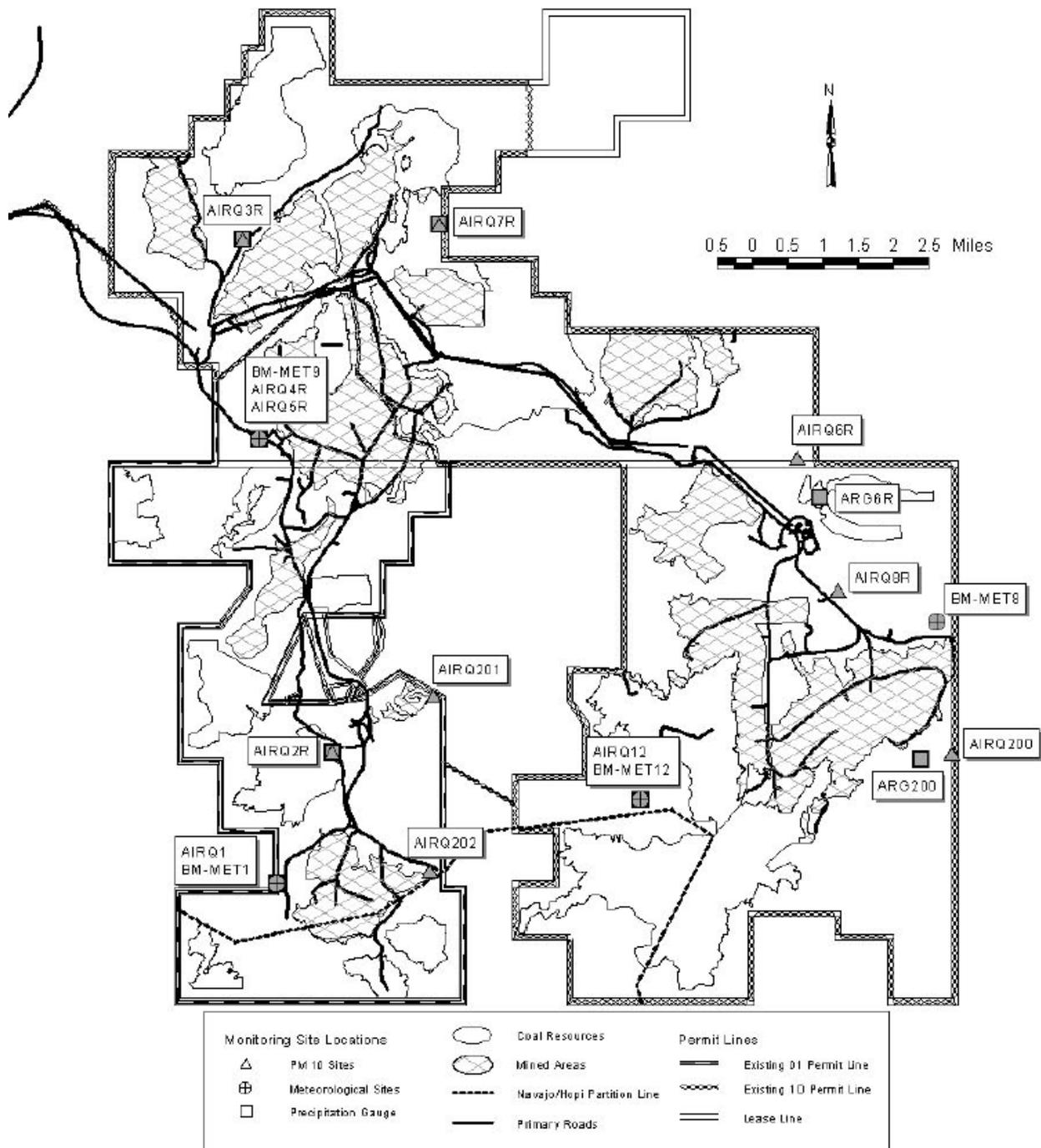
SOURCE: TRC Environmental Corporation 2005

The Black Mesa region in northeastern Arizona has a semiarid climate, characterized by wide variations in diurnal and annual temperature. The Black Mesa receives much of its precipitation during the summer months, when afternoon showers form as a result of moist air from the Gulf of Mexico moving over the area. Rainfall as high as 0.90 inch for 1 hour and 1.98 inches for 24 hours have been recorded. The total amount of precipitation received at various locations on the Black Mesa Complex may be related to topographic features and changes in altitude. Nearly 50 percent of the annual precipitation is received in the months of July, August, and September, and 64 percent is received from April through September. Most snowfall is light and evaporates within a few days. Mean annual lake evaporation monitored at Sites 1, 8, 9, and 12 from May through October is 45 inches, with the greatest monthly evaporation occurring during June and July.

Peabody has been collecting storm hydrographs from events over the Black Mesa Complex as part of the hydrologic monitoring plan. The storm characteristics are reflective of the Colorado Plateau in general. Mean summer single-peak discharges range from 54.1 to 313.5 cfs, while fall values range between 2.2 and 23.8 cfs.

Due to moderately high elevation (ranging from 6,000 to 8,200 feet above MSL), Black Mesa experiences mild summer and cold winter temperatures. The average annual temperature is about 49.8°F. Summer temperatures generally range from the mid-50s to the low 80s. Temperatures in excess of 100°F are rare.

In winter, early morning temperatures normally drop to the high teens or low 20s; however, the air usually warms rapidly and reaches the upper 30s or low 40s by early afternoon. The coldest month is January, with an average temperature of 31°F. July is the warmest month, with an average temperature of 69°F (U.S. Department of Commerce, National Oceanic and Atmospheric Administration 1974).



SOURCE: TRC Environmental Corporation 2005

Figure 3-4 Monitoring Site Locations at the Black Mesa Complex

For the period of July 7, 1985, through December 31, 2004, average temperature and wind characteristics recorded at sites 1, 9, and 12 are available by month, and are summarized by season in Table 3-10.

Table 3-10 Seasonal Meteorological Conditions at the Black Mesa Complex

Parameter	Winter Average	Spring Average	Summer Average	Fall Average	Annual Average
Temperature Conditions					
Mean Temperature (°F)	32.3	47.7	68.7	50.3	49.8
Maximum Temperature (°F)	43.3	60.3	82.3	62.3	62.1
Minimum Temperature (°F)	21.7	35.0	54.3	37.7	37.2
Wind Speed					
Average Wind Speed (meters per second)	3.1	4.1	3.4	3.3	3.5
Hourly Maximum Wind Speed (meters per second)	18.2	20.2	16.4	19.6	18.6

SOURCE: Peabody Western Coal Company 2000

3.5.3 Climate Change

Based on current scientific research, there is growing concern about changes that may occur to the global climate. Through many complex interactions on a regional and global scale, the lower layers of the atmosphere experience a net warming effect. The earth’s surface temperature has risen by about 1°F more than the last century, and the warming process has accelerated during the past two decades (USEPA 2000; NRC 2001).

There is an ongoing scientific debate about the cause of these trends. As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and documented trends. Current understanding of many other aspects of climate change ranges from “likely” to “uncertain.” Scientists know with virtual certainty the following:

- Human activities are changing the composition of the earth's atmosphere. Increasing levels of greenhouse gases like CO₂ in the atmosphere since pre-industrial times are well-documented and understood.
- The atmospheric buildup of CO₂ and other greenhouse gases is largely the result of human activities such as the burning of fossil fuels.
- A warming trend of about 0.7 to 1.5°F occurred during the 20th century. Warming occurred in both the Northern and Southern Hemispheres, and over the oceans (NRC 2001).
- The major greenhouse gases emitted by human activities remain in the atmosphere for periods ranging from decades to centuries. It is therefore virtually certain that atmospheric concentrations of greenhouse gases will continue to rise over the next few decades.
- Increasing greenhouse gas concentrations tend to warm the planet. (USEPA 2006a)

The Intergovernmental Panel on Climate Change has stated “There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.” In short, a number of scientific analyses indicate, but cannot prove, that rising levels of greenhouse gases in the atmosphere are contributing to climate change (as theory predicts). In the coming decades, scientists anticipate that as atmospheric concentrations of greenhouse gases continue to rise, average global temperatures and sea levels will continue to rise as a result and precipitation patterns will change.

Important scientific questions remain about how much warming will occur, how fast it will occur, and how the warming will affect the rest of the climate system including precipitation patterns and storms. (USEPA 2006a)

The National Research Council of the National Academy of Sciences noted in 2001 that:

“The warming trend is spatially widespread and is consistent with the global retreat of mountain glaciers, reduction in snow-cover extent, the earlier spring melting of ice on rivers and lakes, the accelerated rate of rise of sea level during the 20th century relative to the past few thousand years, and the increase in upper-air water vapor and rainfall rates over most regions. A lengthening of the growing season also has been documented in many areas, along with an earlier plant flowering season and earlier arrival and breeding of migratory birds. Some species of plants, insects, birds, and fish have shifted towards higher latitudes and higher elevations. The ocean, which represents the largest reservoir of heat in the climate system, has warmed by about 0.05°C (0.09°F) averaged over the layer extending from the surface down to 10,000 feet, since the 1950s” (NRC 2001).

Among the predicted changes in the United States are “potentially severe droughts, increased risk of flood, mass migrations of species, substantial shifts in agriculture and widespread erosion of coastal zones” (NAST 2000).

Greenhouse gases are gases that trap heat in the atmosphere. Some greenhouse gases such as CO₂ occur naturally and are emitted to the atmosphere through natural processes and human activities. Other greenhouse gases (e.g., fluorinated gases) are created and emitted solely through human activities. The principal greenhouse gases that enter the atmosphere because of human activities are:

- CO₂: CO₂ enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). CO₂ also is removed from the atmosphere (or “sequestered”) when it is absorbed by plants as part of the biological carbon cycle.
- Methane (CH₄): CH₄ is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.
- Nitrous oxide (N₂O): N₂O is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- Fluorinated gases: Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are often used as substitutes for ozone-depleting substances (i.e., CFCs, HCFCs, and halons). These gases typically are emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases (“High GWP gases”) (USEPA 2006b).

The greenhouse gas of most concern is CO₂ since the naturally occurring chemical also is generated by the continuing burning of fossil fuels, can last in the atmosphere for centuries, and “forces” more climate change than any other greenhouse gas (NRC 2001). In 2004, CO₂ accounted for 85 percent of the greenhouse gas emissions produced in the United States, and electrical generation accounted for 40 percent of those CO₂ emissions. In 2004, 2,525 million short tons (2,290.6 million metric tons or teragrams) of CO₂ were produced in the United States from electrical generation (USEPA 2006c). According to USEPA’s Acid Rain Program database, the Mohave Generating Station produced 10.7 million short tons of CO₂ in 2004 or about 0.4 percent of that total.

3.6 AIR QUALITY

The Federal Clean Air Act (CAA) and subsequent amendments provide the authority and framework for USEPA regulation of air emission sources. The USEPA regulations serve to establish requirements for the permitting, monitoring, control, and documentation of activities that affect ambient concentrations of certain pollutants that may endanger public health or welfare.

The criteria used to assess the existing conditions within the air quality study area include the following quantifiable indicators:

- National Ambient Air Quality Standards (NAAQS), as identified in the CAA and regulated by the USEPA (Table 3-11)
- Observed levels of visibility in Class I areas

Assessment data were available from Federal, State, and local air quality permitting authorities, including the USEPA, and Arizona, California, and Nevada authorities. Actual project activity occurs in Arizona and Nevada, but not in California. The applicable Arizona and Nevada regulations pertain to control of fugitive dust. The Mitigation section, below, addresses measures to be used to control fugitive dust.

3.6.1 National Ambient Air Quality Standards

Under the CAA, USEPA has established NAAQS, which have historically applied to six criteria pollutants—sulfur dioxide (SO₂), total suspended particulate (TSP), carbon monoxide (CO), nitrogen dioxide (NO₂), lead (Pb) and ozone (O₃). These standards are defined in terms of threshold concentration (e.g., micrograms per cubic meter [$\mu\text{g}/\text{m}^3$]) measured as an average for specified periods of time (averaging times). Short-term standards (i.e., 1-hour, 8-hour, or 24-hour averaging times) were established for pollutants with acute health effects, while long-term standards (i.e., annual averaging times) were established for pollutants with chronic health effects. More recently, additional standards for 8-hour average O₃ concentrations, particulate matter equal to or less than 10 microns in diameter (PM₁₀), and particulate matter equal to or less than 2.5 microns in diameter (PM_{2.5}) were added. The NAAQS for TSP is no longer enforced. Table 3-11 summarizes the current NAAQS.

Table 3-11 National Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS	
		Primary	Secondary
Sulfur dioxide (SO ₂)	3-hour	—	1,300 $\mu\text{g}/\text{m}^3$
	24-hour	365 $\mu\text{g}/\text{m}^3$	—
	Annual	80 $\mu\text{g}/\text{m}^3$	—
Particulate matter equal to or less than 10 microns in diameter (PM ₁₀)	24-hour	150 $\mu\text{g}/\text{m}^3$	150 $\mu\text{g}/\text{m}^3$
	Annual	50 $\mu\text{g}/\text{m}^3$	50 $\mu\text{g}/\text{m}^3$
Particulate matter equal to or less than 2.5 microns in diameter (PM _{2.5})	24-hour	65 $\mu\text{g}/\text{m}^3$	65 $\mu\text{g}/\text{m}^3$
	Annual	15 $\mu\text{g}/\text{m}^3$	15 $\mu\text{g}/\text{m}^3$
Carbon monoxide (CO)	1-hour	40,000 $\mu\text{g}/\text{m}^3$	—
	8-hour	10,000 $\mu\text{g}/\text{m}^3$	—
Nitrogen dioxide (NO ₂)	Annual	100 $\mu\text{g}/\text{m}^3$	100 $\mu\text{g}/\text{m}^3$
Lead (Pb)	Quarterly	1.5 $\mu\text{g}/\text{m}^3$	1.5 $\mu\text{g}/\text{m}^3$
Ozone (O ₃)	1-hour	235 $\mu\text{g}/\text{m}^3$	235 $\mu\text{g}/\text{m}^3$
	8-hour	157 $\mu\text{g}/\text{m}^3$	157 $\mu\text{g}/\text{m}^3$

SOURCES: U.S. Environmental Protection Agency 2005b, 2005c, 2005d, 2005e, 2005f, 2005g, 2005h, 2005i

NOTES: ppm = parts per million
 $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter
 NAAQS = National Ambient Air Quality Standards

Geographic areas are designated as “attainment,” “nonattainment,” or “unclassified” for each of the six criteria pollutants with respect to the NAAQS. If sufficient monitoring data are available and air quality is shown to meet the NAAQS, the USEPA may designate an area as an attainment area. Areas in which air pollutant concentrations exceed the NAAQS are designated as “nonattainment” for specific pollutants and averaging times. Typically, nonattainment areas are urban regions and/or areas with higher-density industrial development. Because an area’s status is designated separately for each criteria pollutant, one geographic area may have all three classifications.

Two areas within the air quality study area are designated as nonattainment with respect to the NAAQS—the Clark County, Nevada, 8-hour O₃ and San Bernardino County, California, PM₁₀ nonattainment areas (Map 3-10). These areas are located more than 200 miles (325 km) from the Black Mesa Complex. They are only mentioned here because earth-moving activity associated with construction of the western terminus of the coal slurry pipeline may occur within or near these areas. The remaining portions of the air quality study area, including all portions within Arizona, are designated as attainment or unclassified. An unclassified designation indicates that attainment status has not been verified through data collection. When permitting new sources, an unclassified area is treated as an attainment area.

3.6.2 Federal Prevention of Significant Deterioration (PSD) Program

Under the CAA, the USEPA established the PSD program. The PSD program was established to prevent unlimited increases in air pollution in areas that are already in compliance with the NAAQS (i.e., attainment areas). Certain Federal lands where the air quality is and should remain very good, such as national parks, national monuments, wilderness areas and other lands with special designations, are identified as Class I areas. Class I areas are afforded a higher degree of protection than other areas within the United States. The PSD program allows only minimal increases in air pollution in Class I areas. Class I areas that overlap the air quality study area include the Grand Canyon National Park and the Lake Mead National Recreation Area to the north, and the Sycamore Canyon Wilderness Area to the south (Map 3-11). Other nearby Class I areas include the Pine Mountain and Mazatzal Wilderness areas to the south, and the Petrified Forest National Park to the southeast. All areas not designated as Class I are, by default, designated as Class II areas. The PSD program specifies limited air pollution increases in Class II areas that are designed to allow economic development while still maintaining good levels of air quality in those areas. Two sensitive Class II areas, the Monument Valley Visitor’s Center and the Navajo National Monument (which are both located on Navajo tribal land), are shown on Map 3-11. All Class I and sensitive Class II areas in the vicinity of the proposed project are listed in the Peabody Technical Support Document (McVehil-Monnett Associates, Inc. 2006).

While the designation of areas and the attendant limitations under the PSD program are based on air pollution levels, the program also established air quality related values (AQRVs). One such AQRV is visibility. Permit applicants under the PSD program also must demonstrate that their project will not cause visibility degradation in excess of specified limits. See Section 3.6.8 for a discussion of regional visibility conditions.

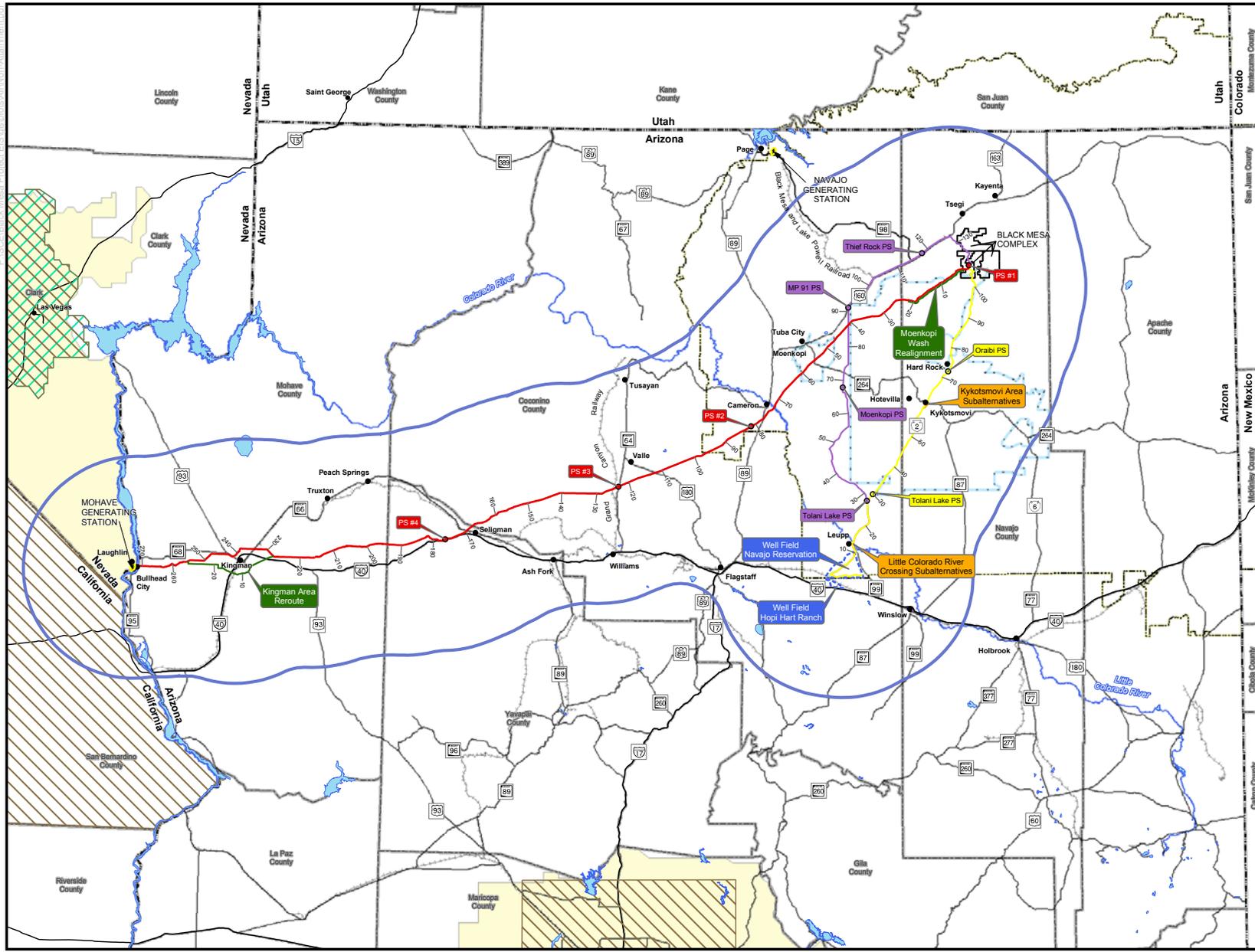
3.6.3 Designation of Air Quality Study Area for Proposed Project

For the purposes of evaluating air quality within the vicinity of the Black Mesa Project, the air quality study area encompasses a 31-mile (50-km) buffer from the locations where the elements of the Black Mesa Project would be sited. This study area is located primarily in Arizona with some small portions extending into Utah, Nevada and California. A 31-mile (50-km) buffer was chosen to be consistent with air quality analyses required for major source air quality permitting (ADEQ 2003b). However, relative to actual or anticipated impacts of the Black Mesa Project within this study area, the following statements should be considered:

Map 3-10 Attainment Classification

National Ambient Air Quality
Standards Attainment Classifications
Black Mesa Project EIS

- LEGEND**
- Coal-Sturry Pipeline**
 - Existing Route
 - Realignments
 - Proposed Water-Supply Pipeline
 - Eastern Route (preferred alternative)
 - Subalternatives (preferred alternative)
 - Western Route
 - Other Project Features**
 - C-Aquifer Well Field
 - PS = Pump Station
 - Peabody Lease Area
 - Air Quality Data Locations**
 - Air Quality Study Area
 - Unclassifiable/Attainment
 - Nonattainment Areas
 - Particulate Matter (PM₁₀)
 - Carbon Monoxide
 - Ozone (8-Hour)
 - General Features**
 - River
 - Lake
 - Navajo Reservation Boundary
 - Hopi Reservation Boundary
 - State Boundary
 - County Boundary
 - Interstate/U.S. Highway/State Route
- SOURCES:**
 URS Corporation 2005, 2006
 Arizona State Land Department 2005
 Environmental Protection Agency 2005

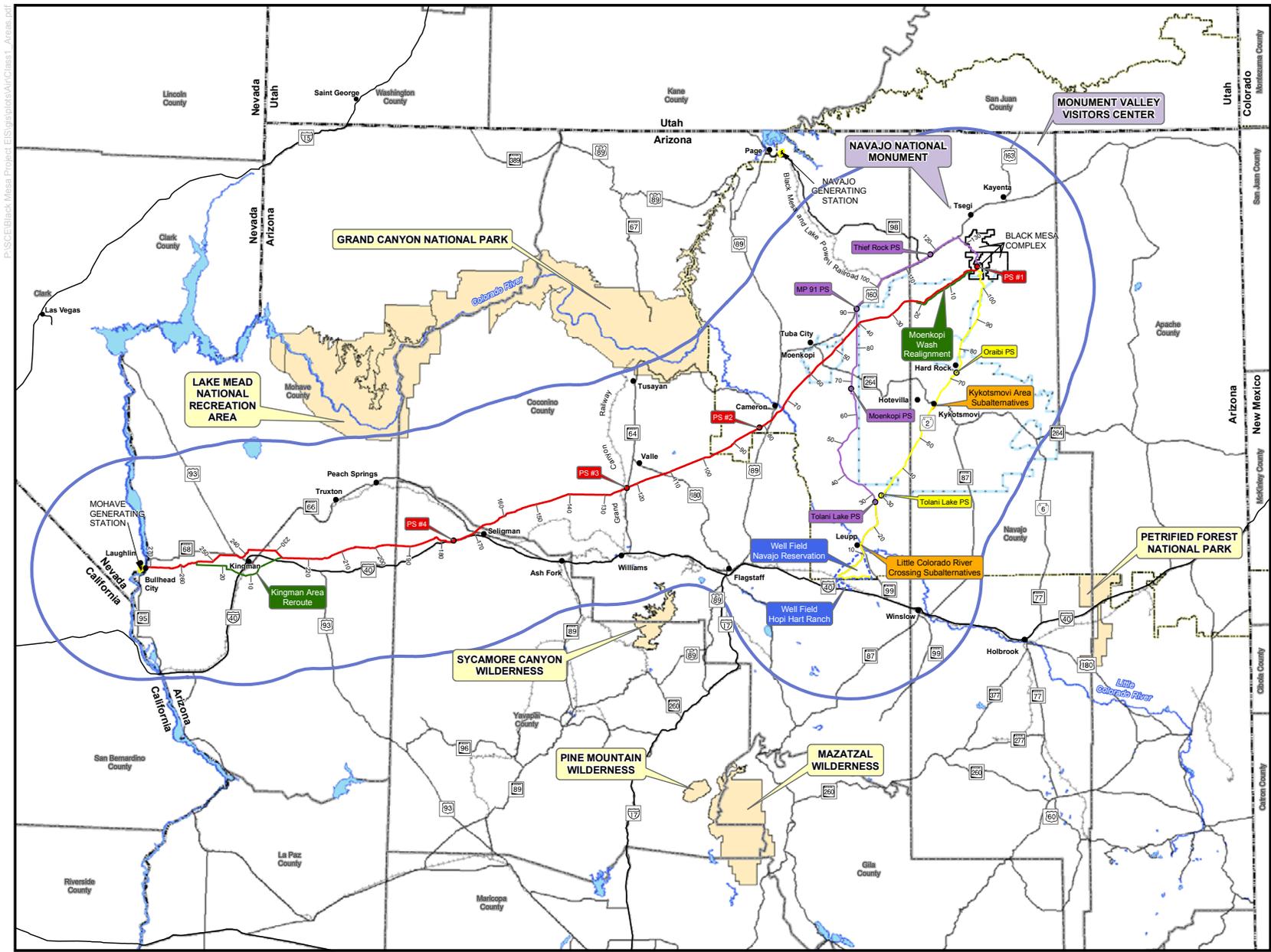


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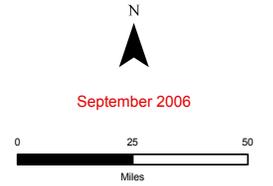
Map 3-11
Class I and Sensitive
Class II Areas

Black Mesa Project EIS

LEGEND

- Coal-Slurry Pipeline**
 - Existing Route
 - Realignments
 - (Existing route with realignment/reroute is the preferred alternative)
- Proposed Water-Supply Pipeline**
 - Eastern Route (preferred alternative)
 - Subalternatives (preferred alternative)
 - Western Route
- Other Project Features**
 - C-Aquifer Well Field
 - PS = Pump Station
 - Peabody Lease Area
- Air Quality Data Locations**
 - Air Quality Study Area
 - Federal Class I Area
 - Sensitive Class II Area
- General Features**
 - River
 - Lake
 - Navajo Reservation Boundary
 - Hopi Reservation Boundary
 - State Boundary
 - County Boundary
 - Interstate/U.S. Highway/State Route

SOURCES:
 URS Corporation 2005, 2006
 Arizona State Land Department 2005
 Environmental Protection Agency 2005
 Navajo Nation Parks and Recreation 2005



Prepared By:
URS

- Any air quality permitting likely to be required for the project will not involve major source permitting because the magnitude of emissions increases associated with any air permitting will likely be less than significant, as defined in the PSD program regulations. Therefore, the selection of a 31-mile (50-km) buffer to establish a study area should not be construed as an implication that major source permitting requirements apply to the project.
- For major source permitting, such a buffer is established around a proposed new source or major modification of an existing source to encompass the geographic area of impact typically resulting from air pollutants being discharged from elevated point sources, such as chimneys. In contrast, air pollutant emissions from the Black Mesa Project consist of fugitive process emissions along with fugitive dust. Such ground-level releases consisting of coarse particulate matter (PM) remain close to the ground and do not disperse significantly over large distances. Some of these emissions are associated with construction activity, are temporary, and are not subject to major source permitting requirements.
- Selection of the 31-mile (50-km) buffer to establish the study area should not be construed as an implication that air pollutant emissions from the project will overlap and intermingle with emissions from other major stationary air pollutant sources within the study area.

3.6.4 Black Mesa Complex Ambient Air Monitoring

The air pollutant (resulting from Black Mesa Complex operations) of primary concern is PM. Emission sources for PM include blasting, overburden removal, coal extraction/handling/ storage, fugitive road dust, and operation of vehicles and equipment. Operation of vehicles and equipment also causes emissions of other criteria pollutants, including CO, SO₂, oxides of nitrogen (NO_x) and volatile organic compounds (VOC). NO_x and VOC are precursors to the formation of O₃ in the atmosphere.

Pursuant to 30 CFR 816.95, OSM requires Peabody to develop and implement a plan to effectively control fugitive dust. In addition, pursuant to 30 CFR 780.15(a)(1), OSM requires Peabody to conduct air quality monitoring to evaluate the effectiveness of the fugitive dust control program. Air quality data collected from the Black Mesa Complex monitoring network during active mining operations are presented herein. Map 3-10 shows the locations of the Peabody air quality monitoring stations. These data should not be considered as representative of air quality throughout the study area or indicative of air quality impacts from the mining operations alone, as explained below.

The monitoring network includes 12 PM₁₀ samplers at 11 locations throughout the mining complex (Map 3-12). Although this PM₁₀ monitoring network is operated in accordance with relevant USEPA requirements, including a quality assurance program, it was designed to monitor air quality conditions on a microscale within the Black Mesa Complex to evaluate the effectiveness of the fugitive dust control program, and is not required to satisfy rigorous USEPA siting requirements. Specifically, some monitors are located close to residences and unpaved roads used by local residents and consequently do not measure PM₁₀ concentrations truly representative of local or regional air quality. Peabody has not proposed to revise the monitoring system.

Quarterly monitoring reports are submitted to OSM and NNEPA. The record from these monitoring sites is very reliable for 2003 to 2005, in that 98 percent data completeness was achieved. Additional information regarding this monitoring program is provided in the Peabody Technical Support Document that is included in the Administrative Record for this Draft EIS.

3.6.4.1 Average Annual Ambient Air Concentrations

During the three most recent calendar years (2003 to 2005), the ambient monitoring network at the Black Mesa Complex did not record any exceedances of the annual PM₁₀ NAAQS of 50 µg/m³. Table 3-12 presents the annual monitoring results for each site for this 3-year period. Several monitors on the north and east sides of the Black Mesa Complex (3R, 6R, 7R, and 200R) show consistently lower ambient PM₁₀ concentrations than the other sites. This is attributed to the location of these sites being generally upwind of and distant from any mining activities. Consequently, these can be viewed as the best representation of background conditions outside the influence of mining activities.

The co-located samplers 4R/5R, and site 12 are located in the vicinity of mining activities and are probably more impacted by mining activities than any of the other samplers. However, they also are subject to impacts from tribal residential activities inside the mine permit area such as roads used solely for nonmining purposes, and off-site activities.

Table 3-12 Annual Average Ambient PM₁₀ Monitoring Data (in µg/m³) at Black Mesa Complex 2003-2005

Monitor ID ¹	Relative Position Within Mine Complex ¹	Monitored Annual Average PM ₁₀ Concentration (µg/m ³)		
		2003	2004	2005
1	SW	33.6	31.4	22.5
2R	SW	37.7	28.8	35.3
3R	NW	13.1	9.3	11.9
4R	W	37.2	28.2	33.4
5R	W (co-located w/4R)	36.4	28.8	34.4
6R	NE	15.8	12.0	13.2
7R	N	19.1	11.8	13.7
8R	E	30.6	20.4	27.8
12	S	23.6	23.7	23.4
200	SE	16.6	11.0	12.6
201	S	21.5	19.3	26.7
202	SW	19.7	15.7	16.8

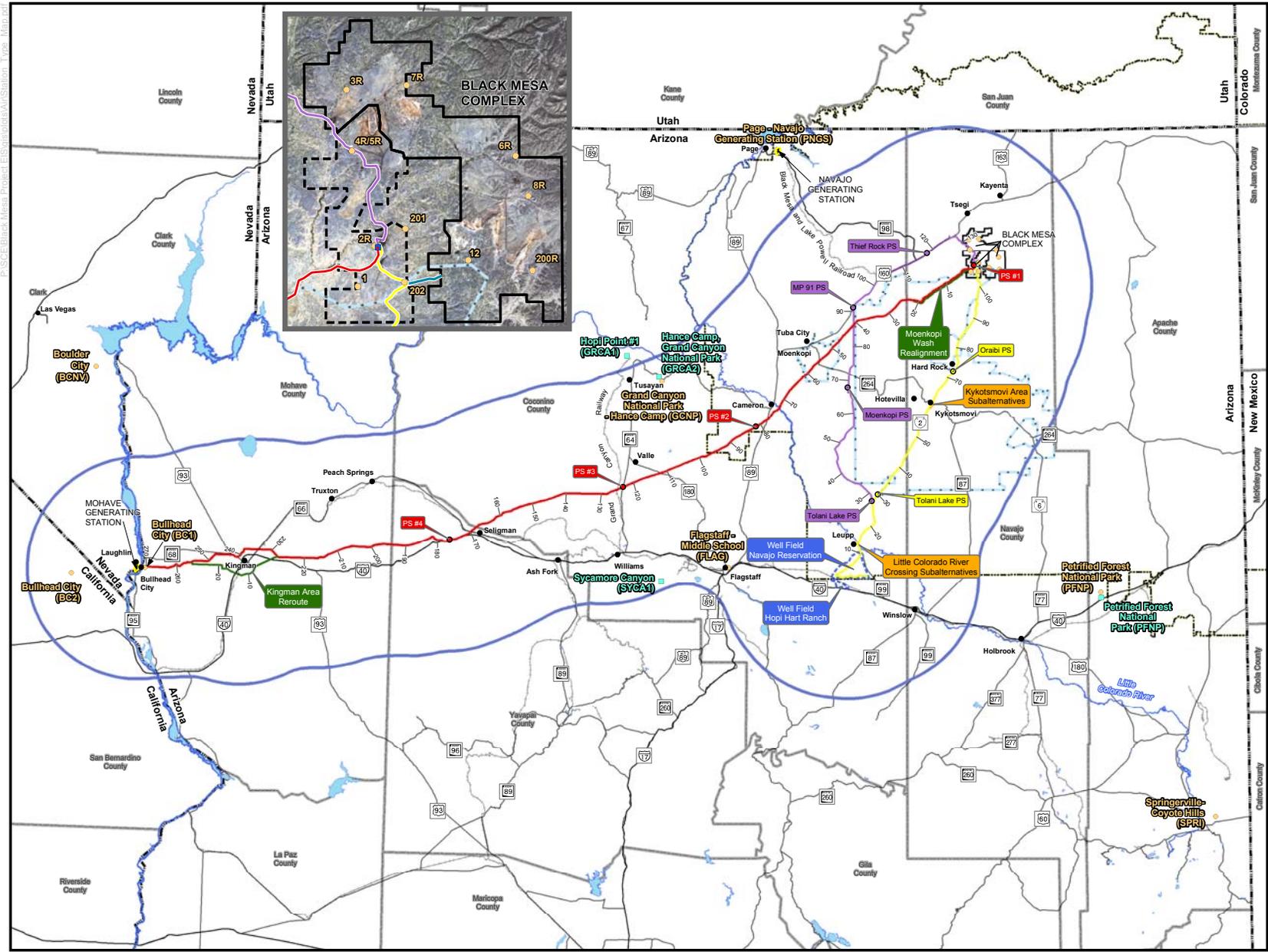
SOURCE: McVehil-Monnett Associates, Inc. 2006

NOTE: ¹ Refer to Map 3-10 for location of PM₁₀ ambient monitors at the Black Mesa Complex.

3.6.4.2 Short-Term (24-hour) Ambient Air Concentrations

Table 3-13 lists the highest and second highest measured PM₁₀ concentrations at each of the 12 samplers surrounding the Black Mesa Complex for the three-year period 2003 to 2005. Of these highest measurements, 14 samples exceeded the PM₁₀ 24-hour standard of 150 µg/m³ during the 3-year period. These 14 elevated measurements account for 0.6 percent of 2,297 valid measurements taken during this period, and occurred on six separate days, two in each year. The dates and circumstances related to the exceedances are indicated in the footnotes to Table 3-13. Additional information regarding this monitoring program is provided in the Peabody Technical Support Document, available in the Administrative Record for this EIS.

Evaluation of meteorological conditions during the six days when values above the 24-hour average PM₁₀ NAAQS suggests that mining activities are not the primary cause of these exceedances. Non-mining activities such as vehicle traffic on local unpaved roads both within and outside of the mine property can cause fugitive dust that contributes to elevated short-term PM₁₀ concentrations at nearby monitors. More significantly, long-term dryness in the region tends to counteract the effects of mitigation, including extensive application of dust suppressants on roads and other dust-control measures that are practiced within the Black Mesa Complex.



Map 3-12 Air Monitoring Stations

Black Mesa Project EIS

- LEGEND**
- Coal-Slurry Pipeline**
 - Existing Route
 - Realignments (Existing route with realignment/ reroute is the preferred alternative)
 - Proposed Water-Supply Pipeline**
 - Eastern Route (preferred alternative)
 - Subalternatives (preferred alternative)
 - Western Route
 - Other Project Features**
 - C-Aquifer Well Field
 - PS = Pump Station
 - Black Mesa Complex**
 - Kayenta Mining Operation Area, including Coal-Loading Site, Overland Conveyor, and Power Line (permanent permit area)
 - Black Mesa Mining Operation Area (currently unpermitted area)
 - Proposed Coal-Haul Road
 - Air Quality Data Locations**
 - Air Quality Study Area
 - Air Quality Monitoring Stations**
 - Air Quality Monitoring Station
 - IMPROVE Station
 - General Features**
 - River
 - Lake
 - Navajo Reservation Boundary
 - Hopi Reservation Boundary
 - State Boundary
 - County Boundary
 - Interstate/U.S. Highway/State Route
- SOURCES:
 Peabody Energy 2006
 URS Corporation 2005, 2006
 Arizona State Land Department 2005
 Environmental Protection Agency 2005

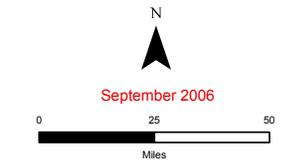


Table 3-13 24-hour Average Ambient PM₁₀ Monitoring Data (in µg/m³) at Black Mesa Complex 2003 to 2005

Monitor ID	2003		2004		2005	
	First High	Second High	First High	Second High	First High	Second High
1	144	140	258 ^d	141	150	138
2R	231 ^b	85	160 ^c	130	125	112
3R	106	47	33	27	41	28
4R	267 ^a	137	123	89	358 ^f	168 ^e
5R	228 ^a	125	170 ^c	99	335 ^f	175 ^e
6R	175 ^b	36	51	30	40	39
7R	215 ^b	62	41	39	47	46
8R	352 ^b	73	57	54	63	60
12	119	79	121	77	150	138
200	175 ^b	46	50	34	36	36
201	142	55	67	56	130	78
202	104	65	74	36	81	37

SOURCE: McVehil-Monnett Associates, Inc. 2006

- NOTES: a. September 24, 2003. Causes appeared to be drought, and mining activities may have contributed.
 b. October 30, 2003. Causes were extreme winds and long-term dryness.
 c. June 2, 2004. Cause was long-term dryness throughout the area.
 d. August 8, 2004. Cause was long-term dryness, particulate originated off site to the west.
 e. August 20, 2005. Causes were high winds and long-term dryness.
 f. August 26, 2005. Causes were high winds and long-term dryness.

3.6.5 Coal-Slurry Pipeline

Other than insignificant air-pollutant emissions due to periodic coal-slurry pipeline maintenance, there are no air quality emissions associated with the existing coal-slurry pipeline.

3.6.6 C Aquifer Water-Supply System

The C-aquifer water supply system has not yet been constructed, so there are no historic air pollutant emissions. The area proposed for the C aquifer water-supply system is within the air quality study area described above.

3.6.7 Other Emission Sources in the Region

A number of diverse major point sources are located within and near the air quality study area, including industrial, commercial and local government facilities such as gas- and coal-fired power plants, natural-gas-pipeline compressor stations, various manufacturers, and landfills. Table 3-14 provides a summary of these sources.

Table 3-14 Major Sources Located within and near the Air Quality Study Area

Owner	Facility Type	Location	Permitting Authority
American Woodmark	Cabinet manufacturer	Kingman	ADEQ
Arizona Public Service Company (Cholla Power Plant)	Coal-fired power plant	Joseph City	ADEQ
BFI Waste Systems – La Paz County Regional Landfill	Landfill	Parker	ADEQ
Calpine-South Point Energy Center	Gas-fired power plant	Bullhead City	USEPA Region 9
Cerbat Landfill	Landfill	Kingman	ADEQ
Chemical Lime Company	Lime plant	Peach Springs	ADEQ
Citizen’s Utilities Company	Gas-fired power plant	Lake Havasu City	ADEQ
City of Flagstaff – Cinder Lake Landfill	Landfill	Flagstaff	ADEQ
El Paso Natural Gas Company (Dilkon Compressor Station)	Natural gas compressor station	Dilkon	USEPA Region 9
El Paso Natural Gas Company (Dutch Flats)	Natural gas compressor station	Lake Havasu City	ADEQ
El Paso Natural Gas Company (Flagstaff)	Natural gas compressor station	Flagstaff	ADEQ
El Paso Natural Gas Company (Hackberry)	Natural gas compressor station	Hackberry	ADEQ
El Paso Natural Gas Company (Leupp Compressor Station)	Natural gas compressor station	Leupp	USEPA Region 9
El Paso Natural Gas Company (Seligman)	Natural gas compressor station	Seligman	ADEQ
El Paso Natural Gas Company (Topock)	Natural gas compressor station	Topock	ADEQ
El Paso Natural Gas Company (Williams)	Natural gas compressor station	Williams	ADEQ
Griffith Energy, LLC	Gas-fired power plant	Griffith	ADEQ
Mohave Pipeline Operating Company (Topock)	Natural gas compressor station	Topock	ADEQ
Mohave Valley Landfill	Landfill	Mohave	ADEQ
Navajo Generating Station	Coal-fired power plant	Page	USEPA Region 9
Norcraft Companies, LLC	Cabinet manufacturer	Mohave	ADEQ
North Star Steel Company	Steel manufacturer	McConnico	ADEQ
Peabody Western Coal Company	Coal mine	Kayenta	USEPA Region 9
Phoenix Cement Company	Cement plant	Clarkdale	ADEQ
Printpack, Inc.	Packaging material manufacturer	Prescott Valley	ADEQ
Snowflake Recycled Paper Mill (Abitibi)	Paper mill	Snowflake	ADEQ
Southern California Edison – Mohave Generating Station	Coal-fired power plant	Laughlin (Nevada)	NDEP
Transwestern Pipeline Company (Flagstaff)	Natural gas compressor station	Flagstaff	ADEQ
Transwestern Pipeline Company (Kingman)	Natural gas compressor station	Kingman	ADEQ
Transwestern Pipeline Company (Leupp)	Natural gas compressor station	Leupp	USEPA Region 9
USA Waste – Pen-Rob Landfill	Landfill	Joseph City	ADEQ
Waste Management of Arizona – Gray Wolf Regional Landfill	Landfill	Dewey	ADEQ

SOURCE: U.S. Environmental Protection Agency 2005a

NOTE: All locations are in Arizona unless otherwise specified.
 NDEP=Nevada Department of Environmental Protection
 ADEQ = Arizona Department of Environmental Quality

Minor point sources within and near the study area include industrial and commercial operations of many kinds. Prevalent types of portable sources include rock- and construction-product industries (e.g., portable crushing and screening plants), hot-mix asphalt plants, and concrete batch plants. Stationary industrial sources in this category include a broad range of consumer goods manufacturing facilities, mortuaries, and dry cleaners. Several significant area sources exist within the study area, as well. Prevalent types of area sources include sand, gravel and cinder mining operations, unpaved roads, concentrated livestock operations, and controlled range/forest burns.

Vehicle emissions consist of NO₂, CO, and PM₁₀, which may warrant consideration in an assessment of ambient air quality in the study area.

Monitoring data in and around the study area indicate that air quality is, for the most part, in compliance with the NAAQS.

3.6.8 Visibility Conditions

The Cooperative Institute for Research in the Atmosphere operates a network of visibility monitoring stations in or near mandatory Class I areas (Map 3-12), and publishes Integrated Monitoring of Protected Visual Environments (IMPROVE) data. Map 3-10 shows the locations of the IMPROVE program visibility monitoring stations. The purpose is to identify and evaluate patterns and trends in regional visibility. Data from four IMPROVE monitors in and near the study area show that fine and coarse particulates were the largest contributors to the impairment of visibility (including both primary PM emissions and particulates formed from SO₂, NO_x and VOC). These particulates impact the standard visual range—the distance that can be seen on a given day—from each monitor location. Standard visual ranges for each of the four monitors on their best (highest visibility), worst (lowest visibility), and intermediate (average visibility) visibility days are provided in Table 3-15.

Table 3-15 Standard Visual Ranges from IMPROVE Monitors in and near the Air Quality Study Area

Monitor ^{(1) (2)}	Best Visibility Days (miles [km])	Intermediate Visibility Days (miles [km])	Worst Visibility Days (miles [km])
Petrified Forest National Park	127 (212)	92 (153)	61 (102)
Sycamore Canyon	122 (204)	79 (132)	49 (82)
Hance Camp, Grand Canyon National Park	162 (270)	106 (177)	70 (116)
Hopi Point #1	144 (240)	102 (170)	73 (121)

SOURCE: Interagency Monitoring of Protected Visual Environments 2005

NOTES: ¹ Refer to map 3-10 for locations

² The period used for the Petrified Forest National Park is 1999-2003, for Sycamore Canyon it is 2001 to 2003, for Hance Camp at the Grand Canyon National Park it is 1999 to 2003, and for Hopi Point #1 it is 1993 to 1997.

As shown in Table 3-15, the standard visual range from Sycamore Canyon, located on the south-central edge of the study area, is consistently the lowest in each category. The two monitors that recorded the best standard visual range, Hance Camp and Hopi Point #1, are located on the north-central edge of the study area.

3.6.9 Air Quality Monitor Data

There are numerous monitors located in several areas in and surrounding the air quality study area for different criteria pollutants that are representative of conditions in the vicinity (refer to Map 3-10). Table 3-16 summarizes the data from these monitors, as reported in annual Air Quality Reports published by the ADEQ (ADEQ 2002, 2003a, 2004) and in the Clark County Network Review Report (Clark County Department of Air Quality Management 2002).

As shown in Table 3-16, average NO₂, SO₂, and PM_{2.5} concentrations were all below the NAAQS. However, the Boulder City, Nevada, monitor recorded exceedances of the 8-hour average O₃ concentration (0.084 ppm as compared to NAAQS of 0.08 ppm) and the 24-hour average PM₁₀ concentration (371 µg/m³ as compared to NAAQS of 150 µg/m³). This monitor is located northwest of the air quality study area, in proximity to Las Vegas, Nevada, and these concentrations most likely are attributed to the metropolitan Las Vegas area.

3.7 VEGETATION

3.7.1 Black Mesa Complex

3.7.1.1 Vegetation Types

The Black Mesa Complex is located within the Great Basin conifer woodland biotic community (Map 3-13) (Brown 1982; Brown and Lowe 1980). Detailed vegetation data have been collected at various times for coal-mine permitting (Peabody 2004), and baseline vegetation sampling of the coal-resource areas was conducted in 2003 (ESCO Associates 2000a, 2000b, 2003). The Black Mesa Complex mining operation areas generally occur within four native plant communities: piñon/juniper woodland, sagebrush shrub, saltbush shrubland, and greasewood shrubland, which are described below. A reclaimed lands plant community is created where mine lands have been revegetated, which also is described below.

Piñon/juniper woodland is the dominant plant community within the Black Mesa Complex and occupies approximately 65 to 70 percent of the undisturbed land area. Piñon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) are dominant, with tree canopy cover mostly in the range of 14 to 18 percent. Common shrubs include big sagebrush (*Artemisia tridentata*), fourwing saltbush (*Atriplex canescens*), cliffrose (*Cowania mexicana*), Douglas rabbitbrush (*Chrysothamnus viscidiflorus*), and shadscale (*Atriplex confertifolia*). Grasses and forbs provide a small amount of cover, with the most common grasses being bottlebrush squirreltail (*Sitanion hystrix*), Indian ricegrass (*Oryzopsis hymenoides*), and muttongrass (*Poa fendleriana*). Some piñon/juniper stands appear to have very little understory vegetation, while others have a moderate presence of shrubs. Total vegetation cover in the various stands sampled by ESCO Associates (2003) ranged from 11 to 22 percent. Species density ranged from 12 to 20 species per 1,076 square feet (100 square meters). Piñon/juniper woodland has extensive areas of bare soil, rock, and litter below trees. It occurs at an elevation range of 6,300 to more than 7,200 feet above MSL in the area of the mines. Piñon tends to be dominant over juniper at higher elevations, and juniper is dominant at lower elevations.

Sagebrush shrub is the second most dominant vegetation type at the Black Mesa Complex, covering 30 to 35 percent of undisturbed land areas. This community occurs on flatter areas and in valley bottoms within the matrix of piñon/juniper woodland. It is dominated by big sagebrush and blue grama (*Bouteloua gracilis*). There is varying and sometimes substantial presence of other shrubs and subshrubs, especially fourwing saltbush, Douglas rabbitbrush, Greene rabbitbrush (*Chrysothamnus greenei*), and rubber rabbitbrush (*C. nauseosus*). Along with blue grama, galleta (*Hilaria jamesii*) is a common warm-season grass. Cool-season grasses are less common and include big squirreltail (*Sitanion jubatum*), bottlebrush squirreltail, needle and thread (*Stipa comata*), Indian ricegrass, and western wheatgrass (*Agropyron smithii*). Total vegetation cover ranges from about 8 to 17 percent, with the highest cover associated with dominance by big sagebrush (ESCO Associates 2005). Bare ground occupies 47 to 75 percent of the ground, with 2 to 15 percent rock cover. Species density ranges from 12 to 19 species per 1,076 square feet (100 square meters). Sagebrush extends to 7,000 feet above MSL within the Black Mesa Complex.

Table 3-16 Measured Air Quality Concentrations from Monitors in and near the Air Quality Study Area (Highest Recorded Concentrations During 3-Year Look-Back Period)

Identifier	NO ₂ (µg/m ³)			SO ₂ (µg/m ³)			O ₃ (µg/m ³)		PM ₁₀ (µg/m ³)		PM _{2.5} (µg/m ³)	
	1-Hour Average (1)	24-Hour Average (1)	Annual Average	3-Hour Average	24-Hour Average	Annual Average	1-Hour Average	8-Hour Average	24-Hour Average	Annual Average	24-Hour Average	Annual Average
NAAQS	N-A	N-A	100	1,300 ⁽²⁾	365	80	235	157	150	50	65	15
FLAG ^a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	60	20	16.9	5.7
GCNP ^a	N/A	N/A	N/A	N/A	N/A	N/A	0.161	0.153	N/A	N/A	N/A	N/A
PFNP ^a	N/A	N/A	N/A	N/A	N/A	N/A	0.165	0.151	N/A	N/A	N/A	N/A
PNGS ^b	0.082	0.036	0.004	15	8	3	0.147	0.128	27	9.8	N/A	N/A
SPRI ^b	0.048	0.012	0.002	73	13	0.4	N/A	N/A	N/A	N/A	N/A	N/A
BC1 ^a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	121	20	N/A	N/A
BC2 ^b	0.116	0.052	0.022	170	54	7	N/A	N/A	114	23 ^d	N/A	N/A
BCNV ^c	0.213	0.066	0.018	N/A	N/A	N/A	0.177	0.165	371	21	27.0	6.0

SOURCES: Arizona Department of Environmental Quality 2002, 2003a, 2004; Clark County Department of Air Quality Management 2002

NOTES: ¹ These values may have been reported for purposes of compliance with state ambient standards; there are no 1-hour or 24-hour National Ambient Air Quality Standards for NO₂

² Secondary National Ambient Air Quality Standards

N-A = Not applicable

N/A = Not available

ppm = parts per million

µg/m³ = micrograms per cubic meter

FLAG = Flagstaff Middle School

GCNP = Grand Canyon National Park-Hance Camp

PFNP = Petrified Forest National Park

PNGS = Page-Navajo Generating Station

SPRI = Springerville-Coyote Hills

BC1 = Bullhead City

BC2 = Bullhead City

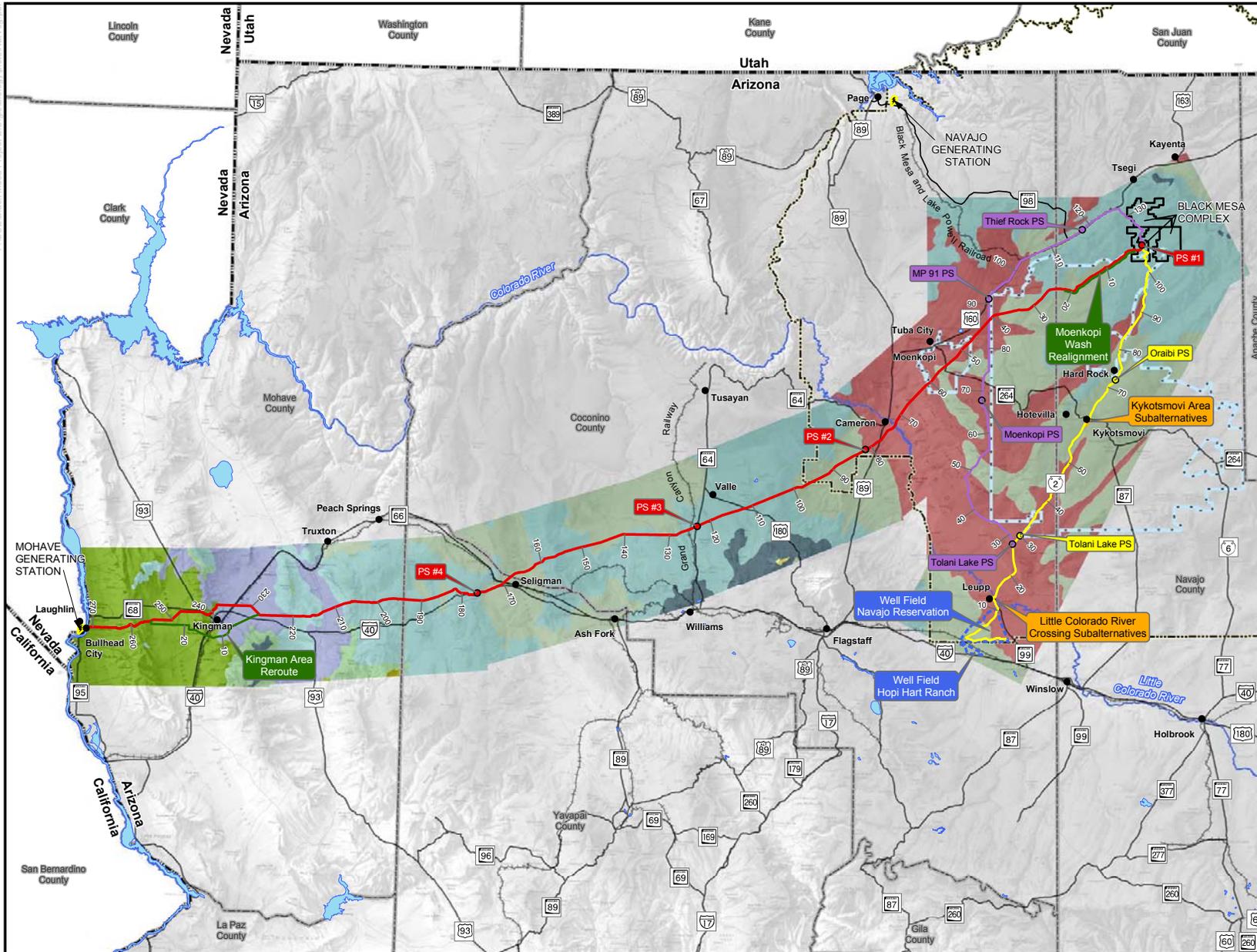
BCNV = Boulder City

^aData are from the Arizona Department of Environmental Quality 2004 Air Quality Report.

^bData are from the Arizona Department of Environmental Quality 2002 Air Quality Report or 2003 Air Quality Report.

^cData are from the Clark County Department of Air Quality Management 2002 Air Monitoring Network Review.

^dThese data do not satisfy the U.S. Environmental Protection Agency's summary criteria, usually meaning that less than 75 percent of valid data recovery was available in one or more calendar quarters.



Map 3-13
Vegetation

Black Mesa Project EIS

LEGEND

- Coal-Slurry Pipeline**
 - Existing Route
 - Realignments
(Existing route with realignment/reroute is the preferred alternative)
- Proposed Water-Supply Pipeline**
 - Eastern Route (preferred alternative)
 - Subalternatives (preferred alternative)
 - Western Route
- Other Project Features**
 - C-Aquifer Well Field
 - PS = Pump Station
 - Peabody Lease Area
- Vegetation**
 - Great Basin Conifer Woodland
 - Great Basin Desertscrub
 - Mohave Desertscrub
 - Petran Montane Conifer Forest
 - Petran Subalpine Conifer Forest
 - Plains and Great Basin Grassland
 - Semidesert Grassland
- General Features**
 - River
 - Lake
 - Navajo Reservation Boundary
 - Hopi Reservation Boundary
 - State Boundary
 - County Boundary
 - Interstate/U.S. Highway/State Route

SOURCES:
URS Corporation 2005, 2006
Brown, Lowe, and Pace 1979



September 2006



Prepared By:
URS

Saltbush and greasewood shrublands are two additional upland shrub communities that occupy relatively small areas. Saltbush and greasewood shrublands occupy the margins of terraces associated with the primary, secondary, and occasional tertiary drainages. The terraces are mostly 5 to 20 feet above the drainage channel floodplains where alluvial soil materials may be as much as 30 feet deep. Fourwing saltbush and greasewood (*Sarcobatus vermiculatus*) are dominant in these communities, with sparse-to-dense understories of annual forbs and grasses.

Reclaimed land areas occupy thousands of acres of mined land in the Black Mesa Complex (8,300 acres of the Kayenta mining operation and 3,425 acres of the Black Mesa operation through 2005). This community is dominated by native and introduced grasses and shrubs. Cool-season native grass species include western wheatgrass, thickspike wheatgrass (*Agropyron dasystachyum*), Indian ricegrass, needle and thread, big squirreltail, and bottlebrush squirreltail, and common warm-season native grass species are blue grama, galleta, and alkali sacaton (*Sporobolus airoides*). The most abundant introduced perennial grass species is Russian wildrye (*Elymus junceus*), and crested wheatgrass (*Agropyron desertorum*) and intermediate wheatgrass (*Agropyron intermedium*) also are present. Fourwing saltbush is the dominant shrub species, but several other species are common. Several weedy annuals occur primarily in newer reclamation areas, including kochia (*Kochia scoparia*), Russian thistle (*Salsola iberica*), and cheatgrass (*Bromus tectorum*). Total vegetation cover ranges from about 10 to 45 percent, with average cover about 23 percent in 2004 (ESCO Associates 2005). Bare ground typically occupies 30 to 70 percent of the ground surface, with 1 to 10 percent rock cover in most areas. Species density ranges from 10 to 30 species per 1,076 square feet. Biomass production averaged 539 to 816 pounds/acre in 2004, and woody stem density averaged 3,260 to 7,178 stems per acre.

Elevations of the Black Mesa Complex generally decrease from northeast (7,200 feet above MSL) to southwest (6,100 feet above MSL); therefore, the western and southern areas of the Black Mesa Complex have lower cover of piñon/juniper woodland and a higher cover of sagebrush shrub in unmined areas. In addition, the greasewood and tamarisk (salt cedar, *Tamarix pentandra*) communities are more common because these communities occur where drainages are larger and more developed.

The 40-acre coal-slurry preparation plant site is occupied by approximately 20 acres of shrubland dominated by big sagebrush and broom snakeweed (*Gutierrezia sarothrae*), 19 acres of disturbed land, and about 1 acre of reclaimed land (BMPI 2005). The sagebrush-snakeweed shrubland is typical of sagebrush shrubland in the Black Mesa Complex. The disturbed land has very little vegetation and the reclaimed land is a former airstrip that has been seeded with the revegetation seed mix used for the Black Mesa Complex.

The proposed coal-washing facility would be located near the existing coal-slurry preparation plant and coal-storage piles. Based on an aerial photograph, the vegetation consists primarily of sagebrush shrub and/or reclaimed land.

Riparian habitat occurs along two major drainageways in linear stringers of vegetation. The stringers range from 10 to 20 feet in width, and extend from a few yards to more than 0.5 mile in length. This community occurs on the bottoms of the washes, typically occupying aggrading portions such as sandbars. The dominant species is tamarisk. Small amounts of greasewood, fourwing saltbush, and coyote willow (*Salix exigua*) are associated with the tamarisk on stable sites. The herbaceous vegetation is composed of cheatgrass, European alkali grass (*Puccinellia distans*), stickseed (*Lappula occidentalis*), and desert seepweed (*Suaeda torreyana*). This community is the same as the *Tamarix pentandra* community type in a general classification of riparian forest and scrubland types of Arizona (Szaro 1989). The largest areas mapped by ESCO Associates (2003) are on the Black Mesa mining operation area, in Moenkopi Wash, and Red Peak Valley. Similar riparian habitat occurs downstream from the mine area in Moenkopi Wash and Coal Mine Wash.

Wetland and aquatic plants occur at some of the many impoundments, including freshwater ponds, sediment ponds, and internally draining ponds in reclaimed areas. Some larger ponds have wetland plants along the margin, including tamarisk, coyote willow, bulrush (*Scirpus acutus*) and cattail (*Typha latifolia*). Aquatic plants include common poolmat (*Zanichellia palustris*), pondweeds (*Potamogeton filiformis* and *P. pectinata*), and holly-leaved water nymph (*Najas marina*). The only aquatic macrophyte in most ponds is a blue-green alga (*Chara* sp.).

3.7.1.2 Noxious Weeds and Invasive Species

The Federal Noxious Weed Act of 1974 (7 U.S.C. 28909) established a nationwide definition of noxious weeds. The State of Arizona designates weeds or invasive species as noxious under Arizona Revised Statutes (ARS) 3-201. Weeds that are not indigenous to the State, likely to be detrimental, destructive, and difficult to control or eradicate may be listed as noxious weeds by the State. Noxious weeds can out-compete native vegetation in areas of disturbance and can spread quickly in a short time span.

Table F-1 in Appendix F provides a summary of noxious weeds associated with disturbed land at various project facilities. A number of noxious and invasive plant species are known or expected to occur in the Black Mesa Complex, including bull thistle (*Cirsium vulgare*), common purslane (*Portulaca oleracea*), diffuse knapweed, field bindweed (*Convolvulus arvensis*), musk thistle (*Carduus nutans*), puncture vine (*Tribulus terrestris*), Russian knapweed (*Acroptilon repens*), Scotch thistle (*Onopordum acanthium*), and tamarisk (California Information Node 2005; ESCO Associates 2003; USGS 2004). Common purslane, bull thistle, and tamarisk are reported to be present in the mine permit area (Peabody 2004). The other species are mostly mapped along U.S. Highway 160 and Indian Route 41 in the mine vicinity (California Information Node 2005; USGS 2004).

3.7.1.3 Threatened, Endangered, and Special Status Species

The analysis of threatened, endangered, and special status species included review of FWS county lists (FWS 2005), the Navajo endangered species list (NNFWD 2005b) and Arizona Natural Heritage Program lists (Arizona Game and Fish Department [AGFD] 2006a), and evaluation of habitats and ranges. There are no federally listed, proposed, or candidate plant species known or expected to occur within the Black Mesa Complex.

No naturally occurring unique or ecologically sensitive areas have been identified on the Black Mesa Complex. The vegetation resources are well represented throughout the Great Basin and Colorado Plateau regions (Peabody 2004).

3.7.1.4 Culturally Important Plant Species

Numerous species of native plants have cultural significance to the Hopi and Navajo people for uses as food and medicine, in rituals, and for other uses such as for tools, construction, and baskets. Table F-2 in Appendix F presents a list of native plant species used for these purposes, based on published information about such uses (Begay 1979; Lomaomvaya et al. 2001; Mayes and Lacy 1989). No specific collection areas have been identified, and many of the species are widely distributed within their habitats including the Black Mesa Complex.

3.7.2 Coal-Slurry Pipeline

3.7.2.1 Coal-Slurry Pipeline: Existing Route

3.7.2.1.1 *Vegetation Types*

As mapped by Brown and Lowe (1980), the existing coal-slurry pipeline route crosses five major biotic communities: Great Basin conifer woodland, Plains and Great Basin grassland, Great Basin desertscrub, semidesert grassland, and Mohave desertscrub. The vegetation types intergrade, and there are few abrupt

changes in vegetation type because elevational changes tend to be gradual. The distribution of vegetation types is largely related to elevation, which ranges from about 6,100 to 7,200 feet above MSL at the Black Mesa Complex to about 4,200 feet above MSL at the Little Colorado River near Cameron, and then increases to 6,050 feet above MSL at the southwestern edge of the Navajo Reservation near Mesa Butte. The elevation is constant at about 6,000 feet above MSL until CSP Milepost 159, generally ranges between about 5,200 to 5,800 feet above MSL from CSP Milepost 159 to the Cottonwood Cliffs, and then drops across several basins and ranges to about 550 feet above MSL at Bullhead City.

Great Basin conifer woodland occurs along the pipeline route at Black Mesa, the area north of the San Francisco Peaks, Juniper Mountains, Cottonwood Mountains, and Peacock Mountains. Great Basin conifer woodland has been described previously for the Black Mesa Complex. The piñon/juniper woodland association located in the central and western portions of the route is generally similar, with the addition of oneseed juniper (*Juniperus monosperma*). Much of the area mapped as Great Basin conifer woodland is dominated by or is exclusively juniper. The trees are relatively short, and have a varying density from savanna to woodland to nearly closed canopy forest. The understory in savanna and woodland areas is primarily composed of species present in adjacent scrub or grassland, such as blue grama, sideoats grama (*Bouteloua curtipendula*), broom snakeweed, and big sagebrush.

Along the Moenkopi Wash terrace, the vegetation is mostly greasewood and fourwing saltbush, with narrow strips of tamarisk that vary in abundance and density. Adjoining hills and ridges are dominated by open stands of juniper or a combination of piñon and juniper.

Plains and Great Basin grassland occurs on the Hopi Reservation, in the central portions of the route from Cameron to west of Seligman, and in portions of the Chino Valley and Seventyfour Plains. Plains and Great Basin grassland is dominated by short or mid-grasses. Dominant native perennial grasses include blue grama, wheatgrasses (*Agropyron* spp.), needlegrasses (*Stipa* spp.), Indian ricegrass, galleta, junegrass (*Koeleria macrantha*), sand dropseed (*Sporobolus cryptandrus*), and squirreltail. Cheatgrass, an introduced annual grass, may be abundant. Common shrubs include fourwing saltbush, winterfat, Whipple cholla (*Opuntia whipplei*), rabbitbrush, broom snakeweed, several species of prickly pear (*Opuntia* spp.), and soapweed yucca (*Yucca glauca*). Numerous species of forbs are present, including goldeneye (*Viguiera* spp.), groundsel (*Senecio* spp.), thistles (*Cirsium* spp.), prickly poppy (*Argemone* spp.), and sunflower (*Helianthus* spp.). Much of the Plains and Great Basin grassland in Arizona has been modified by grazing and other land use effects, with resulting increases in shrub cover and decreases in grasses. Much of the degraded grassland has transitioned into Great Basin desertscrub. Grassland farther to the west has been invaded by junipers, sagebrush, and other shrubs.

Great Basin desertscrub occurs from Red Lake to Cameron on the Hopi and Navajo Reservations. These areas include the Moenkopi Plateau, Echo Cliffs, and Painted Desert to near Gray Mountain. Great Basin desertscrub as mapped by Brown and Lowe (1980) occurs primarily in the lower elevations and more arid zones of the Hopi and Navajo Reservations. Dominant species include sagebrushes (*Artemisia* spp.), saltbushes (*Atriplex* spp.), and winterfat (*Ceratorides lanata*). Other common shrub species include rabbitbrush (*Chrysothamnus* spp.), blackbrush (*Coleogyne ramosissima*), spiny hopsage (*Grayia spinosa*), Mormon tea (*Ephedra* spp.), and horsebrush (*Tetradymia* spp.). Three species of sagebrush are common—big sagebrush, Bigelow sagebrush (*Artemisia bigelovii*), and black sagebrush (*Artemisia nova*). Perennial grasses may be common or rare. Introduced annuals are common and include cheatgrass, Russian thistle, filaree (*erodium* spp), and tumble mustard (*Sisymbrium altissimum*). Shadscale is dominant in areas where precipitation is lower than in the sagebrush zone. Shale badlands are present in some areas and have little or no vegetation.

Semidesert grassland occurs in two areas east of Kingman, including 4 miles between the Cottonwood and Peacock Mountains, and in the Hualapai Valley. About 6 miles of the alignment in the Hualapai Valley pass through urban areas. This vegetation type originally was dominated by perennial bunch grasses, but is now often dominated by shrubs, half-shrubs, cacti, and forbs (Brown 1982). Common species include black grama (*Bouteloua eriopoda*), other grama species, three-awns (*Aristida* spp.), and other grasses; seasonally abundant forbs such as filaree (*Erodium cicutarium*), lupines (*Lupinus* spp.), buckwheats (*Eriogonum* spp.) and globemallows (*Sphaeralcea* spp.); leaf succulents such as yuccas (*Yucca* spp.); mesquite (*Prosopis velutina*), oneseed juniper, crucifixion thorn (*Canotia holocantha*), Mormon tea, false mesquite (*Calliandra erophylla*), catclaw acacia (*Acacia greggii*), and other shrubs. Mesquite, one-seed juniper, creosotebush, and snakeweed are common invaders. Other common species observed during field reconnaissance included desert marigold (*Baileya multiradiata*), golden paperflower (*Psilostrophe cooperi*), thistle, and beavertail cactus (*Opuntia basilaris*).

Mojave desertscrub occurs from Kingman west to the Colorado River and the Mojave Generating Station. This area includes the Cerbat Mountains west of Kingman, Sacramento Valley, Black Mountains, and Mohave Valley to the Colorado River. About 1 mile in the Sacramento Valley and about 2 miles near Bullhead City are urbanized. The dominant species are creosotebush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*). In valley areas, the creosotebushes are widely spaced, and most of the openings between shrubs are bare ground most of the year or occupied by a variety of ephemeral herbaceous species following adequate rainfall. Other shrubs and perennial herbs are more common and diverse in rocky areas, along washes, and at higher elevations. Other common species include Anderson thornbush (*Lycium andersonii*), spiny hopsage (*Grayia spinosa*), paper bag bush (*Salazaria mexicana*), flat-top buckwheat (*Eriogonum fasciculatum*), ratany (*Krameria parvifolia*), and brittlebush (*Encelia farinosa*). Joshua tree (*Yucca brevifolia*), visually dominant in some parts of the Mojave Desert, was not reported to be present along the existing alignment (Entrix 2002). A number of cacti are present, including hedgehog (*Echinocereus* spp.), silver cholla (*Opuntia echinocarpa*), Mojave prickly pear (*Opuntia erinacea*), beavertail cactus, and many-head barrel cactus (*Echinocactus polycephalus*). The Black Mountains are relatively undisturbed, while the Sacramento Valley and Cerbat Mountain areas are somewhat developed, with patches of undisturbed habitat. African mustard (*Brassica tournefortii*), an invasive species, is very common along roads in the Sacramento Valley.

3.7.2.1.2 Wetlands and Riparian Habitats

A number of xeroriparian¹ shrub species are present in areas receiving intermittent water supplies, including sandy arroyos, washes, and sub-irrigated bajadas². These species include desert willow (*Chilopsis linearis*), Mormon tea, New Mexican forestiera (*Forestiera neomexicana*), red barberry (*Berberis haematocarpa*), and smoke tree (*Dalea spinosa*) (Entrix 2002).

No wetlands are known to be present along the alignment, but small wetlands may occur in seepage areas along some washes. Narrow strips of riparian vegetation dominated by tamarisk are present along the banks of Moenkopi Wash, Begashibito Wash (with Russian olive), Little Colorado River, and some minor washes east of Cameron (Entrix 2002). There are no wetlands or riparian habitat at the Colorado River crossing.

¹ Species prevalent in dense vegetation along dry washes.

² Broad sloping depositional surface at the base of a mountain range formed of coalesced alluvial fans.

3.7.2.1.3 Noxious Weeds and Invasive Plant Species

Noxious weeds and invasive plant species known or likely to occur along the coal-slurry pipeline include African mustard, camelthorn (*Alhagi camelorum*), Dalmatian toadflax (*Linaria dalmatica*), diffuse knapweed, field bindweed, Russian knapweed, Russian olive (*Elaeagnus angustifolia*), Scotch thistle, and tamarisk (California Information Node 2005; Forest Service 2003; USGS 2004). The known distributions of these species near the coal-slurry pipeline are as follows:

- African mustard occurs near Kingman and in the Sacramento Valley.
- Camelthorn occurs in the area from Tuba City to Cameron.
- Dalmatian toadflax occurs along U.S. Highway 89 near Cameron.
- Diffuse knapweed occurs near Cameron.
- Field bindweed occurs in the vicinity of the existing route west of Valle.
- Russian knapweed and diffuse knapweed have been reported near Cameron.
- Russian olive was observed along Begashibito Wash during the field reconnaissance.
- Scotch thistle occurs near Tuba City, Cameron, and Valle, and has been observed along the route.
- Tamarisk occurs near the Colorado River and Little Colorado River at Cameron, and was observed in Moenkopi and Begashibito Washes during the field reconnaissance.

3.7.2.1.4 Endangered, Threatened, and Special Status Species

The analysis of endangered, threatened, and special status species included review of FWS county lists (FWS 2005), the Navajo endangered species list (NNFWD 2005b), Arizona Natural Heritage Program lists (AGFD 2006a), and Arizona BLM sensitive species list (BLM 2005a), and evaluation of habitats and ranges. Endangered, threatened, and other special status plant species known or expected to occur in the vicinity of the coal-slurry pipeline are listed in Table F-3 in Appendix F. Designations by several agencies are included. Two federally listed plant species are known to occur in the vicinity of the coal-slurry pipeline as follows:

- Fickeisen plains cactus (*Pediocactus peeblesianus* var. *fickeiseniae*) is a Federal candidate species known to occur within 1 mile of the pipeline route near Cameron and westward (Hutchins 2005; NNFWD 2005b). This is a small globose cactus that occurs on gravelly soils in Great Basin desertscrub communities at elevations of 4,000 to 6,000 feet above MSL. It retracts into the soil during drought.
- Welsh's milkweed (*Asclepias welshii*) is a federally listed endangered species with potential to occur in the area near Tuba City (NNFWD 2005b). It occurs on active sand dunes derived from Navajo sandstone. The nearest known location is north of Tuba City and about 0.2 mile of potentially suitable habitat is present along the route.

A number of other special status species occur or have the potential to occur along the route. Seven are known to or may occur on portions of the existing route that cross the Navajo Reservation. They include four species in Group 4 of the Navajo Endangered Species List, and one Forest Service sensitive species as follows:

- Peeble's blue star (*Amsonia peeblesii*), a robust perennial herb in the dogbane family, is known to occur within 1 mile of the route. It occurs in grassland and Great Basin desertscrub communities at elevations of 4,000 to 5,600 feet.

- Round dunebroom (*Errazurizia rotundata*) has the potential to occur along the alignment, in sandy pockets between outcroppings of Moenave sandstone at elevations of about 4,800 to 5,200 feet above MSL.
- Parish's alkali grass (*Puccinellia parishii*) has the potential to occur, if wetlands are present with white alkali crusts.
- Beath milkvetch (*Astragalus beathii*) occurs from Lees Ferry to south of Cameron, on roadsides and washes on seleniferous soils of the Moenkopi Formation (Arizona Rare Plant Committee 1994). This species is reported to occur within 3 miles of the route (Hutchins 2005).
- Cameron water-parsley (*Cymopterus megacephalus*) is reported to occur within 3 miles of the alignment. This species is a stemless perennial forb in the *Apiaceae* family that occurs on sandy, gravelly, or shaley soil in Great Basin desertscrub and desert grassland. It is known to occur near Cameron. This is a Forest Service sensitive species, but the route does not cross land administered by the Forest Service within the potential range of the species. It is not included on the Navajo list.

Additional special status plant species west of the Navajo Reservation include the following:

- Tusayan rabbitbrush (*Chrysothamnus molestus*) is a Forest Service sensitive species known to occur along the alignment within Kaibab National Forest south and east of Valle. It occurs on limestone-derived soils in piñon/juniper woodland and associated grassland above elevation 5,500 feet above MSL.
- Two-color beardtongue (*Penstemon bicolor* spp. *roseus*) occurs in the Black Mountains and is a BLM sensitive species. Although there are no known occurrences near the pipeline alignment, suitable habitat is present and the species may occur. It occurs in dry washes in volcanic hills.
- Chalk liveforever (*Dudleya pulverulenta* spp. *arizonica*) is considered vulnerable by the Nevada Natural Heritage Program (Miskow 2005) but has no status in Arizona. It occurs on rock outcrops and desert slopes.
- The Arizona Native Plant Law provides protection for many species of native plants by requiring authorization for removal, sale, and possession. It is prohibited to remove native plants for sale or other use, and the Arizona Department of Agriculture must be notified in advance of any land-clearing activities that would destroy native plants.

3.7.2.1.5 Culturally Important Plant Species

Culturally important native plant species that may occur along the portions of the existing route on the Hopi and Navajo Reservations are provided in Table F-2 in Appendix F.

3.7.2.2 Coal-Slurry Pipeline: Existing Route with Realignment (Agencies' Preferred Alternative)

The vegetation of the pipeline realignments is generally the same as the existing pipeline route. The Moenkopi Wash realignments involve moving segments of the pipeline out of the active channel, and are likely to be located primarily in saltbush and greasewood shrublands on the alluvial terraces above the wash, in proximity to the existing route. Small areas of tamarisk are present along the edge of the channel. The Kingman reroute would cross about 10 miles of semi-desert grassland southeast of Kingman and 18 miles of Mohave desertscrub in the Sacramento Valley. Portions of the desert grassland habitat have been invaded by juniper on the lower slopes of the Hualapai Mountains.

The noxious and invasive species; endangered threatened, and special status plant species; and culturally important plant species are the same as described for the existing route.

3.7.3 Project Water Supply

3.7.3.1 C Aquifer Water-Supply System (Agencies' Preferred Alternative)

3.7.3.1.1 *Water Withdrawal*

Within the modeled drawdown area, riparian vegetation associated with the C aquifer occurs primarily along portions of lower Clear Creek, lower Chevelon Creek, and Little Colorado River. Riparian vegetation typically is dominated by tamarisk. Other species that occur include grasses, sedges, common reed (*Phragmites australis*), cattail (*Typha latifolia*), tule (*Scirpus acutus*), coyote willow, Gooding's willow (*Salix goodingii*), velvet ash (*Fraxinus velutina*), and Fremont cottonwood (*Populus fremontii*).

About 285 acres of riparian vegetation occur along the lower 1.7 miles of Chevelon Creek dominated by tamarisk and Russian thistle (Lopez, Dreyer, and Gonzales 1998). Above this is about 7 miles of narrow canyon with very limited riparian vegetation. The upper part of the perennial reach has a diverse riparian community consisting of grasses, sedges, poison ivy (*Toxicodendron rydbergii*), walnut (*Juglans major*), and willow.

The lower part of Clear Creek has dense tamarisk. Most of the perennial reach is in a canyon. Velvet ash is tall but has relatively low densities. Tamarisk, common reed, cattail and bulrush (*Scirpus* sp.) are common in some areas (Clarkson and Marsh 2005a).

One Navajo Endangered Species List Group 4 species, Parish's alkali grass, potentially could occur at streams or seeps within the well-field drawdown zone, although it is not known to be present. Parish's alkali grass is a geographically widespread but rare annual grass, whose populations vary greatly in time and space (Arizona Rare Plant Committee 1994).

Information about the potential presence of endangered, threatened, and other special status species at all components of the C-aquifer water-supply system is summarized in Table F-12 and F-13 in Appendix F. Culturally important native plant species that may occur are listed in Table F-2 in Appendix F.

3.7.3.1.2 *Infrastructure*

3.7.3.1.2.1 *Well Field*

The well field is located within two vegetation communities—Great Basin desertscrub on the northeast half and Plains and Great Basin grassland on the southwest half. These communities have been described previously in the discussion of vegetation along the coal-slurry pipeline. The well field does not contain any major drainages. There are no National Wetland Inventory mapped wetlands or known areas of riparian habitat within the well field.

Noxious weeds and invasive species known or likely to occur within the well field area include camelthorn, halogeton (*Halogeton glomeratus*), musk thistle, puncture vine, Russian knapweed, Russian olive, and tamarisk (California Information Node 2005; USGS 2004). The first five species are primarily problems in rangeland and, therefore, more likely to occur. The last two species invade washes and riparian areas and are unlikely to be common because of lack of suitable habitat. All of these species have been reported in the well field or immediately adjacent areas along I-40 or near Leupp. No endangered, threatened, or other special status species are known or expected to occur in the well field area.

3.7.3.1.2.2 *C Aquifer Water-Supply Pipeline*

3.7.3.1.2.2.1 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

The distribution of vegetation types along the eastern route is associated with elevation, which ranges from about 6,700 feet above MSL near the Black Mesa Complex to 4,700 feet above MSL at the Little

Colorado River, and about 5,400 feet above MSL at Canyon Diablo. The eastern route would cross three biotic communities—Plains and Great Basin grassland, Great Basin desertscrub, and Great Basin conifer woodland.

As mapped by Brown and Lowe (1980), grassland occurs along approximately 38 miles of the eastern route, including the southern 6 miles, and from WSP Milepost 52 to 84. This vegetation type is described above in the discussion of vegetation along the coal-slurry pipeline. Much of the grassland along the eastern pipeline route is transitional to Great Basin desertscrub. Areas with shallow soils and rocky outcrops have open stands of Great Basin conifer woodland. Alluvial valleys and terraces close to a wash (within about 10 feet vertically of the wash bottom) are dominated by species such as greasewood and fourwing saltbush.

Great Basin desertscrub occurs along a total of 55 miles. Most occurs near the Little Colorado River, the Painted Desert, and upland areas near Oraibi Wash, and the remaining along Dinnebito Wash. This community also is described above for the coal-slurry pipeline. Shale badlands within this community have little or no vegetation. Great Basin conifer woodland occurs for 19 miles at the eastern route's northern end on Black Mesa. This community is the same as described for the Black Mesa Complex.

No wetlands are known to be present along the eastern route, but small wetlands may occur in seepage areas along some washes. Narrow strips of riparian vegetation dominated by tamarisk are present along the banks at the Little Colorado River crossing and other drainages.

Noxious and invasive plant species known to be present in the vicinity of the eastern pipeline route include camelthorn, halogeton, musk thistle, puncture vine, Russian knapweed, Russian olive, and tamarisk (California Information Node 2005; USGS 2004). The first five species occupy rangeland and the last two species are trees that occur primarily along washes and in riparian areas, including the Little Colorado River near Leupp. The available information on the distribution of these species is provided below, based primarily on USGS (2004) and California Information Node (2005):

- Camelthorn is widespread in Great Basin desertscrub on the southern 40 miles of the eastern route.
- Halogeton is known from a number of sites near the Little Colorado River and lower Oraibi Wash.
- Musk thistle occurs in the Kayenta and Black Mesa mining areas and along Dinnebito Wash.
- Puncture vine has been reported to occur at Dinnebito Wash.
- Russian knapweed is known from a number of locations, including Dinnebito Wash, Kykotsmovi, and Leupp.
- Russian olive occurs along the Little Colorado River near Leupp and in Oraibi Wash.
- Tamarisk occurs along the Little Colorado River and in washes.

No federally listed, proposed, candidate, threatened, or endangered plant species are known or expected to occur. Two Navajo Endangered Species List Group 4 plant species are known to be present within 3 miles of the alignment:

- Round dunebroom is a low aromatic shrub in the pea family that occurs on exposed sites in desertscrub in the Little Colorado River Valley at elevations of 4,800 to 5,200 feet above MSL. The plants grow in sandy and gravelly soils associated with sandstone and calcareous outcrops (AGFD 2005b; Arizona Rare Plant Committee 1994).

- Parish's alkali grass could potentially occur between WSP Mileposts 92 and 96 if there are wetlands present that contain white alkali crusts (NNFWD 2005b).

Culturally important native plant species that may occur are listed in Table F-2 in Appendix F.

3.7.3.1.2.2.2 C Aquifer Water-Supply Pipeline: Western Route

The western route would follow the same route as the eastern route for about the first 27 miles, and then diverge for the remainder of the route. It would cross about 6 miles of Plains and Great Basin grassland and 21.5 miles of Great Basin desertscrub. Although it would follow a different route for the remaining distance, it crosses the same vegetation types as the eastern route. Plains and Great Basin grassland occurs along the Moenkopi Plateau, and a section in the Klethla Valley along U.S. Highway 160. Great Basin desertscrub occurs for a total of 68 miles, along Painted Desert and Ward Terrace, Moenkopi Plateau, and from Coal Mine Canyon to near Cow Springs.

Great Basin conifer woodland occurs along 21 miles of the western route, along U.S. Highway 160 and Indian Route 41 on Black Mesa. Several miles are within or adjacent to mined areas in the Black Mesa mining operations.

No wetlands are known to be present along the western route, but small wetlands may occur in seepage areas along some washes. Narrow strips of riparian vegetation dominated by tamarisk are present along the banks at the Little Colorado River crossing, Moenkopi Wash, Begashibito Wash, and several other locations.

Noxious weeds and invasive plant species known or likely to occur along the western route include bull thistle, camelthorn, diffuse knapweed, field bindweed, halogeton, musk thistle, puncture vine, Russian knapweed, Russian olive, spotted knapweed, and Scotch thistle. The known distributions of some of these species are as follows, based primarily on USGS (2004) and California Information Node (2005):

- Bull thistle occurs along U.S. Highway 160.
- Camelthorn has been reported at many locations along the southern two-thirds of the route.
- Diffuse knapweed has been reported at a number of locations, including along U.S. Highway 160 and near Leupp.
- Puncture vine occurs along the portion of U.S. Highway 160 paralleled by the pipeline.
- Field bindweed is reported for a number of locations along U.S. Highway 160 and Indian Route 41.
- Halogeton has been reported only for the southern portion of the western route that it shares with eastern route.
- Musk thistle occurs along U.S. Highway 160 and in the mining operations area.
- Russian olive occurs along U.S. Highway 160, and near Leupp and Oraibi Wash.
- Scotch thistle has been reported at several locations where the western route would parallel U.S. Highway 160.
- Spotted knapweed occurs along U.S. Highway 160.
- Tamarisk is reported for the Leupp area and washes in the Black Mesa Complex area.

Table F-4 in Appendix F provides a summary of endangered, threatened, and other special status species that may occur along the western route. One federally listed threatened plant species, Welsh's milkweed, has a potential to occur if there are sand dunes derived from the Navajo Formation (NNFWD 2005b).

Two special status plant species may occur:

- Round dunebroom is considered to have a potential for occurrence from WSP Milepost 43 to 62 (NNFWD 2005b).
- Parish's alkali grass is known to occur within 3 miles of the western route from about WSP Milepost 119 to 127 (NNFWD 2005b).

Culturally important native plant species that may occur are listed in Table F-2 in Appendix F.

3.7.3.2 N Aquifer Water-Supply System

Drainages receiving groundwater discharge from the N aquifer include Chinle and Laguna Wash on the northeast side of Black Mesa, and Pasture Canyon, Moenkopi Wash, Dinnebito Wash, Oraibi Wash, Polacca Wash, and Jeddito Wash on the west and south sides of Black Mesa (GeoTrans 2005). Riparian vegetation along these washes is supported by baseflow and runoff, and includes tamarisk, coyote willow, occasional cottonwoods, and Russian olive. Both tamarisk and Russian olive are considered to be invasive species. Groundwater discharge occurs only in the unconfined portions of the aquifer and is constant throughout the year, but is typically only present as surface flow in the winter when evapotranspiration is at a minimum.

One federally listed threatened species—Navajo sedge (*Carex specuicola*)—is known to occur within the study area. This is a grass-like species restricted to seeps and hanging gardens on vertical cliffs and alcoves of the Navajo Formation (Arizona Rare Plant Committee 1994), and occurs at a number of locations north of U.S. Highway 160 near Tsegi. This species has not been affected to date by pumping from the N aquifer (Peabody 2004). In addition, Parish's alkali grass has been reported from near Tuba City and Shonto but could potentially occur at any alkaline seep, spring, or seasonally wet area within the region.

3.8 FISH AND WILDLIFE

3.8.1 Black Mesa Complex

3.8.1.1 Summary of Habitats

The vegetation types of the Black Mesa Complex are described in Section 3.7. The major types are piñon/juniper woodland, which occupies about 65 to 70 percent of the coal resource areas, and sagebrush shrub, which occupies 30 to 35 percent of the areas. Saltbush and greasewood shrub communities and riparian communities dominated by tamarisk occupy relatively small areas along drainages. Mixed conifer woodland does not occur within the Black Mesa Complex, but does occur as close as 1 mile from the northeastern corner of the Black Mesa Complex at elevations between 6,800 and 8,200 feet above MSL. Other habitats include revegetation areas, sandstone bluffs, and aquatic and wetland habitat in some impoundments. All of the major drainages in the Black Mesa Complex are intermittent. However, about 2 miles of Moenkopi Wash downstream from the confluence of Coal Mine Wash intersects the groundwater table and has extended periods of stream flow each year. Common wildlife species associated with each habitat type are listed in Table F-11 in Appendix F.

3.8.1.2 Wildlife

Twenty-six mammal species were recorded in the Black Mesa Complex during baseline wildlife studies conducted in 1979 through 1983 (Peabody 2004). Updated information on wildlife distribution and habitat was collected during a 2003 field reconnaissance (BIOME 2003). A 1979-1980 census for ungulates recorded two observations of mule deer (*Odocoileus hemionus*), both north of the Black Mesa

Complex. In 2003, 10 mule deer and numerous pellet groups of mule deer and elk (*Cervus elaphus*) were observed during biological surveys for birds and threatened and endangered species (BIOME 2003).

The sagebrush shrubland and piñon/juniper woodland support the largest small mammal populations. Deer mice (*Peromyscus maniculatus*) are the most common species trapped in the Black Mesa Complex. Piñon/juniper woodland supports piñon-mice (*Peromyscus truei*), brush mice (*Peromyscus boylii*), Ord's kangaroo rat (*Dipodomys ordii*), Stephen's woodrat (*Neotoma stephensi*), and Colorado chipmunk (*Tamias quadrivittatus*). Gunnison's prairie dogs (*Cynomys gunnisonii*) occur in grassland habitats. Black-tailed jackrabbits (*Lepus californicus*) and desert cottontails (*Sylvilagus audubonii*) occur in all habitats at Black Mesa as do coyotes (*Canis latrans*), red foxes (*Vulpes fulva*) and grey foxes (*Urocyon cinereoargenteus*). Bat surveys have not been conducted, but up to 16 species may occur.

Bird surveys have recorded a total of 203 bird species in the Black Mesa Complex, more than half of which are known to or potentially nest in the area (Peabody 2004). The highest number of birds and the greatest diversity of species is observed in summer, partly due to fledged offspring (Peabody 2004). The more common species and their habitats are presented in Table F-5 in Appendix F.

Raptor studies in the 1980s recorded a total of 22 raptor species with nine of those likely to nest in the Black Mesa Complex. Red-tailed hawks (*Buteo jamaicensis*) were the most abundant raptor species; Cooper's hawks (*Accipiter cooperii*) and sharp-shinned hawks (*Accipiter striatus*) were relatively common in coniferous woodland habitats. Later raptor surveys in 2003 recorded American kestrel (*Falco sparverius*) and Cooper's hawk. A historic red-tailed hawk nest remained inactive in 2003 (BIOME 2003). Other less common species that may breed include northern goshawk (*Accipiter gentilis*), prairie falcon (*Falco mexicanus*), western screech owl (*Otus kennicottii*), great horned owl (*Bubo virginianus*), northern pygmy owl (*Glaucidium gnoma*), and long-eared owl (*Asio otus*).

A high diversity of migratory waterfowl and shorebirds utilize the larger impoundment ponds. Mallards (*Anas platyrhynchos*) are likely the only nesting species, though redheads (*Aythya americana*), ruddy ducks (*Oxyura jamaicensis*), and American coots (*Fulica americana*) also may nest in the vicinity (Corman and Wise-Gervais 2005). Many other species may utilize the ponds during migration such as eared grebe (*Podiceps nigricollis*), great blue heron (*Ardea herodias*), blue-winged teal (*Anas discors*), green-winged teal (*Anas crecca*), cinnamon teal (*Anas cyanoptera*), northern shoveler (*Anas clypeata*), gadwall (*Anas strepera*), American wigeon (*Anas americana*), and lesser scaup (*Aythya affinis*) (Corman and Wise-Gervais 2005). Killdeer (*Charadrius vociferous*) are the only shorebirds that may nest in the Black Mesa Complex (Corman and Wise-Gervais 2005).

Reptile species observed during 2003 field reconnaissance include whiptail lizard (*Cnemidophorus* spp.), collared lizard (*Aspidocelis collaris*), sagebrush lizard (*Sceloporus graciosus*), fence lizard (*Sceloporus undulates*), and side-blotched lizard (*Uta stansburiana*) (BIOME 2003). Other common reptiles and amphibians that may occur are listed in Table F-11 in Appendix F.

The 40-acre coal-slurry preparation plant site is dominated by Great Basin desertscrub consisting of sagebrush-snakeweed shrubland, disturbed land with little vegetation, and a small portion of reclaimed land (BMPI 2005). Operational ponds present on the site are used by deer, small mammals, shorebirds, and other avian species (BMPI 2005). Bats may be present during foraging episodes over water tanks or small ponds, but the area is not considered significant habitat for bats. Mule deer are the only big game species identified in the coal-slurry preparation plant area, but they occur in low numbers (BMPI 2005). The other principal game species in the area are waterfowl, mourning doves (*Zenaidura macroura*), jackrabbits, and rabbits. Others include coyote, bobcat, red fox, and gray fox (BMPI 2005). Other wildlife are similar to those described for the Black Mesa Complex, but occurrence is limited due to disturbed habitats and human activity.

The proposed coal-washing facility would be located near the coal-slurry preparation plant, coal-storage piles, and other buildings supporting the Black Mesa mining operation. Based on an aerial photograph, the vegetation consists primarily of sagebrush shrub and/or vegetation on reclaimed land. Due to the disturbed nature of the area in and immediately adjacent to the facility, though some species of wildlife may occur on the site, such as desert cottontails, rodents, or occasional coyotes or foxes, the area is not likely a significant source of habitat for wildlife in general.

The proposed new coal-haul road corridor would be located in piñon/juniper woodland, and the site has wildlife typical of this habitat.

3.8.1.3 Fisheries and Aquatic Habitats

No natural fisheries or aquatic habitats are present at the Black Mesa Complex. Sedimentation ponds, internally draining ponds in reclaimed areas, and permanent impoundments currently provide some aquatic habitat. There are currently 158 sedimentation ponds to support the Kayenta and Black Mesa mining operations, and Peabody proposes 117 additional ponds as part of the LOM revision. Of these 267 impoundments, Peabody proposes to retain 51 as permanent impoundments in the post-mining reclaimed landscape.

3.8.1.4 Federally Listed Threatened, Endangered, Proposed, Candidate, and Other Special Status Animal Species

Seventeen special status wildlife species are known to occur or have the potential to occur in the area of the Black Mesa Complex, either as residents or as migrants/transients (Tables F-6 and F-7 in Appendix F). Four of these species—the bald eagle (*Haliaeetus leucophalus*), Mexican spotted owl (*Strix occidentalis lucida*), black-footed ferret (*Mustela nigripes*), and southwestern willow flycatcher (*Empidonax trailii extimus*)—are federally listed as threatened or endangered under the ESA.

Bald eagles have been observed occasionally. Two adults were observed in the southern portion of the Black Mesa Complex at an impoundment pond in 1985, and an individual was observed in the northern portion during the 1999 field season (BIOME 2003). The Black Mesa Complex does not contain suitable nesting habitat for bald eagles, but does provide occasional foraging habitat for migratory or wintering birds at impoundments and from roadkill or small mammals.

California condors may occur occasionally, especially as the reintroduced population grows and expands its range. Condors are naturally curious and may be attracted to human activity.

Mexican spotted owls are known to occur on Black Mesa and have been intensively studied and monitored from 1994-2001. The nearest Protected Activity Center (PAC) occurs about 0.7 mile from the active N-10 mine area, and there are no records of nesting within the permit boundary. The owls occur in mixed conifer forest, a habitat that is distinctly different than the piñon/juniper woodlands present in the mine permit area. There is also no evidence that the owls use mine reclamation or adjacent undisturbed habitat in the permit area. The closest records are in Yellow Water Canyon and in side canyons of Coal Mine Wash and Moenkopi Wash.

Suitable habitat (prairie dog towns) is present for black-footed ferret, but the species is not expected to occur and there are no known naturally occurring populations in Arizona.

At least three subspecies of southwestern willow flycatchers may be present in the area during migration, but none have been documented to breed in the region (AGFD 2002a; Corman and Wise-Gervais 2005). All drainages that support dense stands of *Tamarix* sp. with surface water or saturated soil may be

considered suitable habitat for the migrating birds. Potentially suitable habitat exists on the extreme western and northwestern portions of the Black Mesa Complex (BIOME 2003).

3.8.2 Coal-Slurry Pipeline

3.8.2.1 Coal-Slurry Pipeline: Existing Route

Most of the vegetation types that occur in the study area are crossed by the existing coal-slurry pipeline route. A more detailed description of vegetation types can be found in Section 3.7. Wildlife habitats include the vegetation types crossed by the pipeline and urban areas:

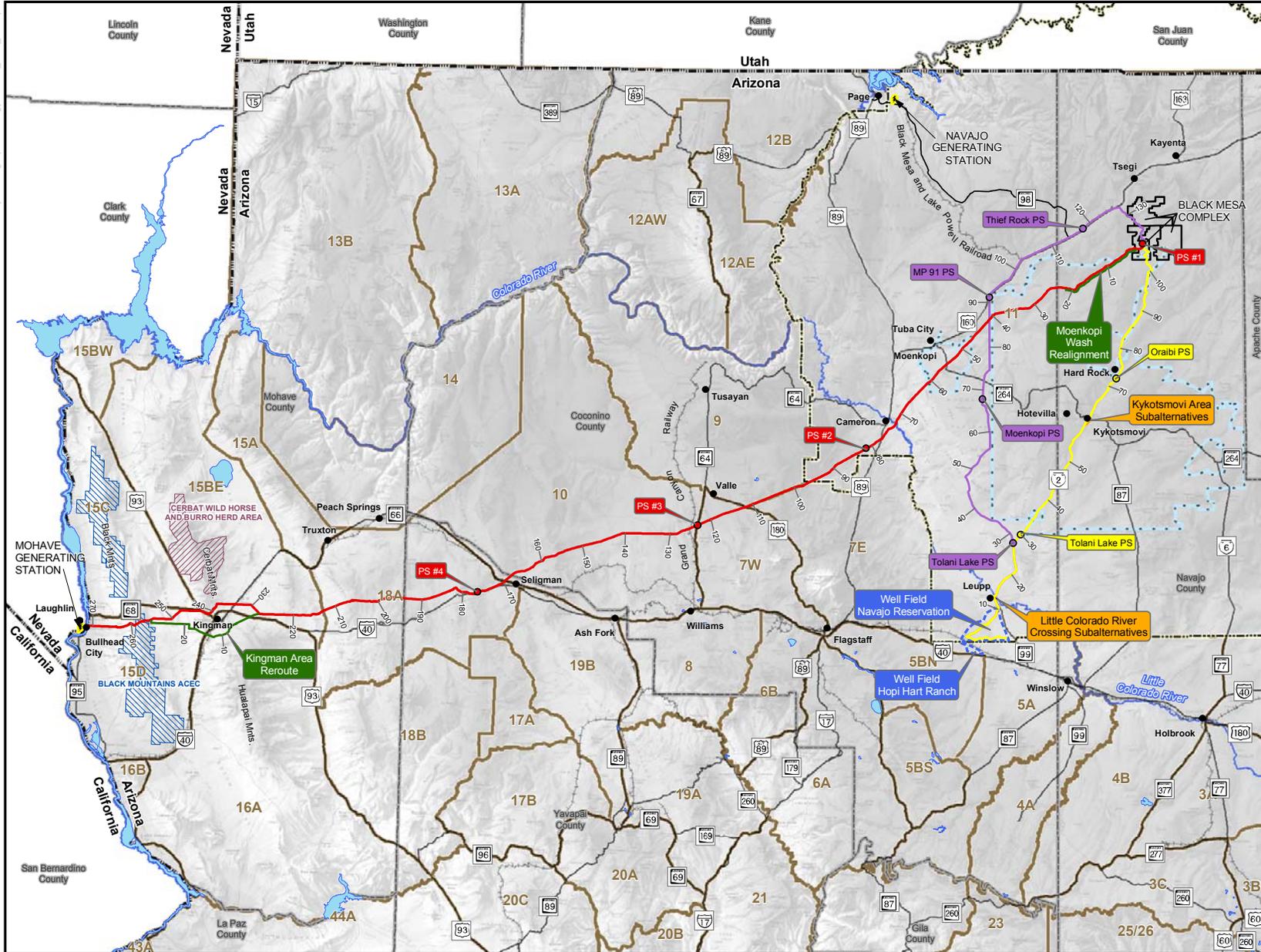
- Great Basin Conifer Woodland
- Mohave Desertscrub
- Semidesert Grassland
- Great Basin Desertscrub
- Plains and Great Basin Grassland
- Urban (Kingman and Bullhead City)

Typical wildlife associated with these habitats is listed in Table F-11 in Appendix F.

The desert bighorn sheep (*Ovis canadensis*) and wild burro (*Equus asinus*) herds in the Black Mountains are considered important resources of national significance (BLM 1995b). The Hualapai Mountains (6 or more miles south of the existing alignment) provide crucial habitat for the federally listed endangered Hualapai Mexican vole (*Microtus mexicanus hualpaiensis*), which primarily occupies dry grass/forb habitats in ponderosa pine forest and moist grass/sedge habitat along streams (BLM 1995b).

The coal-slurry pipeline crosses six AGFD game management units (GMUs) from the Navajo Reservation to the Colorado River (AGFD 2005a) (Map 3-14). From east to west, the GMUs are 7, 8, 10, 15B, 15D, and 18A. The primary game species hunted within GMUs crossed by the pipeline include mule deer, elk, pronghorn antelope (*Antilocarpa Americana*), javelina (*Tayassu tajacu*), bighorn sheep, mountain lion (*Felis concolor*), mourning dove, and Gambel's quail (*Callipepla gambelli*). Arizona GMU descriptions provide the following information (AGFD 2005a). Mule deer occur throughout, although populations are low from the Cerbat Mountains west to the Colorado River. Elk and pronghorn antelope hunting occurs from the Navajo Reservation to Kingman (GMUs 8 to 18A). Elk winter in piñon/juniper habitat within this area and pronghorn occur in open grassland. Javelina are considered common in GMU 18A, which stretches from west of Seligman to the Cottonwood Mountains. Bighorn sheep occur in the Black Mountains. Mountain lions are hunted mostly in GMUs 18A and 15B from Seligman to Kingman. Mourning dove hunting occurs mostly in GMUs 15B and 15D in the Sacramento, Hualapai, and Mohave Valleys. Gambel's quail occur mostly in the Peacock Mountains and the desert west of Kingman. On BLM-administered land, big game are managed cooperatively by AGFD and BLM's Kingman Field Office (BLM 1995b).

Wildlife movement corridors occur west of Kingman in the Cerbat and Black Mountains (Union Pass). The entire area west of Kingman is within BLM's Cerbat Wild Horse and Burro Management Area.

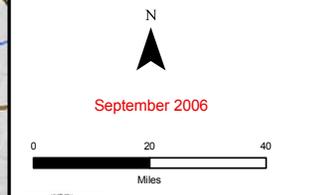


Map 3-14
Arizona Game and Fish Department
Game Management Units

Black Mesa Project EIS

LEGEND

- Coal-Slurry Pipeline**
 - Existing Route
 - Realignments
 - Proposed Water-Supply Pipeline**
 - Eastern Route (preferred alternative)
 - Subalternatives (preferred alternative)
 - Western Route
 - Other Project Features**
 - C-Aquifer Well Field
 - PS = Pump Station
 - Peabody Lease Area
 - Recreation**
 - AGFD Game Management Unit and Number
 - BLM Area of Critical Environmental Concern
 - BLM Wild Horse and Burro Herd Area
 - General Features**
 - River
 - Lake
 - Navajo Reservation
 - Hopi Reservation
 - State Boundary
 - County Boundary
 - Interstate/U.S. Highway/State Route
- SOURCES:
 URS Corporation 2005
 Bureau of Land Management 2005
 Arizona Game and Fish Department 2004



Prepared By:
URS

The Black Mountains (BLM's Black Mountains Herd Management Area) have been identified as the largest block of contiguous desert bighorn sheep habitat in Arizona and are therefore critical to the continued existence of desert bighorn sheep. The existing pipeline alignment bisects about 7 miles of medium- and high-quality desert bighorn sheep habitat (BLM 1995b). The species are highly sensitive to human disturbance, communicable disease, and inter- and intra-specific competition for food, water, and habitat (BLM 1995b). Desert bighorn sheep compete for habitat with mule deer and wild burros in the Black Mountains (BLM 1995b).

The existing coal-slurry pipeline crosses through five areas identified as conservation priorities by the Nature Conservancy: the Moenkopi Plateau east of Cameron, Aubrey Valley northeast of Seligman, Peacock/Cottonwood Mountains, Sacramento Wash, and Black Mountains South (Colorado Plateau Ecoregional Planning Team 2002; Marshall et al. 2004; Nature Conservancy of Nevada 2001). These areas were identified for conservation planning purposes based on occurrence of natural communities and rare species, and have no official status. The Nature Conservancy conservation priority areas are identified in Arizona's Comprehensive Wildlife Conservation Strategy (AGFD 2005a) as a source to be used in place of a comprehensive statewide landscape analysis, until AGFD completes its own analysis.

Golden eagles are known to nest near the existing coal-slurry pipeline route. Other potential nesting raptors include red-tailed hawk, Swainson's hawk, American kestrel, prairie falcon, great horned owl, western screech owl, and Cooper's hawk. Other common raptors likely to occur during wintering or foraging include turkey vulture (*Cathartes aura*), northern harrier (*Circus cyaneus*), ferruginous hawk (*Buteo regalis*), and rough-legged hawk (*Buteo lagopus*).

3.8.2.1.1 Fisheries and Aquatic Habitats

The only perennial water crossed by the coal-slurry pipeline is the Colorado River, near Bullhead City. Game fish present in this section of the Colorado River include rainbow trout (*Oncorhynchus mykiss*), largemouth bass (*Micropterus salmoides*), striped bass (*Morone saxatilis*), crappie (*Pomoxis nigromaculatus*), green sunfish (*Lepomis cyanellus*), and channel catfish (*Ictalurus punctatus*) (AGFD 2005c).

3.8.2.1.2 Threatened, Endangered, and Special Status Animal Species

The potential for occurrence, habitat, and status of federally listed and other special status species are summarized in Tables F-8 and F-9 in Appendix F. Federally listed threatened or endangered species potentially present where the coal-slurry pipeline would cross under the Colorado River near Bullhead City include razorback sucker (*Xyrauchen texanus*) and bonytail chub (*Gila elegans*) (AGFD 2005c; Miskow 2005). Razorback sucker critical habitat occurs upstream of Davis Dam, and critical habitat for bonytail chub occurs from Hoover Dam to Parker Dam including the area near Bullhead City. Possible bonytail chub individuals are present between Davis Dam and Parker Dam (AGFD 2001e). The Mohave population of desert tortoise (*Gopherus agassizii*) is not likely to occur on the short section of pipeline route in Nevada, as the habitat is mostly disturbed and unsuitable. Southwestern willow flycatcher is likely to occur occasionally during migration in riparian habitat in Moenkopi Wash and at the crossing of the Little Colorado River, but the subspecies of migrating willow flycatcher has not been documented. Bald eagle and California condor may occur occasionally, but no key habitat features are present.

Black-footed ferrets have been reintroduced into the Aubrey Valley. The Aubrey Valley Experimental Population Area extends along U.S. Highway 66 to Chino Point, just north of the existing coal-slurry pipeline (Van Pelt and Winstead 2003). A prairie dog colony providing potential habitat for black-footed ferrets occurs approximately 6 miles north of Seligman (Van Pelt and Winstead 2003). Prairie dog towns of sufficient size to support black-footed ferrets are not present along the pipeline route.

Other special status species known or likely to be present include ferruginous hawk, golden eagle, western burrowing owl (*Athene cunicularia hypugaea*); several species of bats near Kingman; banded Gila monster (*Heloderma suspectum*); Sonoran desert tortoise; northern leopard frog (*Rana pipiens*); and flannelmouth sucker (*Catostomus latipinnis*) (Table F-9 in Appendix F). The flannelmouth sucker was extirpated from the Colorado River below Lake Mead, but was reintroduced in the mid-1970s below Davis Dam, where populations persist until today (AGFD 2001a). Other special status species that occur include pronghorn antelope (Navajo Nation threatened species), Wupatki Arizona pocket mouse (*Perognathus amplus cineris*), milk snake (*Lampropeltis triangulum*), Maricopa tier beetle, (*Cinindela oregona maricopa*), and Navajo Jerusalem cricket (*Stenopelmatus Navajo*).

Forest Service Management Indicator Species within Ecosystem Management Area 3 are listed in Table F-10 in Appendix F, based on information provided by Kaibab National Forest. The only indicators applicable to this project are juniper titmouse (*Baeolophus ridgwayi*), mule deer, and pronghorn antelope. The Forest Service Management Indicator Species are only applicable on the approximately 5 miles of Kaibab National Forest traversed by the pipeline.

3.8.2.2 Coal-Slurry Pipeline: Existing Route with Realignment (Agencies' Preferred Alternative)

3.8.2.2.1 Habitat and Wildlife

The habitat and wildlife of the realignments are mostly the same as those described in Section 3.8.2.1 above. No fisheries or perennial aquatic habitat occur along either of the Moenkopi Wash realignments or Kingman area reroute.

The Moenkopi Wash realignments are in proximity to the existing pipeline route and would move segments of the pipeline out of the active channel. Habitat and wildlife species are mostly the same as the existing route. The major habitats present along the Moenkopi Wash realignment are Plains and Great Basin grassland and Great Basin conifer woodland. Typical wildlife associated with these habitats is presented in Table F-11 in Appendix F.

The Kingman reroute would cross about 10 miles of semidesert grassland southeast of Kingman and 18 miles of Mohave desertscrub in the Sacramento Valley. Typical wildlife of these habitats is presented in Table F-11 in Appendix F. Game species in areas along the Kingman reroute include mule deer, mourning dove, Gambel's quail, and perhaps elk. Major habitats present along the Kingman reroute are Mohave desertscrub, semidesert grassland, and Great Basin conifer woodland. Typical wildlife of these habitats is present in Table F-11 in Appendix F.

The threatened, endangered, and special status animal species are the same as described for the existing route (Table F-9 in Appendix F). Several BLM-sensitive bat species may occur on BLM land along the Kingman reroute south and southeast of Kingman. In addition, desert tortoise and banded Gila monster have several additional miles of suitable habitat along the Kingman reroute.

3.8.3 Project Water Supply

3.8.3.1 C Aquifer Water-Supply System

3.8.3.1.1 Water Withdrawal

Groundwater levels in the C aquifer primarily reflect the topography and the locations of recharge and discharge areas. Discharge areas for the C aquifer include portions of the Little Colorado River from Lyman Lake downstream to Hunt Valley and from Woodruff to Joseph City; and Silver, Chevelon, Clear, and East Clear Creeks. The nearest perennial streams where the C-aquifer discharges to the stream channel are upper East Clear, lower Clear, and lower Chevelon Creeks, located approximately 41, 26, and 33 miles, respectively, south and southwest of the proposed well field. East Clear Creek is located in the

same watershed above Clear Creek and becomes Clear Creek at its confluence with Willow Creek. Based on USGS water quality studies from June 30 to July 5, 2005, perennial flow in lower Clear Creek begins about 10 miles above the confluence with the Little Colorado River, and perennial flow in Chevelon Creek begins about 12 miles above the confluence. The winter of 2003-2004 was wetter than usual, and those base flow conditions may not be typical of average years. Some, but not all, of East Clear Creek and its tributaries are perennial (Brown 1982). Groundwater levels near the areas with perennial flow are nearly equal to the stream elevation, indicating a marginal connection between the C aquifer and East Clear Creek (SSPA 2005).

East Clear, Clear, and Chevelon Creeks have their headwaters on the Mogollon Rim and flow north and northeast to join the Little Colorado River near Winslow (Map 3-15). The lower portions of both Clear and Chevelon Creeks are perennial because groundwater discharge from the C aquifer maintains baseflow during the dry season (early summer). Their primary source of water is snowmelt and runoff from precipitation, and flows are much higher than at other times of the year. The middle portions of the streams are interrupted perennial and mostly dry during the summer, but contain permanent or semipermanent pools.

Channel substrates within the perennial reaches of lower Clear Creek and Chevelon Creek are primarily bedrock-dominated but include boulders, gravels, sands and organic detritus. Native fish species recorded within the Clear Creek watershed in 2004 and 2005 (Clarkson and Marsh 2005a, 2005b) include Little Colorado River sucker (*Catostomus* sp.) and roundtail chub (*Gila robusta*). Nonnative fish include green sunfish, fathead minnow (*Pimephales promelas*), rock bass (*Ambloplites rupestris*), plains killifish (*Fundulus zebrinus*), and common carp (*Cyprinus carpio*). Other fish recorded within these streams include native speckled dace (*Rhinichthys osculus*) and nonnative golden shiner (*Notemigonus crysoleucus*), rainbow trout (*Oncorhynchus mykiss*), and brown trout (*Salmo trutta*) (Young, Lopez, and Dorum 2001). Species recorded in lower Chevelon Creek are similar but also include native Little Colorado spinedace (*Lepidomeda vittata*), bluehead sucker (*Pantosteus discobolus*), non-native black bullhead (*Ameiurus melas*), yellow bullhead (*Ameiurus natalis*), red shiner (*Cyprinella lutrensis*), and channel catfish.

Riparian vegetation potentially related to discharge from the C aquifer occurs in the lower portions of Clear and Chevelon Creeks, and along much of the Little Colorado River. These areas are used by migrating songbirds and some breeding birds, as well as reptiles, amphibians, and mammals.

Federally listed threatened or endangered species that may occur within upper East Clear, and lower Clear and lower Chevelon Creeks are listed in Table F-12 in Appendix F.

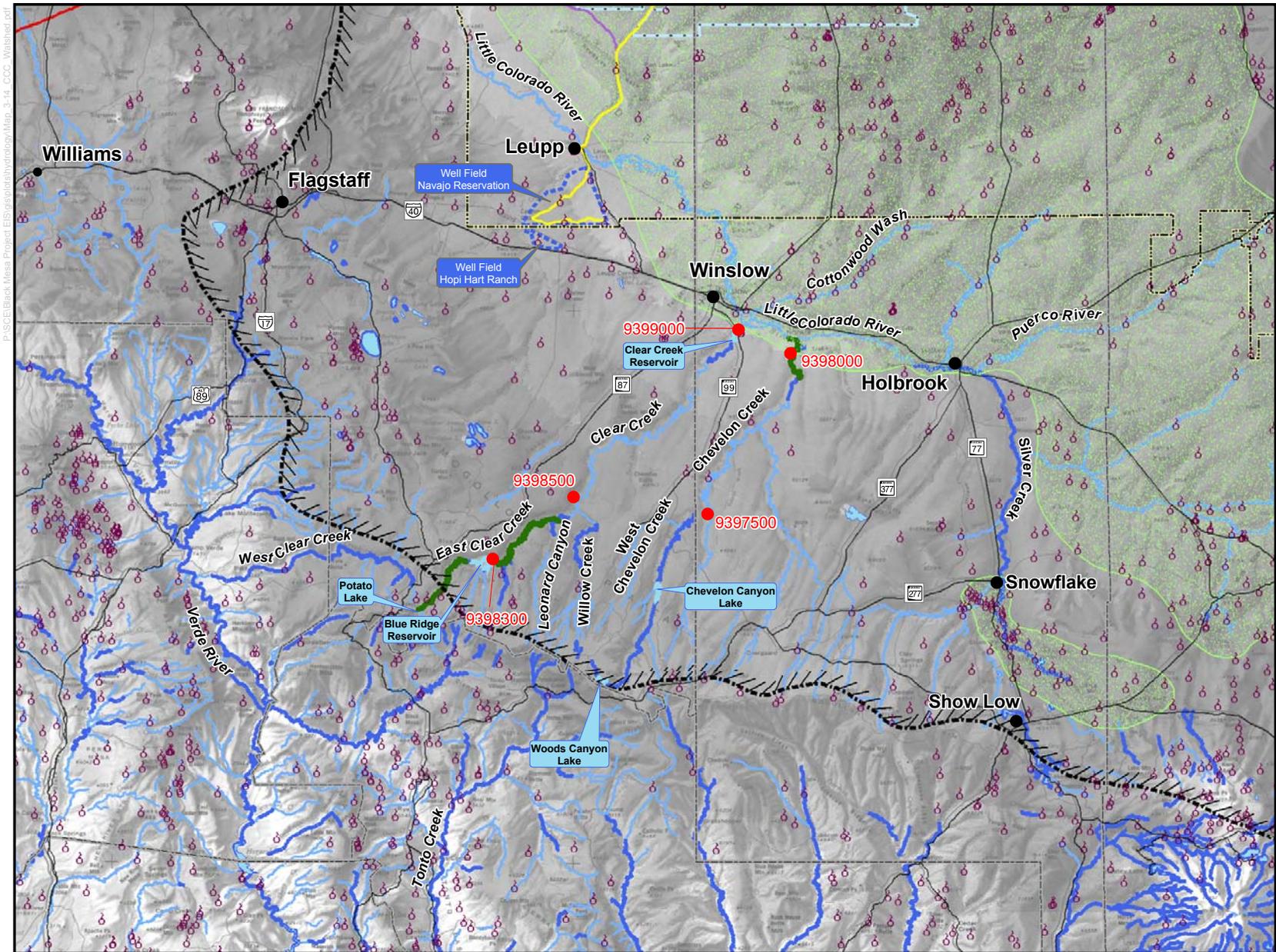
The only federally listed fish species known to occur or to be potentially present in these streams is the Little Colorado spinedace. The lower 8 miles of Chevelon Creek is designated as critical habitat, and Little Colorado spinedace is known to occur both within the critical habitat and in adjacent areas upstream. Little Colorado spinedace have not been found in lower Clear Creek since 1960, but are considered potentially present because this stream reach is downstream from known occupied habitat and because this species is notorious for extreme population fluctuations in which it seemingly disappears from an area for years or decades and then is found in abundance at a later date. Spinedace may be present in lower Clear Creek after high flows, but are unlikely to persist because of abundant predatory non-native fish and other limiting factors. East Clear Creek is generally outside of the C-aquifer groundwater discharge area, but is known to have populations of this species and contains designated critical habitat. Critical habitat for spinedace within the Clear Creek watershed occurs along approximately 18 miles of stream extending from its confluence with Clear Creek at Leonard Canyon, upstream to the Blue Ridge (recently renamed C.C. Gragin) Reservoir Dam, and approximately 13 miles of stream extending from the upper end of Blue Ridge Reservoir upstream to Potato Lake.

Several other federally listed aquatic species occur within waters that receive discharge from the C aquifer. Humpback chub (*Gila cypha*) and razorback sucker occur in the lower Little Colorado River below Blue Springs. Razorback sucker, Gila chub, and Page springsnail (*Pyrgulopsis morrisoni*) occur in streams or springs within the watersheds of the Salt, Gila, and Verde Rivers.

Southwestern willow flycatcher is likely to occur in riparian habitat along lower Clear Creek, lower Chevelon Creek, and the Little Colorado River during migration, but breeding has not been documented. Bald eagle also may occur in riparian habitat during migration and winter.

Several aquatic special status species occur within the general region surrounding the project area. They include:

- Bluehead sucker occurs in Clear Creek, Chevelon Creek, and the Little Colorado River (Young, Lopez, and Dorum 2001), but was very uncommon in Chevelon Creek during sampling in 1995 and 1996 (Lopez, Dreyer, and Gonzales 1998). Bluehead sucker occupy a variety of habitats from headwater streams to large rivers, and from cold, clear streams to warm, very turbid rivers (AGFD 2003a).
- Roundtail chub had been petitioned for Federal listing as threatened or endangered, but the FWS determined on May 3, 2005, that listing of that distinct population segment in the lower Colorado River Basin was not warranted. It is known to occur in Clear Creek and in Chevelon Creek (Voeltz 2002). Populations of roundtail chub in Chevelon Creek are considered to be “unstable-threatened” because they are uncommon and have an extremely limited range within the creek (Voeltz 2002). In addition, at least 18 non-native fish species have been recorded. All areas below Chevelon Lake are considered unsuitable for sustainable populations because of lack of perennial flow and pool habitat, and the presence of predatory nonnative fish. Populations in East Clear Creek are considered to be “stable-threatened” (Voeltz 2002). Roundtail chub were found to be common during sampling in 1999 and 2000, but were mostly found in intermittent reaches of the creek. Most individuals were found above Clear Creek Reservoir. One individual was found in lower Clear Creek during sampling in the fall of 2004 (Clarkson and Marsh 2005a), and a large population was found in a permanent pool just above the perennial portion of lower Clear Creek (Clarkson and Marsh 2005b). Roundtail chub occur in cool-to-warm waters of mid-elevation rivers and streams, and often occupy the deepest pools and eddies of large streams.
- Little Colorado River sucker is known to occur in Clear Creek, Chevelon Creek including lower reaches, and Little Colorado River (AGFD 2001b; Young et al. 2001). This species is found in creeks and small- to medium-sized rivers, mostly in pools with abundant cover.
- Northern leopard frog may occur along Clear Creek, Chevelon Creek, and the Little Colorado River, all of which are within historic habitat.

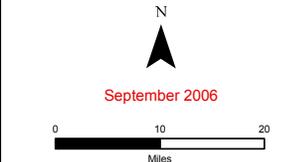


Map 3-15
Clear and Chevelon
Creek Watershed
Features

Black Mesa Project EIS

LEGEND

- Coal-Slurry Pipeline**
 - Existing Route
 - (Existing route with realignment/reroute is the preferred alternative)
 - Proposed Water-Supply Pipeline**
 - Eastern Route (preferred alternative)
 - Subalternatives (preferred alternative)
 - Western Route
 - Other Project Features**
 - C-Aquifer Well Field
 - Peabody Lease Area
 - Watershed Features**
 - Little Colorado Spinedace Critical Habitat
 - Stream Gage Station
 - Perennial Streams
 - Ephemeral Streams
 - C-Aquifer Boundary
 - Confined Area of C-Aquifer
 - Spring
 - General Features**
 - Lake
 - Navajo Reservation Boundary
 - Hopi Reservation Boundary
 - State Boundary
 - County Boundary
 - Interstate/U.S. Highway/State Route
- SOURCES:
 URS Corporation 2005, 2006
 Arizona State Land Department 2005
 U.S. FWS Critical Habitat Portal 2005



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3.8.3.1.2 *Infrastructure*

3.8.3.1.2.1 *Well Field*

Two vegetation types are present in the well field—Great Basin desertscrub on the northeast half and Plains and Great Basin grassland on the southwest half. The well field does not contain any major drainages. Wildlife species associated with these habitats is provided in Table F-11 in Appendix F.

Golden eagles are known to nest within or near the well field. Other potential nesting raptors include red-tailed hawk, Swainson's hawk, American kestrel, prairie falcon, and great horned owl. Other common raptors likely to occur during wintering or foraging include turkey vulture, northern harrier, red-tailed hawk, ferruginous hawk, and rough-legged hawk.

No aquatic habitat is present in the well field area. The nearest drainage is Canyon Diablo, which is intermittent, and there is no information on fish populations (Young et al. 2001).

The potential for occurrence of other special status species is presented in Table F-13 in Appendix F. The golden eagle, a Navajo-listed species, is known to nest within 1 mile of the proposed well field. The western burrowing owl, pale Townsend's big-eared bat (*Corynorhinus townsendii pllescens*), pronghorn antelope, kit fox (*Vulpes velox*), and milk snake may occur. Some other species have potential to occur occasionally, including ferruginous hawk.

3.8.3.1.2.2 *C Aquifer Water-Supply Pipeline*

3.8.3.1.2.2.1 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

Habitats present along the eastern route include Plains and Great Basin grassland, Great Basin desertscrub, and Great Basin conifer woodland at the higher elevations. Typical wildlife associated with these habitats is listed in Table F-11 in Appendix F. Big game species occurring along the eastern route include mule deer, but no information on herd numbers is available.

Raptors include golden eagle, ferruginous hawk, and western burrowing owl, which are discussed as special status species in Table F-13 in Appendix F. Other potential nesting species include red-tailed hawk, American kestrel, prairie falcon, great horned owl, western screech owl, and Cooper's hawk. Other common raptors likely to occur during wintering or foraging include turkey vulture, northern harrier, red-tailed hawk, ferruginous hawk, and rough-legged hawk.

No fisheries or perennial stream habitats would be crossed by the eastern route. The Little Colorado River is intermittent in the study area.

Threatened, endangered, and other special status animal species potentially present in the study area are presented in Tables F-12 and F-13 in Appendix F. Bald eagle and southwestern willow flycatcher may occur occasionally along Oraibi and Dinnebito Washes. The most important species, in terms of known occurrence, is the golden eagle. Western burrowing owl also is likely to occur. There are historic records of black-footed ferret within 3 miles of the route. Other species that may occur include ferruginous hawk, mountain plover (*Charadrius montanus*), peregrine falcon, pale Townsend's big-eared bat, pronghorn antelope, kit fox, and milk snake.

3.8.3.1.2.2.2 C Aquifer Water-Supply Pipeline: Western Route

From its beginning on the south end to about WSP Milepost 27, the western route would follow the same alignment as the eastern route, and would cross Plains and Great Basin grassland and Great Basin desertscrub. It would follow a different route for the remainder of the route, but would cross the same vegetation types as the eastern route; therefore, wildlife would be similar as those described for the eastern route. The species of raptors likely to occur along the western route are the same those likely to occur along the eastern route.

The potential for occurrence of threatened or endangered species is the same as that of the eastern route, except that Mexican spotted owl is known to occur within 3 miles along the northern portion of the route. Southwestern willow flycatchers may occur occasionally in riparian habitat along streams that would be crossed by the western route, including Dinnebito Wash, Moenkopi Wash, and Begashibito Wash. Two special-status raptor species also occur along the western route, including golden eagle nests within 1 mile of the route in both the southern and northern sections, and northern goshawk nests within 1 mile in the northern part of the route.

3.8.3.2 **N Aquifer Water-Supply System**

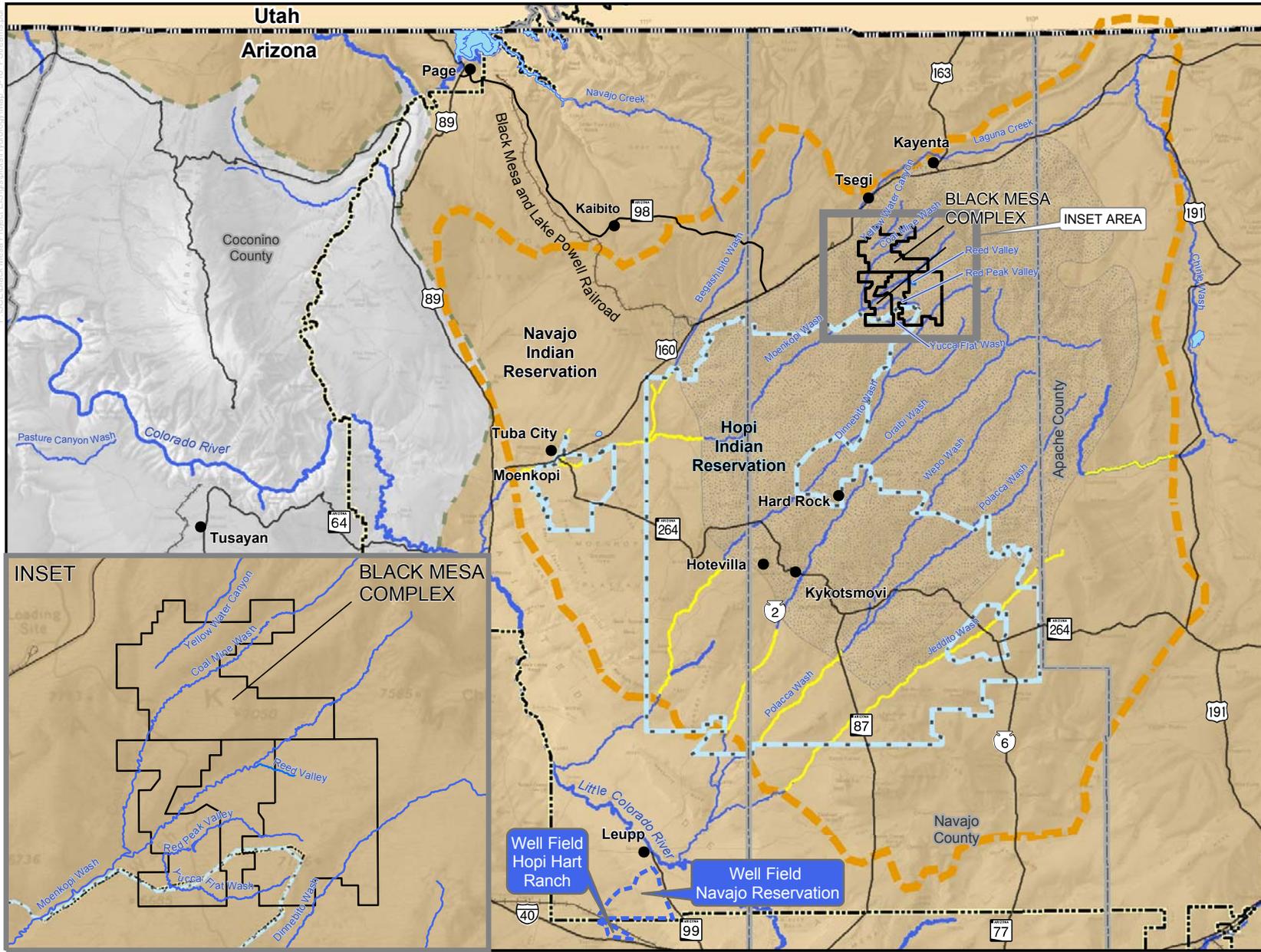
Several major washes have riparian vegetation and seasonal stream flow resulting from discharge of groundwater from the N aquifer, including Moenkopi Wash, Pasture Canyon, Dinnebito Wash, Oraibi Wash, Polacca Wash, Jeddito Wash, Begashibito Wash, Chinle Wash, and Laguna Creek (Map 3-16). All of these streams are intermittent and are not habitat for threatened, endangered, or special status fish species. The riparian habitats in these washes provide habitat for migrating songbirds. Southwestern willow flycatcher, a federally listed endangered species, occurs during migration but is not known to breed in the area. Bald eagles could occur occasionally. Northern leopard frogs are potentially present.

3.9 **LAND USE**

The study area examined for land use spans northern Arizona between Kayenta, Arizona, and Laughlin, Nevada, and includes five counties—Navajo, Coconino, Yavapai, and Mohave Counties in Arizona, and Clark County in Nevada (Map 3-17). Land use patterns have been influenced by a variety of factors, most notably by surface management and major transportation corridors. Land includes Federal land administered by the Forest Service (Kaibab National Forest) and BLM (Kingman Field Office, Lake Havasu Field Office, and Phoenix Field Office), State Trust Land administered by the Arizona State Land Department (ASLD), privately owned land, and American Indian Reservations held in Trust by the Federal Government for the Hopi Tribe and Navajo Nation. Both tribes own land outside the boundaries of their respective reservations—for example, the Hopi Tribe owns Hart Ranch near Winslow, Arizona, and the Navajo Nation owns Big Boquillas Ranch near Seligman, Arizona.

Most Federal land, State Trust Land, and tribal land in the study area, as well as much of the private land, is used for ranching and livestock grazing. The BIA and tribal grazing committees, ASLD, Forest Service, and BLM all manage grazing within the study area. The BIA issues grazing permits for large portions of land on the Hopi and Navajo Reservations. Descriptions of the range units and their respective carrying capacities are provided in Tables G-1 through G-5 in Appendix G.

PN\SC\Black Mesa Project EIS\spatial\hydrology\Map 3-16_PotentialRiparianAreas.dwg



Map 3-16
Riparian Areas Potentially Associated with N-Aquifer Discharge

Black Mesa Project EIS

- LEGEND**
- Other Project Features**
- C-Aquifer Well Field
 - Peabody Lease Area
 - Potential Riparian Areas
 - Streams
- Aquifers**
- C-Aquifer
 - N-Aquifer
 - Confined Area of N-Aquifer

- General Features**
- Lake
 - Interstate/U.S. Highway/State Route
 - Navajo Reservation Boundary
 - Hopi Reservation Boundary
 - State Boundary
 - County Boundary

SOURCES:
 URS Corporation 2005.
 USGS 2005
 USGS Water Resources 2006
 Bureau of Reclamation 2005

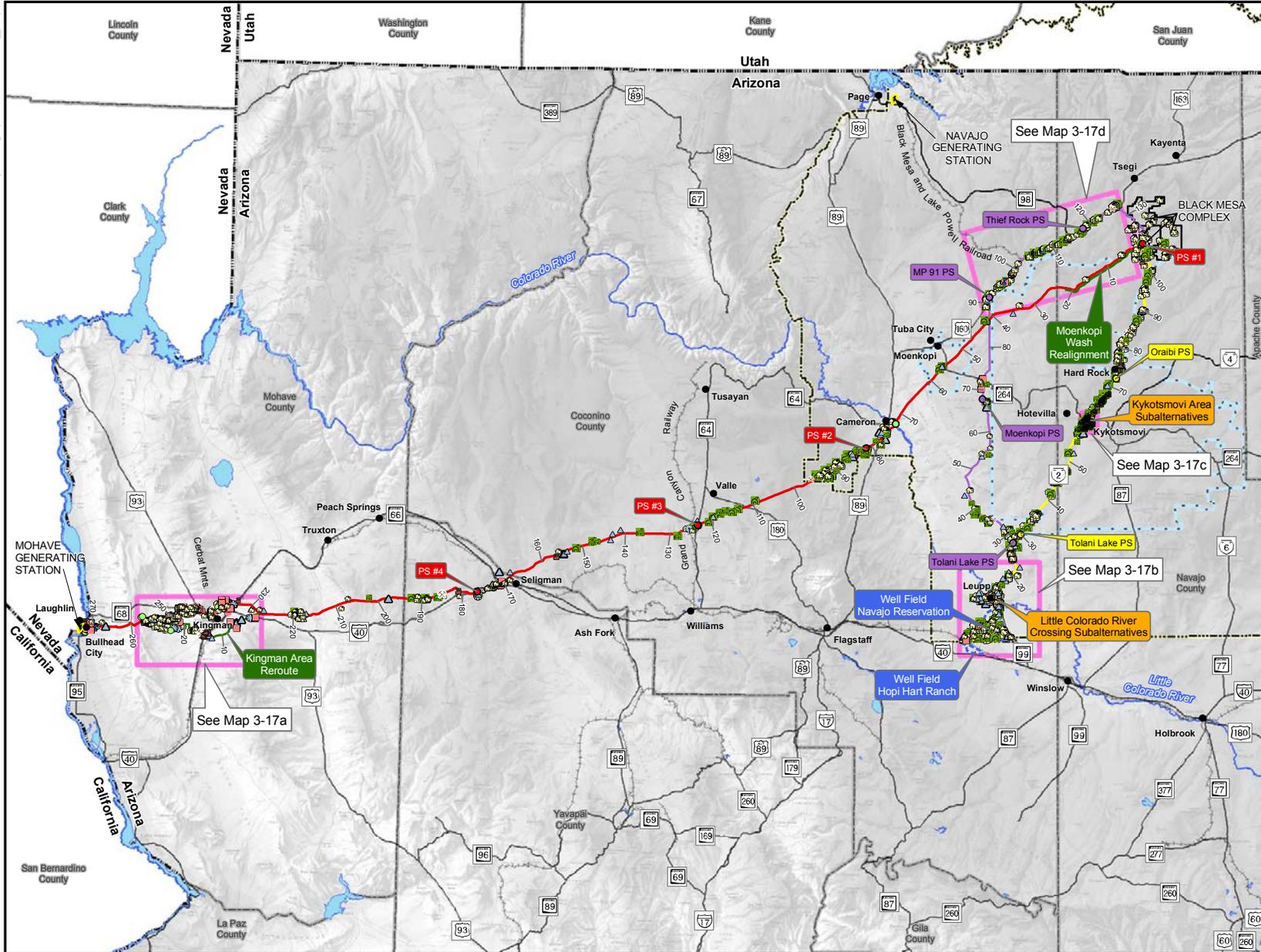
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September 2006

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Prepared By:
URS



Map 3-17 Existing Land Use

Black Mesa Project EIS

LEGEND

- Coal-Slurry Pipeline**
 - Existing Route
 - Realignments
(Existing route with realignment/reroute is the preferred alternative)
- Water-Supply Pipeline**
 - Eastern Route (preferred alternative)
 - Subalternatives (preferred alternative)
 - Western Route
- Other Project Features**
 - C-Aquifer Well Field
 - PS = Pump Station
 - Peabody Lease Area

Existing Land Use*

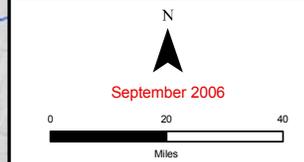
- Residential
- Commercial/Mixed Use
- Industrial
- Extraction - Mining
- Public/Quasi-Public
- School/Educational
- Air Facilities
- Agricultural (Includes livestock corral, and water tanks)
- Parks/Recreation/Preservation
- Pipeline
- Pipeline Pump Station (Natural gas or coal-slurry)
- Utilities (Includes power substations and water tanks)

*Note: Land uses are shown for areas within 2 miles of an alignment.

General Features

- River
- Lake
- Navajo Reservation Boundary
- Hopi Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route

SOURCES:
URS Corporation 2005



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URS

With grazing the predominant land use, most of the land within and near the entire study area is unoccupied, or is occupied by either dispersed residents or by those living remotely in small- to medium-sized communities. The majority of the Hopi population lives within community mixed-use areas that include residential, commercial, industrial, and public facilities—such as in Kykotsmovi, Moenkopi, and Hotevilla. Public facilities such as schools and health care centers are not well integrated into the communities, but are located on the peripheries (Hopi Office of Community Planning & Economic Development 2001). Navajo people have traditionally lived in dispersed, remote locations surrounded by ample land, but today many Navajo people live in large, mixed-use communities such as Leupp, Hard Rock, Kayenta, Cameron, and Tuba City. The notable exceptions to the pattern of dispersed residential use on the Hopi and Navajo Reservations occur mostly off the reservations in western Arizona, and in areas along major transportation routes. In these areas, residential uses appear to be more clustered and associated with the communities of Kingman and nearby Sacramento/Golden Valley, Bullhead City, and South Mohave Valley, Arizona, and Laughlin, Nevada.

Commercial land uses, such as gas stations and small convenience stores, are dispersed throughout the study area along major transportation corridors (U.S. Highway 160, U.S. Highway 89, U.S. Highway 180, Arizona Highway 66, and I-40) and in association with residential uses (Map 3-17a). Commercial uses are greater in the western portion of the study area and are largely associated with the communities of Kingman and nearby Sacramento/Golden Valley, Bullhead City, South Mohave Valley, and Laughlin.

The most prominent industrial land uses in the study area are the mining operations at the Black Mesa Complex, coal-slurry pipeline (which currently is not in operation), and the Mohave Generating Station. In addition, there are airports and other industrial uses in Kingman and Bullhead City.

Most of the agriculture in the study area is associated with residences (i.e., small family gardens), with small fields on the Hopi Reservation. Most Hopi farmers use a cultivation method known as dry farming and have several small fields in different locations, such as at the base of mesas, on sand slopes, in small canyons, along alluvial plains in washes, or in the valleys between mesas.

3.9.1 Black Mesa Complex

The Black Mesa Complex is located on approximately 101 square miles of land leased from the Hopi Tribe and Navajo Nation (Peabody 1986). The lease area covers 64,858 acres on the northern part of the Black Mesa just south of Kayenta, with additional grant-of-easements for approximately 361 acres (Peabody 1986). Approximately 1,860 acres in the northeast corner of the lease area are neither in the permanent permit area nor the proposed permit area.

The Hopi and Navajo Reservation land within the complex includes approximately 40,000 acres of the former Navajo Hopi Joint Use Area, where the tribes have joint and equal interests in the underlying minerals but where the surface land has been partitioned—approximately 6,130 acres to the Hopi Tribe and 33,860 acres to the Navajo Nation. The remaining acreage within the lease area (approximately 24,850 acres) is on the Navajo Reservation, where the Navajo Nation holds exclusive rights to surface and mineral interests. Table 3-17 shows the number of acres of Hopi and Navajo Reservation land in the Black Mesa Complex divided by chapter, within the permanent program permit area and the currently unpermitted area.

Table 3-17 Acres of Hopi and Navajo Reservation Land in the Black Mesa Complex

Navajo Chapter/Hopi Reservation	Permanent Program Permit Area (acres)	Unpermitted Area (acres)
Chilchinbito Chapter	25,700	9,500
Forest Lake Chapter	15,400	5,750
Shonto Chapter	-	800
Hopi Reservation	3,000	2,850
Total ¹	44,100	18,900

NOTE: ¹ Reported acres are approximate.

The permanent permit area of the Black Mesa Complex comprises approximately 3,000 acres of the Hopi Reservation and 41,100 acres of the Navajo Reservation. The lease area contains 68 residences (SWCA Environmental Consultants 2005). A map of residence locations (SWCA Environmental Consultants 2005) indicates that about 50 residences are located within the permanent program permit area. Coal facilities at the mine include three coal preparation areas. Peabody obtained a grant-of-easement in August 1996 for two parcels on the permanently permitted area, totaling about 78 acres for an overland conveyor, overland conveyor maintenance roads and transfer facilities, 69kV transmission line, and seven sedimentation ponds, including access roads (OSM 1990).

The unpermitted area of the Black Mesa Complex is located on approximately 2,850 acres of the Hopi Reservation and 16,050 acres on the Navajo Reservation. According to the map of residence locations (SWCA Environmental Consultants 2005), approximately 18 residences are located within the currently unpermitted area. Peabody obtained a grant-of-easement in August 1996 for two parcels (about 284 acres) on the currently unpermitted area, where a haul road (Indian Route 41), a 69kV transmission line, water and telephone lines, utility access roads, two sedimentation ponds, a rock borrow area, and an access road to the Navajo water well are located.

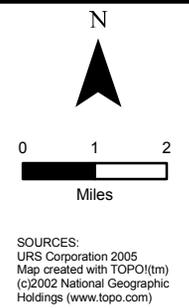
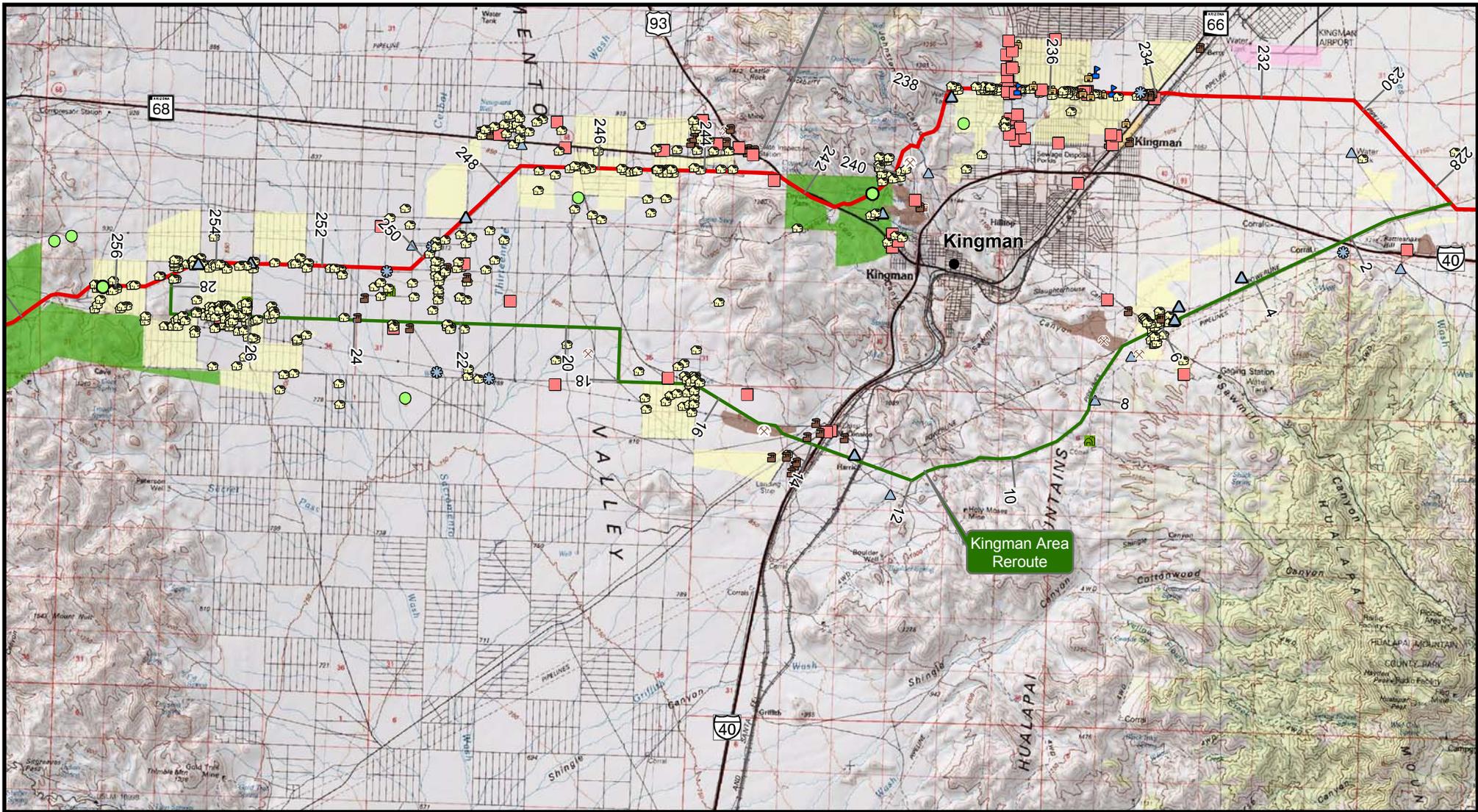
The site for the proposed coal-washing facility is located adjacent to industrial structures associated with the coal-slurry preparation plant. The closest residence is approximately 1,500 feet to the north of the site, just outside the complex (Peabody 1986). Within the complex, the closest residence is approximately 4,500 feet south of the site (Peabody 1986). Grazing and perhaps plant collection for construction, heating, medicinal, ceremonial, and edible purposes occur in the vicinity.

The coal-slurry preparation plant occupies 40 acres of land leased by BMPI from both the Hopi Tribe and Navajo Nation.

The proposed coal-haul road would pass through land used year-round for livestock grazing. The sole exception to this land use is one residence, located approximately 250 feet north of the proposed road alignment.

The Black Mesa Complex is surrounded by land used for the same purposes—primarily grazing, with intermittent residences (OSM 1990).

There are two rights-of-way held by Peabody outside the Black Mesa Complex that are associated with the mining operation. The first is designated for an overland conveyor and rail-loading site, located north of the mining complex. The site occupies a total area of approximately 88 acres. The second accommodates a 69kV power line, located generally between two coal resource areas, extending southeast and off the Black Mesa Complex, and then to the west. The approximate area is 9 acres (OSM 1990).



LEGEND

Coal-Slurry Pipeline
 — Existing Route
 — Reroute
 (Existing route with realignment/reroute is the preferred alternative)

General Features
 — Interstate/U.S. Highway/
 State Route

- Existing Land Use***
- Residential
 - Commercial/Mixed Use
 - Public/Quasi-Public
 - School/Educational
 - Agricultural (Includes livestock corral, and water tanks)
 - Parks/Recreation/Preservation
 - Industrial
 - Extraction - Mining
 - Pipeline
 - Pipeline Pump Station (Natural gas or coal-slurry)
 - Utilities (Includes power substations and water tanks)

- Residential
 - Air Facility
 - Parks/Recreation/Preservation
 - Industrial
- *Note: Land uses are shown for areas within 2 miles of an alignment.

**Existing Land Use:
Kingman Area**

Black Mesa Project EIS

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Map 3-17a

Residences on the Black Mesa Complex consist of individual family dwellings or extended family camps with several dwellings—there are no concentrated population centers (Peabody 1986). Land within the Black Mesa Complex is currently home to approximately 68 individual households (Peabody 1986). Households are relocated at Peabody’s expense as areas become affected by surface mining activities (Peabody 1986). Thirty residences have been relocated since mining within the Black Mesa Complex began (Wendt 2005). In a few cases, families have been relocated more than once.

Grazing within the complex continues year-round. There are four range units (Hopi and Navajo) on or adjacent to the Black Mesa Complex, with a combined total of 50,852 sheep units (refer to Tables G-1 and G-2 in Appendix G). All classes of livestock are grazed.

The presence of wildlife habitat and associated species on the Black Mesa Complex encourages recreational activities such as hunting.

There is little commercial development on or within 5 miles of the Black Mesa Complex. A gas station with a convenience store is located north of the complex at the intersection of U.S. Highway 160 and Indian Route 41. The closest commercial area with food and lodging services is at Tsegi on U.S. Highway 160 north of the Black Mesa Complex. The next closest commercial area is Kayenta, approximately 15 miles northeast of the complex.

Peabody’s mining operations, including transportation and support facilities, are the sole industrial uses currently in operation within the Black Mesa Complex (Peabody 1986).

Family gardens associated with residences occur frequently within the Black Mesa Complex, and there are 31 small fields within the complex that are or have been used for the production of adapted crops, particularly corn for domestic use (Peabody 1986). The total area of all plots equals 138 acres, with individual plots averaging approximately 5 acres (Peabody 1986). The land on the Black Mesa Complex has received a negative determination as prime farmland from the NRCS (Peabody 1986).

The Hopi and Navajo people use the plants in the area of the Black Mesa Complex for construction, heating, medicinal, ceremonial, and edible purposes (OSM 1990). Unknown quantities of piñon pine, Utah juniper, and one-seed juniper trees that dominate the Black Mesa Complex are harvested for firewood, fence posts, and construction materials.

3.9.2 Coal-Slurry Pipeline

3.9.2.1 Coal-Slurry Pipeline: Existing Route

The existing pipeline route crosses land under Federal, State, and tribal jurisdictions. It crosses the Navajo Nation’s Big Boquillas Ranch between CSP Mileposts 158 and 170 (refer to Map 3-17). The ranch is located near Seligman in Chino Valley beyond the Navajo Reservation boundary. Land along most of the route is used for livestock grazing.

The pipeline passes within 1 mile of dispersed residences (including hogans) along some portions of the route, and crosses some moderately dense residential areas outside urban areas and along major transportation routes (i.e., outlying areas of Seligman, Kingman, Golden Valley, Bullhead City, and Laughlin) (refer to Map 3-17 and 3-17a). Residential developments within 250 feet (or a 500-foot corridor) of the existing route are dispersed along the route.

Permitted livestock grazing is prevalent along the existing pipeline route, except in more developed areas, and corrals and water tanks associated with grazing are dispersed throughout the study corridor. Tribal land crossed by the existing route is used primarily for livestock grazing. The existing pipeline route

crosses grazing allotments on the Kaibab National Forest, used by two permit holders that collectively use approximately 46,550 acres (with approximately 2,500 animal unit months [AUMs]). All State Trust Land in the study area—in Coconino, Yavapai, and Mohave Counties—is used for grazing (with the exception of a small area near Bullhead City). The existing route crosses 20 grazing allotments on State Trust Land (with a total of 105,373 AUMs), and approximately six allotments on BLM-administered land (4,713 AUMs) (refer to Tables G-1 through G-5 in Appendix G). A large area of BLM land, just east and south of Bullhead City, is closed to grazing due to special designations, and most of the land west of Kingman is closed to domestic sheep and goat grazing.

The more densely populated areas along the route, Seligman, Kingman, Golden Valley, and Bullhead City, have the typical development associated with urbanization, including commercial and public buildings (e.g., office buildings, post offices). The pipeline passes within 500 feet of a hotel isolated from the denser urban area near CSP Milepost 81 along U.S. Highway 89, and within 500 feet of schools in denser urban areas such as Kingman. Industrial land uses occur within the Black Mesa Complex where the existing route begins at the coal-slurry preparation plant (currently dormant) and at the pump stations along the coal-slurry pipeline. General industrial areas are located within the more developed areas such as Kingman and Bullhead City.

No agricultural fields were identified within 250 feet of the existing route, with the exception of family gardens associated with residences on the Navajo Reservation. American Farmland Trust identified high-quality farmland on private and State Trust Land within a low-density development area near Seligman in Yavapai County, Arizona, crossed by the pipeline for approximately 10 miles (between CSP Mileposts 170 and 180). However, consultation with NRCS resulted in a negative determination of prime and unique farmland occurring at any of the project components, including that segment of the pipeline.

Multiple high-voltage power lines ranging from 69kV to 500kV cross and parallel the existing pipeline route between CSP Mileposts 75 and 80, CSP Mileposts 174 and 179, and as the pipeline approaches the Mohave Generating Station (near CSP Mileposts 202, 217, and 227, and sporadically between CSP Mileposts 240 and 271). A 230kV power line crosses the existing route near CSP Milepost 257 within BLM's Black Mountain Area of Critical Environmental Concern (ACEC). The pipeline crosses through the Kaibab National Forest within a utility corridor designated by the Forest Service between CSP Mileposts 113 and 117 (Forest Service 1996). It follows a utility corridor designated by the BLM within the Black Mountain and abuts the Mount Nutt Wilderness Area (BLM 1993). The pipeline crosses the Blue Canyon Special Management Area (between CSP Mileposts 30 and 32), an area dedicated by the Hopi Tribe to serve outdoor recreation and conservation purposes. However, the area remains undeveloped for outdoor recreation uses at this time.

Most of the land within the Hopi Reservation is planned for agriculture and range use, with the exception of the major washes that cross the reservation, which are identified as conservation areas with recreational opportunities (Hopi Office of Community Planning & Economic Development 2001). The planned land use places development constraints on these areas. On the Navajo Reservation, the draft Forest Lake Chapter Land Use Plan did not identify future uses for the area crossed by the pipeline (Navajo Nation Division of Community Development 2003). The area crossed by the pipeline within the Shonto Chapter (0.9 mile) has been identified for open space used for grazing. The Chilchinbito, Tuba City, Coal Mine Mesa, and Cameron Chapters have not developed land use plans as of July 2005.

In Coconino County, the existing pipeline passes through land zoned for residential development with associated agricultural uses (CSP Milepost 96 to 170). In Yavapai County, it passes through unincorporated land zoned for rural residential development (CSP Mileposts 170 and 194) (Yavapai County 2003). It passes through unincorporated land in Mohave County (intermittently between CSP Mileposts 194 and 272) that has been identified for rural, industrial, and commercial development

(Mohave County 2005). The land uses identified by the Mohave County General Plan are land use categories that are more general than zoning districts.

According to the Kingman General Plan, industrial development is planned near the airport industrial park (north of the existing route), and residential development is planned south of the existing route near CSP Milepost 231 to 234. The plan designates land for development of new commercial and medical facilities, parks, and residential areas, including higher-end infill housing and multiple-family developments, to be interspersed within areas of older, affordable housing. The largest concentration of residential growth is expected on the east side of Kingman.

The Cerbat Foothills Recreation Area has been identified for open space preservation and includes land owned by the City of Kingman and land managed by the BLM. The existing route crosses this open space land between CSP Mileposts 240 and 244 (City of Kingman 2005).

According to the Bullhead City General Plan, future residential uses are planned (CSP Milepost 268 to 269), as are future industrial/commercial uses (CSP Milepost 269 to 273). The proposed Colorado River Heritage Trail passes through the pipeline right-of-way within Bullhead City (near CSP Milepost 275) (Bullhead City 2002). Land within the existing pipeline route is planned for future public/industrial/commercial development (CSP Milepost 270 to 272).

BLM has identified non-Federal land along the existing route for acquisition, near I-40 between Kingman and Bullhead City (between CSP Mileposts 239 and 243) (BLM 1993). This land is located within and near the Cerbat Mountains in Sections 11, 10, 16, and 17 of T. 21 N., R. 17 W.

ASLD has developed conceptual land use plans that have been incorporated into the City of Kingman and the Bullhead City general plans. Two planning classifications have been identified by ASLD for particular parcels of State Trust Land—conceptual plans and development plans. Within the Kingman area, the existing pipeline parallels, within 500 feet, land of both classifications (between CSP Mileposts 232 and 238). Near the Bullhead City area the pipeline parallels conceptually planned residential parcels and public/quasi-public parcels (near CSP Mileposts 267, 269, and 270).

3.9.2.2 Coal-Slurry Pipeline: Existing Route with Realignment (Agencies' Preferred Alternative)

The Moenkopi Wash realignments could cross Federal land, State Trust Land, and tribal lands, where land is used primarily for livestock grazing. The Navajo Nation Shonto Chapter Comprehensive Land Use Plan identifies Shonto Chapter land along the route of the realignments for future grazing open space.

The Kingman reroute would pass within 500 feet of developed areas in the following locations: residential (near reroute Mileposts 6 and 17 and between reroute Mileposts 22 and 28); commercial (reroute Milepost 17, near reroute Milepost 23, and between reroute Mileposts 26 and 27); and industrial (reroute Mileposts 6, 7, 23, and 24, between reroute Mileposts 13 and 16).

Between reroute Mileposts 0 and 11, it would pass areas zoned for parks and open space and residential development. Between reroute Mileposts 11 and 16, Mohave County has identified land for industrial and commercial development. Between reroute Mileposts 16 and 17, land is zoned for various levels of rural/urban and suburban development (City of Kingman 2003).

Golden Valley Ranch, a large development approved in December 2005, will be located south of the reroute (from reroute Milepost 17 to 21, in Sections 2, 3, 4, 8, 9, 10, 11, 16, and part of 14 of T. 20 N., R. 18 W.) and will include residential, commercial, and educational facilities, and parks and recreation areas. Parks and commercial and residential developments are planned adjacent to the reroute (with one park

located north of Shinarump Road near T. 21 N., R. 18 W.). As of March 2006, land located southwest of reroute Milepost 18 is being cleared for this development.

The BLM has identified several areas along the Kingman reroute for land tenure adjustments: land for acquisition near reroute Mileposts 11 and 12 (in Sections 2 and 3 of T. 20 N., R. 17 W.); land for disposal near reroute Milepost 2 and between reroute Mileposts 13 and 16 (in Section 13 of T. 21 N., R. 16 W., and in Sections 6, 8, and 9 of T. 20 N., R. 17 W.); and land for recreation and public purposes near reroute Milepost 15 (in Section 6 of T. 20 N., R. 17 W.).

3.9.3 C Aquifer Water-Supply System

3.9.3.1 Well Field

Most of the well field area is within the Navajo Reservation, except for approximately 2,750 acres that extend south of the BNSF Railroad into the Hart Ranch, which is owned by the Hopi Tribe (Map 3-17b). (Portions of the ranch are managed by ASLD.) Of the 2,750 acres, approximately 1,500 acres of the Hopi Hart Ranch are owned by the Hopi Tribe, and 1,250 acres are managed by the State. Hart Ranch and State Trust Land within the well field are under the jurisdiction of Coconino County ordinances and are zoned for rural residential development (Coconino County 2003).

Dispersed housing, corrals, and windmill wells and water tanks associated with livestock grazing are located within the well field area. This is consistent with the Leupp Chapter Land Use Plan. The Canyon Diablo Railroad ghost town is located within the well field just north of the BNSF Railroad. This has been designated as a historical site (by the Leupp Chapter) that is open to visitors.

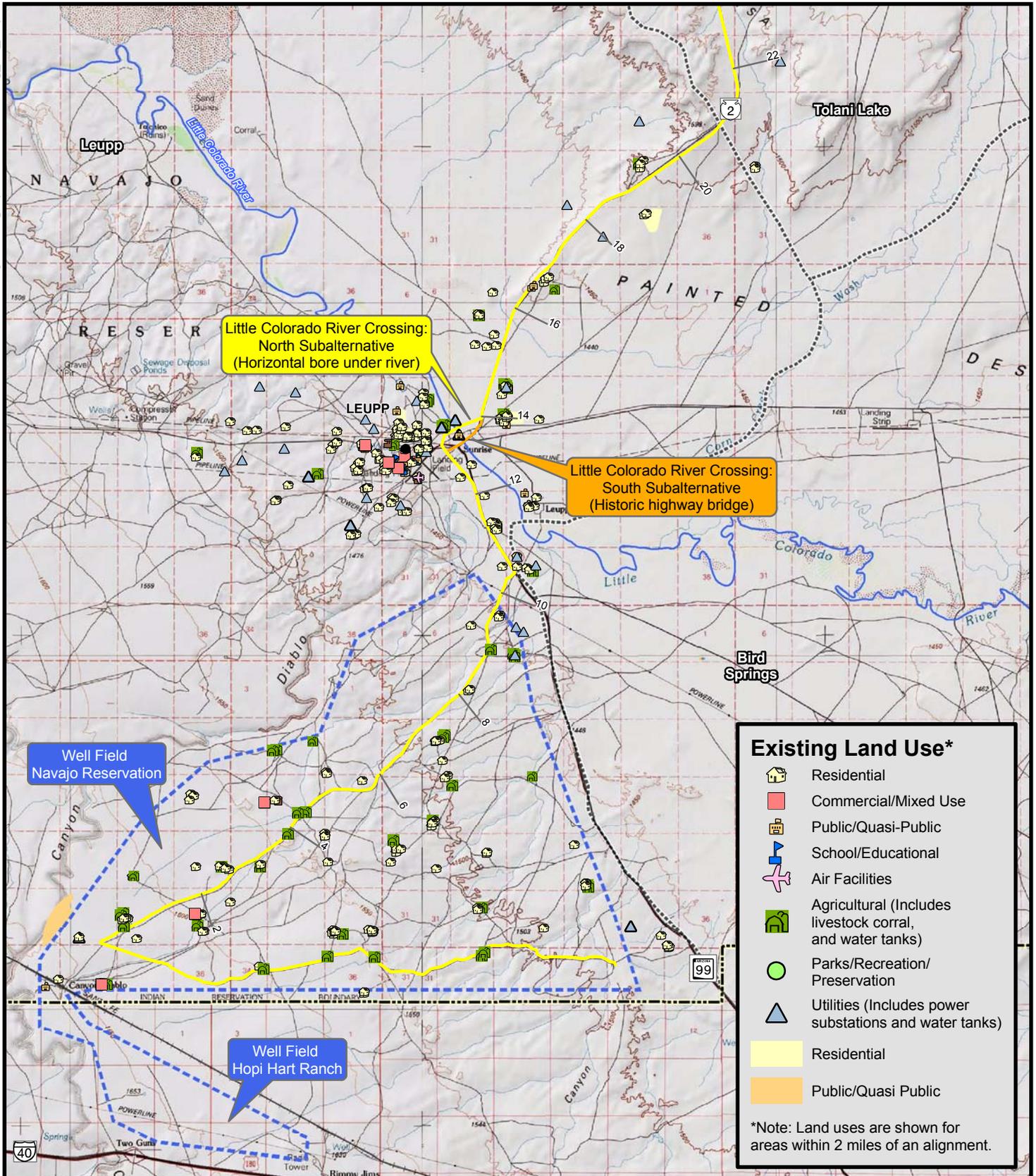
As part of the C aquifer water-supply study, carried out by Reclamation and USGS, wells were drilled within the well field area in 2005. These wells, which are located within the immediate vicinity of existing windmill wells, were used to estimate the effects of long-term pumping from the C aquifer for the proposed project. Currently these wells are capped and are not in use.

3.9.3.2 C Aquifer Water-Supply Pipeline

3.9.3.2.1 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

The eastern route would cross the Hopi and Navajo Reservations. Residences (including hogans) are dispersed throughout the pipeline study corridor, most along primary transportation routes. Dispersed residences outside of a populated community within approximately 250 feet of the alignment are located at WSP Mileposts 2, 8, 10, 15, 35, 59-62, 68, 69, 92, 97, and 100. The route would skirt residential areas by at least 500 feet as it passes through the community of Leupp (refer to Map 3-17b). It would continue through the populated Kytotsmovi area within a road right-of-way where residential, commercial, and quasi-public facilities exist within 250-500 feet of the route. On its way through the Hopi planned community of Tawaovi, the route would avoid all existing residences by at least 500 feet.

Most of the land along the eastern route is permitted for livestock grazing, with water tanks and corrals dispersed throughout. Refer to Table G-2 in Appendix G for grazing districts crossed by the eastern route.



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SOURCES:
URS Corporation 2005
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LEGEND

Water-Supply Pipeline

- Eastern Route (preferred alternative)
- Subalternatives (preferred alternative)

Other Project Features

- C-Aquifer Well Field

General Features

- River
- Navajo Reservation Boundary
- Navajo Reservation Chapter Boundary and Name
- Interstate/U.S. Highway/State Route

**Existing Land Use:
Well Field and
Leupp Area**

Black Mesa Project EIS
September 2006
Map 3-17b

Leupp schools, churches, several small commercial sites (such as convenience stores), and public/quasi-public facilities (including a youth center) are located at least 500 feet from the eastern route, with the exception of a church and cemetery located just outside of Leupp within 250 feet of the alignment. The west Kykotsmovi subalternative (the Hopi's preferred alternative) would parallel Indian Route 2 (the pipeline buried in the road right-of-way) through the community of Kykotsmovi between WSP Mileposts 59 and 62. Residential, commercial, and quasi-public facilities (e.g., a hospital, two schools, and government offices) exist within 250 to 500 feet of the route. High-voltage power lines traverse through the area crossing the subalternative multiple times.

The study area contains multiple agricultural plots within 250 feet of the eastern route, including a large field, along both sides of Indian Routes 2 and 22 (with dry farms on the Hopi Reservation and small family gardens on the Navajo Reservation).

A 12/69kV power line parallels State Route 99 and Indian Route 2, with a slight departure approximately 1 mile to the west before rejoining the roadway for a final 2 miles. Another 12/69kV power line parallels and crosses the eastern route several times before it ends in the Black Mesa Complex. The route would cross two gas pipelines near the community of Leupp, and a 230kV high-voltage power line within Leupp. Near the community of Hard Rock, it would cross under a 500kV high-voltage power line.

The Hopi Strategic Land Use and Development Plan (2001) has identified a majority of Hopi land for continued agricultural and grazing use. The major washes, such as the Dinnebito Wash, are planned for conservation throughout the Hopi Reservation. These conservation areas have been identified within the land use plan as areas with development constraints. One area along the eastern route planned for future residential growth is in the Kykotsmovi community. A planned community development district is located between WSP Mileposts 74 and 79. The district is a planning area designed to integrate new community development with the existing development in accordance with the management practices for the Hopi Partitioned Land (as implemented by various offices in the Department of Natural Resources).

On the Navajo Reservation, the Leupp Chapter identified a wildlife area that traverses the Little Colorado River for future open space. The eastern route would cross the wildlife area near WSP Milepost 13. The Hard Rock Chapter did not identify any planned land uses within the studied corridor.

3.9.3.2.1.1 Little Colorado River Crossing Subalternatives

The area where the eastern route would cross the Little Colorado River is used for grazing. No residences, schools, or other public facilities exist within 500 feet of the alternative alignments. A major gas pipeline crosses the Little Colorado River near the locations where the pipeline would cross.

3.9.3.2.1.2 Kykotsmovi Area Subalternatives

The east Kykotsmovi subalternative would parallel Indian Route 503 and State Route 264 (the pipeline buried in the road right-of-way) as the roads bypass Kykotsmovi on its eastern edge. While there are no adjacent residences, there are residences within 250 feet of the east Kykotsmovi subalternative between subalternative Mileposts 0 and 1 (Map 3-17c). Adjacent commercial land uses (such as art and cellular retail services) are located within 500 feet of subalternative Milepost 2 through 2.5. A public safety building where police and fire personnel are staffed is located less than 250 feet from the route near Milepost 1. Two schools near Milepost 2.5 are located approximately 650 feet from the alignment, to the north and south of State Route 264.

3.9.3.2.2 C Aquifer Water-Supply Pipeline: Western Route

The western route passes entirely through the Navajo Reservation. Residences (including hogans) are dispersed along the western route, with the majority next to transportation corridors. Residential

development occurs within 250 feet of the route in 13 locations (WSP Mileposts 2, 8, 10, 15, 40, 56, 59, 94-96, 99, 104-108, 110, 114, and 126). The route skirts residential areas and associated development by at least 500 feet as it passes through Leupp. As it travels along U.S. Highway 160, it would pass areas of dense residential development (Map 3-17d). Approximately five moderately dense residential areas occur between WSP Mileposts 94 and 100, and approximately seven moderately dense residential areas occur between WSP Mileposts 104 and 119.

Most of the land along the alignment is permitted for livestock grazing with water tanks and corrals dispersed throughout. Refer to Tables G-1 and G-2 in Appendix G for grazing districts/range units that would be crossed by the water-supply pipeline.

The communities of Leupp and Red Lake have schools, small commercial sites, and public/quasi-public facilities (such as churches and youth centers). All are beyond 500 feet of the western route, with the exception of a church and cemetery located just outside Leupp within 250 feet of the route. The route would parallel U.S. Highway 160 as it enters the community of Red Lake; commercial uses such as convenience stores and gas stations occur along the highway near WSP Mileposts 96, 106, and 126. Schools are located along U.S. Highway 160 near WSP Mileposts 96, 108, and 117.

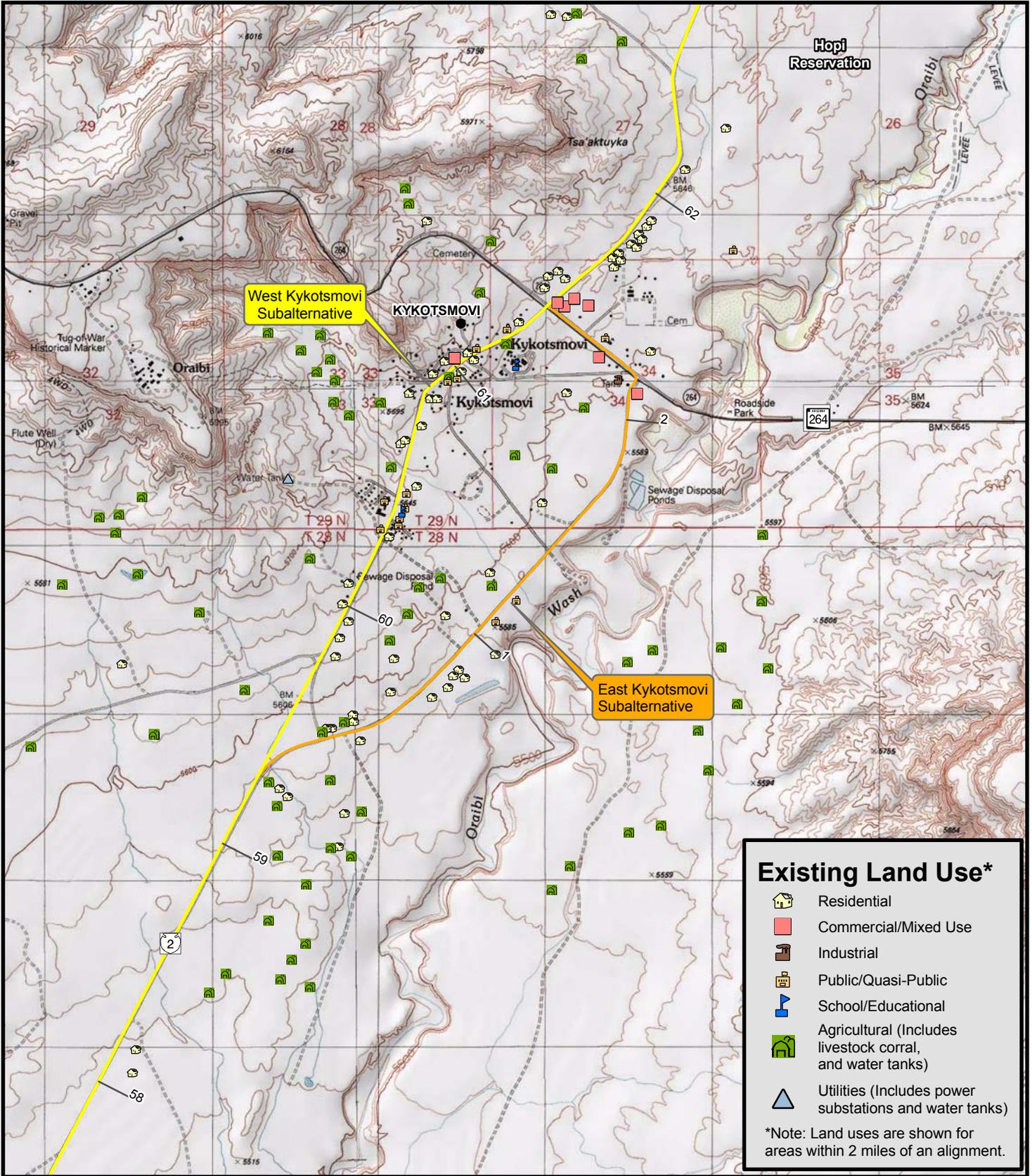
The majority of agricultural uses within the study corridor are smaller plots associated with residential areas. Agricultural plots occur within 250 feet of the alignment in several areas.

Electrical distribution lines would cross the route near WSP Milepost 86 and between WSP Mileposts 130 and 139, and two gas pipelines cross the route near Leupp. High-voltage power lines (500kV) would parallel and cross the western route at four points (near WSP Mileposts 67, 87, 121, and 130) and would parallel it until it terminates at the Black Mesa Complex.

The western route would cross the Leupp Chapter's designated wildlife area along the Little Colorado River near WSP Milepost 13. According to the Shonto Chapter Comprehensive Land Use Plan, the western route would cross three designated growth areas: (1) Blue Lake Center near the western boundary of the chapter (WSP Milepost 110); (2) Mesa View, located near the intersection of U.S. Highway 160 and Arizona Route 98 (WSP Milepost 114); and (3) Black Mesa, located near the intersection of Arizona Highway 564 and U.S. Highway 160 (WSP Milepost 126). New clustered residential subdivisions are planned at the growth centers of these areas. The Blue Lake Center (WSP Milepost 110) is planned for mixed use.

3.10 CULTURAL RESOURCES

The cultural environment includes those aspects of the physical environment that relate to human culture and society, along with the social institutions that form and maintain communities and link them to their surroundings (King and Rafuse 1994). Public and agency scoping identified issues related to potential impacts on two aspects of the cultural environment: archaeological and historical resources, and traditional cultural lifeways and resources. These issues were addressed pursuant to Federal, tribal, State, and local government laws and regulations protecting cultural resources. Section 106 of the NHPA requires Federal agencies to consider the effects of their undertakings on properties eligible for the National Register of Historic Places (National Register).



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SOURCES:
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LEGEND

Proposed Water-Supply Pipeline

- Yellow line: Eastern Route (preferred alternative)
- Orange line: Subalternatives (preferred alternative)

General Features

- Thick black line: Interstate/U.S. Highway/State Route

Existing Land Use*

- House icon: Residential
- Red square: Commercial/Mixed Use
- Factory icon: Industrial
- School icon: Public/Quasi-Public
- Blue building icon: School/Educational
- Green house icon: Agricultural (Includes livestock corral, and water tanks)
- Triangle icon: Utilities (Includes power substations and water tanks)

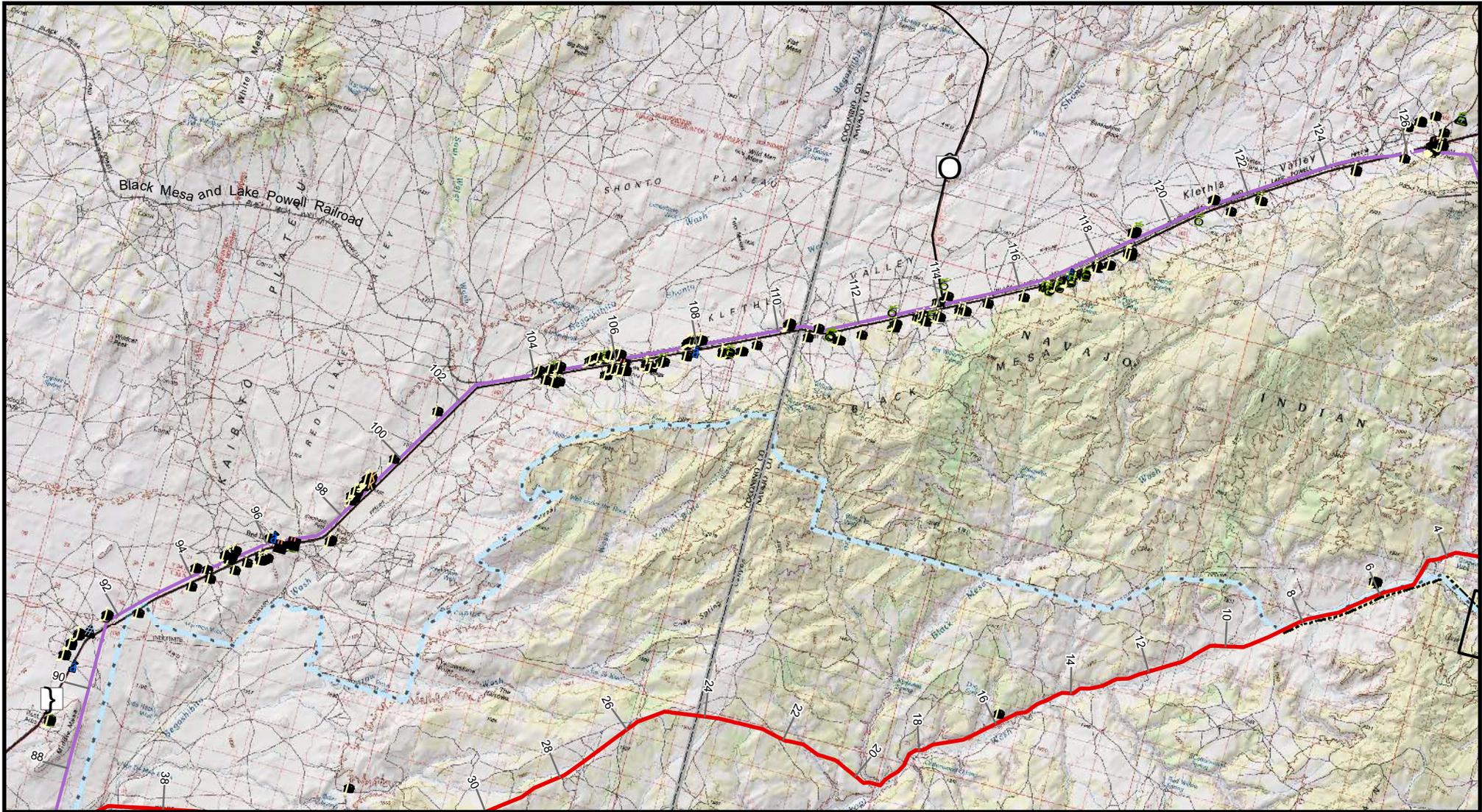
*Note: Land uses are shown for areas within 2 miles of an alignment.

**Existing Land Use:
Kykotsmovi Area**

Black Mesa Project EIS

September 2006

Map 3-17c



 <p>Prepared By: URS</p>	 <p>SOURCES: URS Corporation 2005 Map created with TOPOI(tm) (c)2002 National Geographic Holdings (www.topo.com)</p>	<p>LEGEND</p> <p>Coal-Slurry Pipeline</p> <p>— Existing Route (Existing route with realignment/reroute is the preferred alternative)</p> <p>Proposed Water-Supply Pipeline</p> <p>— Western Route</p> <p>Other Project Features</p> <p>□ Peabody Lease Area</p>	<p>General Features</p> <p>□ Hopi Indian Reservation</p> <p>□ Navajo Reservation Boundary</p> <p>□ County Boundary</p> <p>— Interstate/U.S. Highway/ State Route</p>	<p>Existing Land Use*</p> <p>■ Residential</p> <p>■ Commercial/Mixed Use</p> <p>■ Public/Quasi-Public</p> <p>■ School/Educational</p> <p>■ Agricultural (Includes livestock corral, and water tanks)</p>	<p>■ Extraction - Mining Utilities (Includes power substations and water tanks)</p> <p>*Note: Land uses are shown for areas within 2 miles of an alignment.</p>	<p>Existing Land Use Along Alternative Water-Supply Pipeline: Western Alternative</p> <p>Black Mesa Project EIS</p> <p>September 2006</p> <p>Map 3-17d</p>
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To be eligible for the National Register, properties must be at least 50 years old (unless they have special significance) and have national, State, or local significance in American history, architecture, archaeology, engineering, or culture. They also must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and meet at least one of four criteria:

- Criterion A: be associated with important historical events or trends
- Criterion B: be associated with important people
- Criterion C: have important characteristics of style, type, or have artistic value
- Criterion D: have yielded or have potential to yield important information (36 CFR 60)

To address the identified issues, studies were undertaken to inventory, evaluate, and assess impacts on the following elements of the cultural environment:

- Archaeological and historical resources that are tangible links to the cultural heritage of the region.
- Traditional cultural lifeways and resources significant to the Hopi Tribe, Navajo Nation, and Hualapai Tribe, as well as other tribal groups with traditional cultural affiliations with land in the project vicinity, including the Chemehuevi Indian Tribe, Colorado River Indian Tribes, Havasupai Tribe, Fort Mojave Tribe, Pahrump Paiute Tribe, San Juan Southern Paiute Tribe, and Pueblo of Zuni.

The area of potential effects (or region of influence) is the geographic area within which a project may cause effects on resources. The area of potential effects varies for each type of potential impact on the cultural environment. For direct disturbance due to mining and construction activities, the area of potential effects was defined to include:

- The LOM revision area for the Kayenta and Black Mesa mining operations (approximately 100 square miles), which includes about 5 acres where a coal-washing facility would be constructed just north of the existing coal-slurry preparation plant.
- About 127 additional acres for a right-of-way for a new coal-haul road to be built between the Kayenta and Black Mesa mining operations.
- The 40 acres leased by BMPI within the Black Mesa Mine for the existing coal-slurry preparation plant (all previously disturbed).
- The corridor that could be disturbed by reconstruction of the coal-slurry pipeline, which is about 65 feet wide and 273 miles long (approximately 2,319 acres).
- The construction zones for development of the C aquifer water-supply system (including the wells, collector lines, delivery pipeline, pumping stations, storage tanks, power lines, substation, and access roads) (approximately 900 acres).
- Areas of C and N aquifers where water levels may be lowered by groundwater pumping.

There is limited potential for less-direct impacts on cultural resources due to visual intrusions and increased noise. Such impacts stemming from mining or the construction of a coal-washing plant would be confined largely within the established Black Mesa Complex. The new coal-haul road corridor is an exception, but it is almost surrounded by the coal mining lease areas.

The area of potential effects for visual and noise effects for all linear features of the project was defined as extending 0.5 mile from the centerline of the alignments. (Although some of the features might be visible at greater distances, they are expected to be only minor changes to views from 0.5 mile or farther

away.) The area of potential effects where the C-aquifer well field would be developed was defined as approximately 70 square miles within which a maximum of approximately 21 wells would be drilled.

Biological resources that could have traditional cultural significance include plants collected for food, medicine, ceremonies, crafts, and other traditional uses, as well as raptors (eagles and hawks) captured for ceremonial uses. Other natural resources that could have traditional cultural significance include minerals or clay deposits and sources of surface water or shallow groundwater used for traditional purposes. The area of potential effects for impacts on plants, minerals, and clays would be the same as for construction impacts. Impacts on animal species are likely to result from increased noise or visual intrusions and the area of potential effects was defined as extending 0.5 mile from the various project components.

Hydrogeological modeling indicated that pumping groundwater from the C aquifer could have potential impacts on surface water in two locations—the perennial reaches of lower Clear Creek and possibly lower Chevelon Creek. Continued pumping from the N aquifer could have potential impacts on Laguna Creek, Moenkopi Wash, Dinnebito Wash, Oraibi Wash, Polacca Wash, Jaidito Wash, Begashibito Wash, and Pasture Canyon Spring (GeoTrans 2005). These areas were defined as being the area of potential effects for potential impacts on traditional cultural values associated with surface water or shallow groundwater.

Potential impacts on traditional lifeways and knowledge could affect entire traditional cultures. Therefore the area of potential effects for those types of impacts encompasses traditional tribal territories. The Hopi heartland (*Tutsqwa*) encompasses much of northeastern Arizona, and the traditional land of the Navajo (*Dine Bikeyah*) covers parts of northeastern Arizona, northwestern New Mexico, southeastern Utah, and southwestern Colorado between four sacred mountains (Mount Hesperus, Blanca Peak, Mount Taylor, and the San Francisco Peaks). In northwestern Arizona, the coal-slurry pipeline primarily crosses the traditional territories of 7 of the 14 bands of the Hualapai and Havasupai.

Archaeologists have documented that human occupation of the region began at least 11,500 years ago, and they divide the pre-Columbian era into the Paleoindian, Archaic, Early Agricultural, Formative, and Late Prehistoric periods (Bungart et al. 1998:2-6 to 2-32). These are followed by the temporally overlapping aboriginal Ethnohistoric period and the Historic period of Euro-American settlement. Ancestral Puebloan archaeological sites that were occupied between approximately A.D. 500 and 1300 are particularly common, as are sites that represent Navajo occupation during the late 1800s and 1900s. Sites in the western parts of the project area reflect the prehistoric Cohonina, Cerbat, and Patayan traditions, and historic-era occupation by upland Pai groups, including the Havasupai and Hualapai, and farther to the south, the Yavapai. During the historic period, the Mojave lived along the valley of the lower Colorado River. Various bands of Southern Paiutes lived primarily north and west of the Navajo and Pai groups. The San Juan Southern Paiute lived among the Navajo primarily near Willow Springs and Navajo Mountain, and a Paiute band known as the Chemehuevi moved from the deserts of southeastern California to live among the Mojave along the Colorado River. The technical reports prepared to support the EIS provide additional information about the cultural history of the project area.

To characterize the existing condition of the cultural environment, four study teams conducted cultural resource studies. The HCPO organized a team to study the project components on the Hopi Reservation, and the Navajo Nation Archaeology Department studied the project components on the Navajo Reservation. The Hualapai Tribe Department of Cultural Resources studied traditional Hualapai cultural resources (including those of the closely related Havasupai Tribe) along the coal-slurry pipeline. A URS Corporation team studied archaeological and historical resources along the portion of the coal-slurry pipeline located outside the Hopi and Navajo Reservations, and assisted OSM in consulting with other tribes.

The study teams reviewed records and reports to compile information from prior studies, and undertook intensive pedestrian field surveys to inventory cultural resources within the area of potential effects. The Black Mesa and Kayenta mining operations had been surveyed for cultural resources in conjunction with prior SMCRA permits, and they were not resurveyed. The area of potential effects for construction impacts cannot be precisely defined for other components of the proposed project until final designs are prepared, but construction zones were estimated on the basis of conceptual and preliminary designs for the (1) construction of the C aquifer water-supply system, (2) reconstruction of the coal-slurry pipeline, and (3) building of a new coal-haul road between the Kayenta and Black Mesa mining operations. If the Record of Decision approves the construction of these facilities, supplemental surveys would be conducted if needed during preparation of final designs pursuant to a Section 106 Programmatic Agreement. The agreement is being prepared to stipulate agency responsibilities and procedures for continuing to consider measures to assess and avoid, reduce, or mitigate any adverse effects on cultural resources if project implementation proceeds after the EIS process is completed.

The studies of traditional cultural lifeways and resources addressed the area of potential effects for construction impacts as well as the broader regions of influence defined for potential impacts on traditional lifeways and cultural resources that are significant for retention and transmission of traditional cultures. The Hopi, Navajo, and Hualapai study teams conducted records and literature reviews; undertook field reviews; and interviewed local tribal officials, local residents, elders, and other individuals knowledgeable about cultural traditions. OSM contacted 10 other tribes to solicit information and concerns about potential impacts on traditional cultural resources that might be significant to them, and invited interested tribes to participate in the Section 106 consultations. The results of the cultural resource studies are documented in a technical report prepared to support the EIS.

3.10.1 Black Mesa Complex

Between 1967 and 1986, the 20-year Black Mesa Archaeological Project conducted research within the Black Mesa Complex to identify and study archaeological and historical sites and mitigate the impacts on those resources of mining coal. The Black Mesa Archaeological Project recorded 2,710 archaeological sites (1,671 preceramic and Puebloan and 1,039 historical Navajo), excavated 215 of those sites, and archaeologically tested, mapped, collected artifacts at 887 other sites (Powell et al. 2002). Through that program of research conducted under the initial regulatory program, OSM completed Section 106 requirements for the currently proposed LOM revision area for the Kayenta and Black Mesa mining operations. The proposed LOM revision would not require any additional Section 106 consultations regarding impacts of coal mining on properties eligible for the National Register.

Pursuant to terms and conditions of the LOM Permit AZ-0001C issued on July 6, 1990 and incorporated into Permit AZ-0001D that was recently renewed on July 6, 2005, Peabody continues to:

- Report the discovery of any previously unrecorded cultural resources to OSM and to cease work near discoveries until OSM determines appropriate disposition (Standard Permit Term 9);
- Identify and respectfully treat any human remains associated with archaeological sites pursuant to the 1990 NAGPRA (Special Conditions 3 and 4); and
- Take into account any sacred and ceremonial sites brought to the attention of Peabody by local residents, clans, or tribal government representatives of the Hopi Tribe and Navajo Nation (Special Condition 1).

Since 1990, when the permit terms and conditions were stipulated, Peabody has made three cultural resource discoveries in the Kayenta mining operation area; eight prehistoric human burials found at those discoveries were treated in accordance with the permit terms. In 1997, Peabody reported two additional

finds within the Kayenta mining operation area to OSM, but archaeological evaluation determined there were, in fact, no cultural remains at those locations. No discoveries have been made in the Black Mesa mining operation area.

Although the Black Mesa Archaeological Project excavated many burials, only a sample of the archaeological sites was excavated and additional burials could be present at unexcavated sites within the mining area. Since 1990, Peabody sponsored archaeological testing of 46 unexcavated sites identified as having potential associated human burials. The testing identified 61 burials within 19 of those sites, and they were documented and moved pursuant to the permit conditions before mining was initiated at those locations. Peabody's effort to locate burials is an ongoing commitment.

Traditional Hopis and Navajos consider all of Black Mesa (known as *Nayavuwaltsa* to the Hopi and *Dziljiiin* to the Navajo) to be a significant traditional cultural resource because of its role in traditional stories and ceremonial and clan traditions. Because it is an area where traditional resources are obtained, they feel that development of the mines has adversely affected their traditional lifeways. Although Hopis and Navajos living anywhere might regard continued mining as an impact on their cultural traditions, the lifeways of the approximately 60 Navajo households that continue to reside within the Black Mesa Complex would be most directly affected by continued mining. Pursuant to permit conditions, Peabody also has addressed concerns about 18 sacred and ceremonial sites within the Kayenta and Black Mesa mining operation areas.

Survey of the corridor for the new coal-haul road identified two archaeological sites evaluated as eligible for the National Register—a scatter of Ancestral Puebloan artifacts and remnants of a historical Navajo sweat lodge.

3.10.2 Coal-Slurry Pipeline

3.10.2.1 Coal-Slurry Pipeline: Existing Route

Cultural resource studies conducted in conjunction with the original construction of the coal-slurry pipeline in 1970 identified 58 archaeological and historical sites (although 11 of those were described as actually being of recent origin). Twenty-five of the sites were on the Hopi Reservation, 19 on the Navajo Reservation, and 14 west of the reservations. Excavations were conducted at 6 of the Ancestral Puebloan sites (5 on the Hopi Reservation and 1 on the Navajo Reservation) to mitigate the impacts of the construction of the coal-slurry pipeline (Ward 1976).

Replacement of the coal-slurry pipeline would involve construction activity within the 50-foot-wide right-of-way for the existing line and an extra temporary workspace 15 feet wide along the northern side of the existing right-of-way. Intensive survey of this corridor identified 50 archaeological and historical resources (Table 3-18). Eight of those are on the Hopi Reservation, one on the Navajo Reservation, and 41 are west of the reservations in Arizona. None were identified in the 1.5-mile-long segment of the route that extends into the southern tip of Nevada.

Fourteen of the 50 resources were evaluated as lacking significant historical values that would make them eligible for the National Register. Those are primarily scatters of prehistoric flaked stone artifacts with no chronological or cultural diagnostics, or scatters of historic-period trash of unknown origin. Twenty-three of the other 36 National Register-eligible sites reflect prehistoric occupation of the region, 12 historic-era uses, and 1 has both prehistoric and historical components.

Table 3-18 Archaeological and Historical Sites Along the Coal-Slurry Pipeline¹

Site Type	Prehistoric	Ancestral Pueblo	Navajo	Cohonina or Cerbat	Cohonina or Cerbat/Euro-American	Euro-American	Prehistoric/Euro-American	Totals
<i>Coal-Slurry Pipeline Existing Route</i>								
Habitation		1	1			1		3
National Register eligible		1	1			1		3
Camp		1						1
National Register eligible		1						1
Field house				3	1			4
National Register eligible				3	1			4
Artifact scatter	14	5		4		6	1	30
National Register eligible	8	4		4		0	0	16
Artifact scatter and features		1						1
National Register eligible		1						1
Transportation related						9		9
National Register eligible						9		9
Mining related						1		1
National Register eligible						1		1
Military related						1		1
National Register eligible						1		1
Totals	14	8	1	7	1	18	1	50
National Register eligible	8	7	1	7	1	12	0	36
<i>Moenkopi Wash Realignment</i>								
Habitation		3						3
National Register eligible		3						3
Camp		3						3
National Register eligible		2						2
Artifact scatter and petroglyphs		3						3
National Register eligible		3						3
Totals	0	9	0	0	0	0	0	9
National Register eligible	0	8	0	0	0	0	0	8
<i>Kingman Reroute</i>								
Artifact scatter						8		8
National Register eligible						0		0
Transportation related						1		1
National Register eligible						1		1
Mining related						1		1
National Register eligible						0		0
Transmission Line						1		1
National Register eligible						0		0
Totals	0	0	0	0	0	11	0	11
National Register eligible	0	0	0	0	0	1	0	1

NOTE: ¹ Recommendations regarding eligibility are indicated; agency review is ongoing.

The inventory of eligible prehistoric resources includes 7 Ancestral Pueblo sites, including 1 identified as a habitation and 1 as a temporary camp. The other sites are artifact scatters, sometimes with features. Farther to the west, 7 sites were identified as affiliated with the Cohonina or Cerbat cultures, and 8 other scatters of flaked stone may be related to those cultures or the earlier Archaic era. Features interpreted as remnants of field houses were found at 4 of the Cohonina or Cerbat sites, and were the only evidence of architecture. Eight of the sites are primarily scatters of flaked stone generated by knapping obsidian nodules within the Mount Floyd volcanic field. Exploitation of that tool stone source might have begun during the Archaic period.

The inventory of eligible sites also includes 12 historic-period Euro-American resources. Nine of those are transportation-related and include the Grand Canyon Railway, which is listed in the National Register, and U.S. Route 66. Seven segments of Route 66 in Arizona are listed in the National Register, but those are not in the vicinity of the pipeline. The other sites are remnants of a mine and a homestead, both dating from around the 1910s to 1920s, and the World War II Kingman Army Air Forces Flexible Gunnery School Airfield.

Records reviews, field surveys, and interviews inventoried 54 traditional cultural resources along a 1-mile-wide corridor centered along the route of the proposed coal-slurry pipeline reconstruction (Table 3-19). Sixteen of the resources are significant to the Hopi Tribe, 12 to the Navajo Nation, and 26 to the Hualapai Tribe. The resources include landscape features identified in traditional histories, water sources, petroglyph sites, trails, ceremonial places and shrines, areas where eagles are collected for ceremonial uses, burials, and ancestral archaeological sites as habitations. The tribes consider these resources to be eligible for the National Register.

Table 3-19 Traditional Cultural Resources along the Coal-Slurry Pipeline

Type	Cultural Affiliation			Totals
	Hopi ¹	Navajo ²	Hualapai ³	
Landscape features	1	5	6	12
Water sources	2	4	11	17
Petroglyphs sites	3			3
Trails	2	1	2	5
Ceremonial places, shrines	3			3
Eagle (and other raptor) gathering areas	4			4
Ancestral sites, habitations	1	1	7	9
Burials/cemeteries		1	1	1
Totals	16	12	26	54

NOTES: ¹ The Hopi consider these resources to be eligible for the National Register under Criterion A or A and D.

² The Navajo consider these resources, except for the burial, to be eligible for the National Register under Criterion A or D. The burial is protected by the NAGPRA and the Navajo Nation Jishchaá policy.

³ The Hualapai consider one spring to be eligible for the National Register under Criterion A. The other resource may be eligible but requires further evaluation. Agency review of eligibility is ongoing.

3.10.3 Coal-Slurry Pipeline: Existing Route with Realignments (Agencies' Preferred Alternative)

The proposed reconstruction in the Moenkopi Wash would deviate up to 200 feet from the existing route along selected segments of the pipeline between CSP Mileposts 2 and 20 to move the pipeline away from the active channel of Moenkopi Wash. Because the specific alignment shifts to address erosion problems have not been designed at this time, a corridor 400 feet wide was surveyed along this segment of the route. Nine archaeological sites are located within this expanded corridor. They are all Ancestral Pueblo sites and include 3 habitations, 3 camps, and 3 artifact scatters with petroglyphs. Eight of the 9 sites are evaluated as eligible for the National Register. No additional traditional cultural resources were identified along the expanded Moenkopi Wash corridor.

The only substantial proposed realignment is designed to remove the pipeline from the northern part of Kingman, which has been developed since the original pipeline was installed. The 28-mile reroute would follow other pipelines, transmission lines, and roads through less developed areas south of Kingman. This realignment would cross the historical Atchison, Topeka & Santa Fe Railroad (originally the Atlantic & Pacific Railroad, and currently the BNSF Railway) and U.S. Route 66, as does the original route. Intensive survey identified 11 additional archaeological sites along the reroute, including a mining prospect pit, eight scatters of historical trash, remnants of the Harris Station, and the Davis-Coolidge 230kV transmission line (refer to Table 3-15). Only the railroad station is evaluated as eligible for the National Register.

One traditional Hualapai cultural resource was identified along the Kingman reroute. It is a historical cemetery located about 1 mile from the proposed reroute.

3.10.4 C Aquifer Water-Supply System

3.10.4.1 Well Field

The potential well field encompasses about 70 square miles, but only a small fraction of that area would be disturbed by the proposed drilling of wells and construction of collector lines, power lines, and access roads. Because the number and layout of the wells has not been determined, the specific construction impact zones have not been defined or intensively surveyed for cultural resources. About 5 square miles within the well field were intensively surveyed for cultural resources prior to drilling three test wells and five observation wells (Jolly and Aguila 2004). That survey discovered 13 archaeological and historical sites. A records review documented that the test well survey was by far the most extensive cultural resource survey within the well field area, and only four additional archaeological and historical sites had been recorded by other surveys (Table 3-20).

The 18 sites recorded in the well field include a variety of prehistoric and historic sites. Seven were evaluated as eligible for the National Register, and archaeological testing was recommended to complete evaluation of the eligibility of four other sites. The six other sites were evaluated as lacking significant historical values that would make them National Register eligible. Many other similar sites are undoubtedly present within unsurveyed portions of the well field.

3.10.4.2 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

A total of 31 archaeological and historical sites were identified by intensive survey of areas that could be affected by construction of the proposed water-supply pipeline and associated pumping plants, access roads, and storage tanks (refer to Table 3-20). Most of the sites reflect Ancestral Pueblo or earlier prehistoric occupation of the region. Five of the sites are classified as habitation sites, and the others reflect a variety of more limited activities. Twenty-three of the 31 sites were evaluated as having significant values that make them eligible for the National Register.

One option for crossing the Little Colorado River involves horizontal boring beneath the river. One site is located along the route of that subalternative. The site is a twentieth-century Navajo habitation site that is evaluated as ineligible for the National Register. The other subalternative crossing would use an abandoned, historical bridge that is evaluated as eligible for the National Register under Criterion C.

Three Ancestral Pueblo artifact scatters were found along the west Kykotsmovi area subalternative, and two of these were evaluated as eligible for the National Register. No archaeological or historical sites were found along the east Kykotsmovi area subalternative.

Ten additional archaeological sites were recorded within the subalternative routes and substation sites being considered for the electrical system needed to operate the water-supply system. One of these is the remnants of a mid-twentieth-century Navajo habitation site, another site has remnants of Navajo corrals less than 45 years old, and the eight other sites are scatters of prehistoric flaked stone with no temporally or culturally diagnostic artifacts. None of those sites are evaluated as eligible for the National Register (refer to Table 3-20).

Table 3-20 Archaeological and Historical Sites within the Area of Potential Effects for Construction Impacts of the Proposed C Aquifer Water-Supply System¹

Site type	Prehistoric	Archaic	Archaic/ Ancestral Pueblo	Ancestral Pueblo	Navajo	Euro- American	Totals
<i>Well Field</i>							
Habitation				1			1
National Register eligible				1			1
Camp						1	1
National Register eligible						0	0
Artifact scatter	6		1		1	1	9
National Register eligible	5 ²		1		0	0	6
Livestock related					2	1	3
National Register eligible					2	1	3
Artifact scatter, petroglyphs			1				1
National Register eligible			1				1
Road					1	1	2
National Register eligible					0	0	0
Teepee ring					1		1
National Register eligible					0		0
Subtotals	6	0	2	1	5	4	18
National Register eligible	5 ²	0	2	1	2	1	11
<i>C-Aquifer Water-Supply Pipeline: Eastern Route</i>							
Habitation				5	2		7
National Register eligible				5	0		5
Field house				3			3
National Register eligible				3			3
Artifact scatter	2	2		16			20
National Register eligible	0	1		13			14
Bridge						1	1
National Register eligible						1	1
Subtotals	2	2	0	24	2	1	31
National Register eligible	0	1	0	21	0	1	23
<i>Substation and Power Line for Water-Supply System (outside proposed water pipeline corridor)</i>							
Habitation					1		1
National Register eligible					0		0
Livestock related					1		1
National Register eligible					0		0
Flaked stone (Tolchaco gravels)	7						7
National Register eligible	0						0
Flaked stone, petroglyph	1						1
National Register eligible	0						0
Subtotals	8	0	0	0	2	0	10
National Register eligible	0	0	0	0	0	0	0
Totals	16	2	2	25	9	5	59
National Register eligible	5	1	2	22	2	2	34

^a Testing is recommended at 4 of these sites to further evaluate their eligibility.

NOTES: ¹ The inventory is based on conceptual designs and does not include the locations of components such as the wells and collector lines. The survey did include options for locating the pipeline on either side of existing roads in some locations and alternative locations for the electrical substation and power line, so all of the sites probably would not be affected. Supplemental surveys would be conducted as needed pursuant to a Section 106 Programmatic Agreement during the post-EIS preparation of final designs.

² Recommendations regarding eligibility are indicated; agency review is ongoing.

Record reviews, field surveys, and interviews inventoried 83 traditional cultural resources within the well field and a 1-mile-wide corridor along the proposed water-supply pipeline and associated facilities (Table 3-21). Thirty-seven of the resources are significant to the Hopi Tribe and 48 to the Navajo Nation. The tribes consider these resources to be eligible for the National Register, or protected by the NAGPRA and the Navajo Nation Jishchaá policy.

Table 3-21 Traditional Cultural Resources within Area of Potential Effects for C Aquifer Water-Supply System¹

Type	Cultural Affiliation		Totals
	Hopi ²	Navajo ³	
<i>Well Field</i>			
Ceremonial places, shrines	2		2
Eagle (and other raptor) collecting areas	1		1
Landscape features		1	1
Subtotal	3	1	4
<i>Surface Water (potentially affected by groundwater pumping from the C aquifer)</i>			
Water sources	2		2
Subtotal	2		2
<i>Surface Water (potentially affected by continued groundwater pumping from the N aquifer)</i>			
Water sources	2		2
Subtotal	2		2
<i>Water-Supply Pipeline: Eastern Route (Applicant's Preferred Alternative)</i>			
Ancestral sites, habitations	5	3	8
Ceremonial places, shrines	7	13	20
Eagle (and other raptor) gathering areas	7		7
Landscape features	1	6	7
Trails	3		3
Water sources	5	1	6
Hunting and gathering localities	1	8	9
Traditional fields (numerous fields near Kykotsmovi)	1		1
Abandoned trading post		1	1
Burials		13	13
Subtotal	30	45	75
<i>Power Line for Water-Supply Pipeline (outside pipeline corridor)</i>			
Ceremonial places, shrines		1	1
Burials		1	1
Subtotal	0	2	2
Totals	37	48	85

NOTES: ¹ The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 Programmatic Agreement during the post-EIS preparation of final designs.

² The Hopi consider these resources to be eligible for the National Register under Criterion A or A and D.

³ The Navajo consider these resources, except for burials, to be eligible for the National Register under Criterion A or D. Burials are protected by the NAGPRA and the Navajo Nation Jishchaá policy.

The resources significant to the Hopi Tribe include ceremonial areas and shrines, areas where eagles and other raptors are collected for ceremonial uses, trails or clan migration routes, and Ancestral Pueblo village sites. In addition, the Hopi categorically consider all ancestral archaeological sites to be traditional cultural resources that represent the “footprints” of the Hopi across the landscape through time.

In addition, 33 species of plants that the Hopi use for a variety of traditional purposes grow along the proposed water-supply pipeline. There also are a number of traditional fields located along the proposed water-supply pipeline in the vicinity of Kykotsmovi. Many other traditionally named places within the viewshed of the well field and water pipeline are important elements of the traditional Hopi cultural landscape, but they are not threatened by the proposed project.

In addition to the impact of constructing the proposed C aquifer water-supply system, other traditionally important sources of surface water could be affected by the impacts of pumping groundwater. Hydrogeological modeling evaluated whether drawdown of groundwater around the proposed well field could affect base flows that create perennial reaches at the lower ends of Clear Creek and Chevelon Creek. The Hopi consider all sources of surface water, whether in springs, or ephemeral or permanent streams, to have traditional cultural significance. A Hopi shrine is located at Clear Creek where water is collected for ritual use. The Hopi consider both creeks and the wildlife they support to have significant traditional values. The traditional cultural resources significant to the Navajo include locations where traditional ceremonies were conducted, remnants of corrals used in hunting game, abandoned house sites, an abandoned trading post, and geographic features named in traditional stories, including Black Mesa, the Little Colorado River, and Canyon Diablo (refer to Table 3-21). All of those resources are evaluated as eligible for the National Register. In addition, 14 burial locations were identified, and would need to be addressed pursuant to NAGPRA and the Navajo Nation Jishchaá policy if they were to be affected.

3.10.4.3 C Aquifer Water-Supply Pipeline: Western Route

Because the western route for the water-supply pipeline is only conceptually defined at this phase of planning, the area of potential effects for construction impacts could not be defined with any accuracy, and no field survey was conducted along this alternative. A records and literature review identified more than 340 prior studies that had recorded almost 400 archaeological and historical sites within a 1-mile corridor along the western route. All of the sites but one are on the Navajo Reservation. The extent of prior survey within the corridor has not been quantified, but it covers only a small percentage of the area and many more unrecorded archaeological and historical sites certainly are present in the corridor. The Klethla Valley and Long House Valley crossed by the northern end of the western route are known to have some of the highest densities of archaeological sites in the region, and the types of sites tend to be larger and more complex than those along the eastern route.

Record reviews and interviews inventoried 36 traditional cultural resources along a 1-mile-wide corridor centered along the western route (Table 3-22). Twenty-two resources are significant to the Hopi Tribe and 14 to the Navajo Nation. The tribes consider these resources to be eligible for the National Register, or protected by the NAGPRA and the Navajo Nation Jishchaá policy.

The resources significant to the Hopi Tribe include areas related to ceremonial capture of eagles and other raptors, ceremonial places or shrines, landscape features named in traditional histories, trails, and water sources. One of the eagle capturing areas also is a location where plants are collected for traditional uses. In addition, the Hopi categorically consider all ancestral archaeological sites to be traditional cultural resources that represent the “footprints” of the Hopi across the landscape through time.

The traditional Navajo cultural resources include landscape features named in traditional histories, ceremonial places, and burials. More intensive interviewing of local residents and traditional land users along the route would probably identify many more specific traditional Navajo cultural resources, such as locations where traditional ceremonies were conducted, remnants of corrals used in hunting game, abandoned house sites, and burial locations.

Table 3-22 Traditional Cultural Resources within Area of Potential Effects for Water-Supply Pipeline: Western Route¹

Type	Cultural Affiliation		Totals
	Hopi ²	Navajo ³	
<i>Well Field</i>			
Ceremonial places, shrines	2		2
Eagle (and other raptor) collecting areas	1		1
Landscape features		1	1
Subtotals	3	1	4
<i>Surface Water (potentially affected by groundwater pumping from the C aquifer)</i>			
Water sources	2		2
<i>Alternative Water-Supply Pipeline (Western Route)</i>			
Ceremonial places, shrines, petroglyphs	4		4
Eagle (and other raptor) collecting areas	8		8
Landscape features	2	6	8
Trails	1		1
Water sources	1	3	4
Burials		3	3
Subtotals	16	12	28
<i>Power Line for Water-Supply Pipeline (outside pipeline corridor)</i>			
Ceremonial places, shrines		1	1
Burials		1	1
Subtotals	0	2	2
Totals	21	15	36

NOTES: ¹ The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 Programmatic Agreement during the post-EIS preparation of final designs.

² The Hopi consider these resources to be eligible for the National Register under Criterion A or A and D.

³ The Navajo consider these resources, except for burials, to be eligible for the National Register under Criterion A or D. Burials are protected by the NAGPRA and the Navajo Nation Jishchaá policy.

3.10.5 N Aquifer Water-Supply System

In the event the C aquifer water-supply system is developed, the N aquifer would be used as a temporary back-up supply in case the primary C-aquifer water supply fails for some reason. It is estimated pumping would be reduced by half. An option to the proposed development of a new water supply from the C aquifer is to continue to use existing wells within the Black Mesa Complex to pump groundwater from the N aquifer. The rate of pumping would increase to accommodate the proposed increased rate of mining. Hydrogeological review indicates that the N aquifer is connected to the base flow in Laguna Creek, Moenkopi Wash, Dinnebito Wash, Oraibi Wash, Polacca Wash, Jaidito Wash, Begashibito Wash, and Pasture Canyon Spring. The Hopi consider these water resources to be significant traditional cultural resources.

3.10.6 Summary

The inventory identified 127 archaeological and historical resources within the area of potential effects for the applicants' proposed project (Table 3-23). Approximately two-thirds of the resources are prehistoric sites, and most of those are Ancestral Pueblo. About 9 percent of the inventory is historical Navajo sites, and the remainder are Euro-American, mostly dating to the first half of the twentieth century. Eighty-two of the resources are evaluated as eligible for the National Register. A total of 124 traditional cultural resources plus 15 individual Navajo burials and a Hualapai cemetery also were identified. These resources are considered eligible for the National Register or protected by NAGPRA or the Navajo Nation Jishchaá policy.

Table 3-23 Summary of the Cultural Resources Inventory

Type	Mine/ Coal-Haul Road	Coal-Slurry Pipeline	C-Aquifer Water- Supply System	Totals
<i>Archaeological and Historical Resources</i>				
Prehistoric		14	16	30
National Register eligible		8	5	13
Archaic			2	2
National Register eligible			1	1
Archaic/Ancestral Pueblo			2	2
National Register eligible			2	2
Ancestral Pueblo	1	17	25	43
National Register eligible	1	15	22	38
Cohonina/Cerbat		7		7
National Register eligible		7		7
Cohonina/Cerbat/ Euro-American		1		1
National Register eligible		1		1
Navajo	1	1	9	11
National Register eligible	1	1	2	4
Euro-American		25	5	30
National Register eligible		13	2	15
Prehistoric/ Euro-American		1		1
National Register eligible		1		1
Totals	2	66	59	127
National Register eligible	2	46	34	82
<i>Traditional Cultural Resources¹</i>				
Hopi	1	16	35	52
Navajo	1	11 + 1 burial	34 + 14 burials	46 + 15 burials
Hualapai		26 + 1 cemetery		26 + 1 cemetery
Totals	2	53 + 1 burial + 1 cemetery	69+ 14 burials	124 + 15 burials + 1 cemetery

NOTES: ¹ All considered National Register-eligible or protected by NAGPRA and the Navajo Nation Jishchaá policy.

3.11 SOCIAL AND ECONOMIC CONDITIONS

In accordance with NEPA, the analysis of social and economic conditions addresses the relationships between the proposed project and the communities it may affect. The following characterization of current social and economic conditions describes demographics, employment, income, fiscal and budgetary information, and community facilities in the region that could potentially be affected by the proposed project.

The study area includes areas that may be affected economically and socially by the proposed project due to their proximity to project facilities. For the regional analysis, data were collected for the Hopi and Navajo Reservations, and for up to six counties (depending on the project component), including Navajo, Coconino, Apache, Yavapai, and Mohave in Arizona, and Clark County in Nevada. Data also were collected to depict socioeconomic conditions at the local level.

The local area for the Kayenta and Black Mesa mining operations comprises the Hopi village of Moenkopi and 14 Navajo chapters (see Section 3.11.2.1). A village is the Hopi unit of local government. A chapter is the Navajo unit of local government, and nearly all Navajo land is assigned to chapters. Much 1990 and 2000 Census information appears for chapters and for Moenkopi. Portions of some chapters are unincorporated, yet densely populated communities, and are defined by the Census Bureau as Census Designated Places. Certain information, such as the unemployment rate, is shown for Census Designated Places.

The populated local areas for the coal-slurry pipeline and the proposed C aquifer water-supply system include portions of the Hopi and Navajo reservations, and the City of Kingman, Arizona. (Other than those areas, the pipeline routes traverse areas that are largely unpopulated.) Census information for 1990 and 2000 is available for the affected Navajo chapters. The rural Hopi land crossed by the coal-slurry pipeline is outside the villages and is administered at the tribal level. Information appears for tribal census tract geographic units in that area, where Hopi village information does not exist. Census tract information is available for the Kingman local areas.

Tribal and county-level data used in this analysis overlap somewhat (i.e., where tribal and county boundaries overlap in Navajo, Coconino, and Apache Counties). The proportion of each county's population in each of the two reservations as of the 2000 Census is shown in Table 3-24 to indicate the extent to which these data sources may be duplicated.

Table 3-24 Population in Arizona Counties Residing on Hopi Reservation, Navajo Reservation, or Off-Reservation

	Total County	County, within Hopi Reservation	County, within Navajo Nation	County Remainder (Off-Reservation)
Apache County	69,423	N/A	54,521 (78.5%)	14,902 (21.5%)
Navajo County	97,470	5,812 (6.0%)	26,881 (27.6%)	64,777 (66.5%)
Coconino County	116,320	1,024 (0.9%)	23,350 (20.1%)	91,946 (79.0%)

SOURCE: U.S. Census Bureau 2000, SF 1, Table P1

NOTE: County totals and portions of the Hopi Reservation and off-reservation Trust Land, Arizona, New Mexico, Utah (part); Arizona and Navajo Reservation and off-reservation Trust Land, Arizona, New Mexico, Utah (part); Arizona.

3.11.1 Regional Overview of Demographics and Economics

Table 3-25 presents an overview of demographic characteristics for the two reservations, six counties, and the States of Arizona and Nevada. Arizona and Nevada were two of the fastest growing states in the Nation in the 1990s. Mojave County, Arizona, and Clark County, Nevada, were the only counties within the region of influence whose growth rates exceeded those of their respective states. Rapid growth continued between 2000 and 2004 at the county, tribal, and statewide levels.

Table 3-25 Key Population Characteristics – Regional Level

	Counties						Tribal Areas		State	
	Apache	Coconino	Mojave	Navajo	Yavapai	Clark	Hopi Reservation ¹	Navajo Reservation ²	Arizona	Nevada
Total Population										
1990 Census	61,591	96,591	93,497	77,658	107,714	741,459	7,360	148,451	3,665,228	1,201,833
2000 Census	69,423	116,320	155,032	97,470	167,517	1,375,765	6,946	180,462	5,130,632	1,998,257
Percent Change, 1990-2000	12.7	20.4	65.8	25.5	55.5	85.5	-5.6	21.6	40.0	66.3
2004 estimate	71,320	129,570	180,210	107,420	196,760	1,375,765	11,668	187,152	5,833,685	2,410,768
Median Age, 2000	27	29.6	42.9	30.2	44.5	34.4	29.1	24.0	34.2	35
Dependency Ratio, 2000	67.1	44.2	66.0	64.6	64.5	48.2	68.9	69.7	54.9	48.6
Persons per Household, 2000	3.41	2.8	2.45	3.17	2.33	2.65	3.49	3.77	2.64	2.62

SOURCES: U.S. Census Bureau 1990, 2000, 2004; Hopi Tribe, Navajo Nation 2006

NOTES: ¹ Surveys completed for the Hopi Strategic Land Use and Development Plan indicated a year 2000 population of 10,571, rather than the 6,946 reported in Census 2000. The Hopi Strategic Land Use and Development Plan also reported the population estimate shown for 2004.

² The Navajo Nation reported the population estimate shown for 2004.

The median age of the population in the region is generally similar to that of the Nation. However, the Hopi and Navajo Reservations and those counties that comprise portions of the reservations have lower median ages than the remainder of the region. The Hopi and Navajo Reservations, and Apache, Coconino, and Navajo Counties have relatively large numbers of persons per household.

The dependency ratio is a statistic that compares the size of the economically dependent population age groups to the size of the working-age population. The sum of the under 15 and over 65 population is divided by the population aged 15 through 64. Areas with dependency ratios over 60 tend to have a proportionately small number of employed persons supporting the remainder of the residents. While both Arizona and Nevada have dependency ratios of less than 60, all but Coconino and Clark Counties have dependency ratios over 60, and both tribes' dependency ratios are higher than any of the counties (refer to Table 3-25).

Recently, unemployment rates in the study area generally have been higher than those for Arizona as a whole (Table 3-26). In 2004, while Arizona's statewide unemployment rate was 4.8 percent, Mohave County had a rate slightly lower than the State (3.8 percent), and Coconino County had a rate slightly higher than the State (6.1 percent). Navajo County, which comprises the bulk of the Kayenta and Black Mesa mining operations labor force, had a rate of 10.6 percent, and Apache County, farther from the mining operations, had a rate of 13.3 percent.

Table 3-26 Regional and Local Area Labor Force Characteristics

Year	Labor Force	Employment	Unemployment	Percent Unemployment Rate
Apache County, Arizona				
2004	22,577	19,577	3,000	13.3%
2003	21,874	18,794	3,079	14.1%
Coconino County, Arizona				
2004	68,846	64,655	4,191	6.1%
2003	66,940	62,642	4,298	6.4%
Mohave County, Arizona				
2004	79,741	76,698	3,043	3.8%
2003	75,806	72,126	3,680	4.9%
Navajo County, Arizona				
2004	37,399	33,432	3,967	10.6%
2003	35,938	32,055	3,883	10.8%
Hopi Reservation				
2004	3,457	2,828	629	18.2%
2003	3,451	2,730	721	20.9%
Navajo Reservation (Arizona Portion)				
2004	35,799	28,439	7,360	20.6%
2003	35,890	27,449	8,441	23.5%
Tuba City Census Designated Place				
2004	3,734	3,130	604	16.2%
2003	3,652	3,033	619	16.9%
Kayenta Census Designated Place				
2004	2,267	2,050	217	9.6%
2003	2,179	1,966	213	9.8%
Arizona				
2004	2,762,612	2,630,998	131,614	4.8%
2003	2,690,294	2,539,359	150,935	5.6%

SOURCE: Arizona Department of Economic Security 2005

The unemployment rates of the Hopi Reservation (18.2 percent) and the Navajo Reservation (20.6 percent, Arizona portion) were highest, according to the Arizona Department of Economic Security. Arizona Department of Economic Security data consider neither the unemployed whose unemployment

benefits have run out nor those who are a part of the informal economy. The informal reservation economy focuses on non-business-related social, traditional, and avocational activity and reflects the production of traditional goods required to reciprocate in clan and family social obligations. A 1999 survey for the Hopi Strategic Land Use and Development Plan documented an unemployment rate of about 64 percent for the Reservation. The Navajo Nation Department of Economic Development conducted surveys that indicated an unemployment rate of about 47.6 percent for 2003 (SWCA Environmental Consultants 2005).

The distribution of employment by industry sector in the study area appears in Table 3-27. In the year 2000, the services and information sector dominated employment, to a similar extent, in each of the counties, both of the reservations, and Arizona and Nevada at the statewide level. Retail and wholesale trade and manufacturing were the next largest sectors of Arizona’s economy, while they were generally smaller proportions of the economy in each part of the study area. The most marked differences between a sector’s share of employment in a state and in a part of the study area involve the reservations. Mining employs a much higher proportion of workers on the Navajo Reservation than statewide. Public administration employs a higher proportion of workers on both reservations than statewide.

Table 3-27 Regional Employment, Percent Share by Industry Sector, 2000

		Total Employment	Industry as Percent of Total Employment								
			Agriculture; Forestry; Fishing and Hunting	Mining	Construction	Manufacturing	Retail and Wholesale Trade	Transportation and Warehousing; and Utilities	Services and Information	FIRE ¹ and Rental/Leasing	Public Administration
Counties	Apache	16,469	1.9	1.2	10.9	2.6	9.1	7.2	51.7	2.8	12.6
	Coconino	55,510	1.3	0.4	7.7	5.2	14.8	5.4	54.5	3.9	6.8
	Mohave	60,517	0.8	0.2	9.7	7.0	15.9	5.7	51.5	4.6	4.5
	Navajo	29,575	2.3	1.4	11.1	5.4	14.7	7.0	45.1	3.8	9.2
	Yavapai	68,098	1.6	1.6	11.7	7.0	16.1	4.1	47.8	5.7	4.6
	Clark	637,339	0.1	0.2	9.7	3.7	13.5	5.1	57.2	6.8	3.6
Tribal Areas	Hopi Reservation	1,869	0.3	0.7	10.5	5.5	8.6	1.4	45.2	1.8	26.0
	Navajo Reservation (Arizona portion)	21,907	1.0	2.7	12.9	3.3	8.4	6.0	52.7	2.2	10.8
State	Arizona	2,233,004	1.0	0.5	8.7	10.2	15.6	5.0	45.8	7.9	5.4
	Nevada	933,280	0.5	1.1	9.2	4.9	14.0	5.2	54.2	6.5	4.5

SOURCE: U.S. Census Bureau 2000

NOTE: ¹ Finance, Insurance, and Real Estate.

3.11.2 Black Mesa Complex

The Black Mesa Complex is within the jurisdiction of the Hopi and Navajo Reservations and Navajo County. The local area of influence is defined as the areas where the socioeconomic effects of mining operations at the Black Mesa Complex are most keenly felt. The population of the local area includes the residents of the Hopi Village of Moenkopi and 14 Navajo chapters. The area is large due to the long commuting distances—some mining workers return to their family households on weekends only. The Coconino County communities of Page and Flagstaff also are potentially affected by activities at the

Black Mesa Complex, as they provide some mine support services, trade activities, and some mine-related employment.

The Hopi villages other than Moenkopi are not considered as part of the local area because they have almost no mining employment, due partly to the lack of a direct paved road to the mines. The southern portion of the “Turquoise Trail” Hopi road project is under way, with a goal to extend Indian Route 4 from Second Mesa/Shongopovi north through the Black Mesa Complex, connecting with U.S. Highway 160 just northwest of the mines.

3.11.2.1 Population in the Local Area

Table 3-28 identifies population since 1990 within the local area. The two largest communities within the local area are Kayenta Township (within Kayenta Chapter) and Tuba City (a census-designated place within Tuba City Chapter), both designated by the Navajo Nation as “Primary Growth Centers” for economic development. Kayenta Township is the closest urban community to the Kayenta mining operation; the township is the only government structured as a municipality on the Navajo Reservation, with taxing authority and a sales tax of 5 percent.

Table 3-28 Population and Households in the Local Area of Influence

	Navajo Agency	Population (1990)	Population (2000)	Population (est. 2004)	Households (2000) ^a
Hopi Reservation Area¹					
Moenkopi Administration Area	N/A	924	901	1,150 ²	242
Navajo Nation Chapters^{b,c,2}					
Black Mesa	Chinle	455	398	410	126
Chilchinbito	Western	1,177	1,325	1,378	333
Dennehotso	Western	1,548	1,626	1,660	414
Forest Lake	Chinle	444	573	606	174
Hard Rock	Chinle	1,263	1,256	1,282	331
Inscription House	Western	1,010	1,214	1,265	351
Kaibito	Western	1,529	1,970	2,132	431
Kayenta	Western	4,902	6,315	6,651	1,618
Oljato	Western	1,913	2,292	2,395	563
Piñon	Chinle	2,050	3,066	3,247	741
Rough Rock	Chinle	1,009	919	949	217
Shonto	Western	2,330	2,419	2,515	644
Tonalea	Western	2,073	2,537	2,692	619
Tuba City	Western	7,305	8,736	9,216	2,170

SOURCES: ¹Hopi Office of Community Planning & Economic Development 2004; U.S. Census Bureau 1990, 2000

²Navajo Nation Division of Community Development 2004; U.S. Census Bureau 1990, 2000

NOTES: ^aA household includes all the people who occupy a housing unit as their usual place of residence.

^b1990 chapter populations are American Indian population only.

^c2000 and 2004 chapter populations include all races.

The Navajo Nation and BIA each distribute a wide variety of services through the agency system and residents tend to identify with their agency. Tuba City is the headquarters of the Western Navajo Agency. While most of the chapters in the local area of influence belong to the Western Navajo Agency, a few belong to the Chinle Agency (refer to Table 3-28).

On the Navajo portion of the lease areas, there are 70 households with about 175 residents (SWCA Environmental Consultants 2005). Some of the residents are ranchers whose livestock graze on both undisturbed and reclaimed land. (Refer to Section 3.9.1 for more information about grazing on the Black Mesa Complex.)

3.11.2.2 Unemployment in the Local Area

Unemployment is a persistent problem in communities within the study area, particularly on the reservations. The overall unemployment rates for the Hopi and Navajo reservations appear in Section 3.11.1, as reported by the Arizona Department of Economic Security and the tribes. The rates are much higher than the unemployment rates for the State of Arizona or for the entire counties in the study area. The Kayenta and Tuba City areas of the reservation have unemployment rates that are lower than the other parts of the reservation (refer to Table 3-26). Of the two areas, the Kayenta area's 2004 unemployment rate was lowest, at 9.6 percent, less than half of the overall Navajo Reservation rate.

3.11.2.3 Employment and Income in the Local Area

The major employment sectors on the Hopi Reservation according to Census 2000 appear on Table 3-27. Information from the Hopi tribe (Hopi Office of Community Planning & Economic Development 2001) indicates that manufacturing employment is at 40 percent of the labor force, compared with the U.S. Census figure of 5.5 percent. The difference is partly explained by some differences in the definition of employment. The Hopi tribe counts as manufacturing employees many persons who produced crafts—some for market and some for ceremonial purposes and exchange within extended families. The Hopi tribe's information indicates that services employ 37 percent of the labor force. The Hopi definition includes all jobs that the U.S. Census defines as public administration, plus a small number of the jobs that the U.S. Census defines as services jobs, so the figures from the Hopi tribe and the 2000 Census are consistent. The most numerous public administration jobs are with the Hopi tribal government (554 jobs), schools, and the Indian Health Services.

The five largest employers on the Navajo Reservation in 2002 were government entities, comprising the Navajo Nation, the State of Arizona (including school districts), the Indian Health Services, the BIA's Office of Indian Education Program, and the State of New Mexico (SWCA Environmental Consultants 2005). That ranking of largest employers was consistent, in general, with Census 2000 figures which indicated that public administration and the services and information sectors accounted for over 60 percent of employment on the Arizona portion of the Navajo Reservation. Private industries, including mining, manufacturing, agriculture, and tourism, are few in comparison. After the five government entities listed above, Peabody was the sixth largest employer.

The median family income for residents within the local area of influence is \$27,435, which is above that for the Hopi Tribe and Navajo Nation, but still below the median family income for Navajo County and the State of Arizona.

The mining sector provides many jobs in the local area of influence. About 90 percent of all employees of the Kayenta and Black Mesa mining operations live on the Navajo Reservation, and less than 1 percent on the Hopi Reservation. The remaining 10 percent reside primarily in Flagstaff or Page. Figures regarding the place of residence of contractual staff are not available (SWCA Environmental Consultants 2005). Figures were not available concerning the distribution of employees between the two mines, but if mining employment before the cessation of Black Mesa mining operation was roughly proportionate to the coal produced, approximately 621 employees and 135 contract employees worked at the mining operations, with 64 percent of the employment at Kayenta mining operation (or 397 mine employees and 86 contract workers) (SWCA Environmental Consultants 2005).

Mining's share of local employment is higher than its share of regional employment. While mining employed more than 5 percent of workers in the local communities in the year 2000, mining employed less than 3 percent of workers in the Arizona portion of the Navajo Reservation. In Chilchinbito and Kayenta, the mining sector is second to the services and information sector (Table 3-29).

Some communities within the local area have relatively few residents who work at the mines, yet the income earned by those employees has a large influence on the communities. Just a few miners live in the Black Mesa, Forest Lake, and Hard Rock Chapters, where residents are hindered in seeking employment outside their home chapters by the limited paved-road network and limited telephone service.

Many young and elderly persons are supported by mine employees. The ratio of the dependent aged population to the working age population is 72.3 for the entire local area—higher than that for either reservation overall, and much higher than the Arizona ratio (54.9) (refer to Table 3-25).

Table 3-29 Local Area Employment: Total and Percent Share by Industry Sector (2000 Census)

	Total Employment	Industry as Percent of Total Employment								
		Agriculture, Forestry, Fishing, and Hunting	Mining ¹	Construction	Manufacturing	Retail and Wholesale Trade	Transportation, Warehousing, and Utilities	Services and Information	FIRE ² and Rental/Leasing	Public Administration
Hopi										
Moenkopi	207	0.0	6.3	20.8	0.0	5.8	0.0	41.1	0.0	26.1
Navajo Nation Chapter										
Black Mesa	60	0.0	0.0	21.7	0.0	0.0	0.0	78.3	0.0	0.0
Chilchinbito	147	0.0	18.4	0.0	0.0	15.6	12.2	38.1	0.0	15.6
Dennehotso	269	0.0	13.0	9.7	0.0	9.7	1.9	50.9	1.5	13.4
Forest Lake	27	0.0	0.0	29.6	0.0	0.0	33.3	37.0	0.0	0.0
Hard Rock	187	2.1	0.0	21.9	0.0	1.6	10.2	48.1	0.0	16.0
Inscription House	257	0.0	11.7	30.7	5.1	17.1	3.5	30.4	0.0	1.6
Kaibito	400	0.0	0.8	18.5	6.8	14.0	6.5	44.3	1.3	8.0
Kayenta	1,524	0.9	12.3	8.9	1.2	10.0	4.0	57.9	0.0	4.7
Oljato	515	0.0	5.0	13.8	4.7	12.0	8.3	52.0	0.0	4.1
Piñon	615	0.8	3.7	4.4	2.6	12.4	12.4	57.7	1.3	4.7
Rough Rock	135	0.0	3.7	15.6	0.0	0.0	0.0	70.4	0.0	10.4
Shonto	511	1.2	12.5	16.2	5.7	2.7	5.3	51.5	1.6	3.3
Tonalea	434	0.0	0.0	24.0	2.3	6.0	10.1	47.2	3.9	6.5
Tuba City	2,908	0.5	1.6	8.8	2.1	8.6	4.3	61.1	2.7	10.4

SOURCE: U.S. Census Bureau 2000

NOTES: ¹ While Tonalea, Forest Lake, and Hard Rock Chapters reported no mining employment in the 2000 Census, Peabody has supplied employee residence location figures for 2004 that indicate there are currently miners from the three communities.

² Finance, Insurance, and Real Estate.

Residents of the local area around the Black Mesa Complex generally enjoy more prosperity than residents of the Hopi and Navajo Reservations in general. Incomes are highest for mining workers and for those employed in tourism or government. Typically, wages are low in other sectors, and those seeking work exceed the number of jobs available.

A 2004 study of the area including the communities of Kayenta, Chilchinbito, and Oljato identified the mining operations as the driving force behind the local economy (Arizona State University [ASU] Center for Business Research 2004b) because coal sales to Navajo and Mohave Generating Stations bring money into the local economy. Jobs that exist due to a mine worker's household spending, or the spending of a business that supplies the mines, would represent indirect jobs attributable to current mining operations. Similarly, income and spending that support the increase in household spending and supplier spending attributable to the two mining operations and the coal-slurry pipeline represent indirect economic impacts.

The indirect effects on regional employment and income were estimated in a separate economic study using IMPLAN regional economic modeling software (URS Corporation 2005). IMPLAN is a computerized method to develop regional input-output models. Multipliers were derived from IMPLAN to assess the relationship between the Black Mesa Complex and the regional economy. Employment, income, and output multipliers for industries related to the mines and coal-slurry pipeline in the four-county study area range from 1.3 to 2.1 (Table 3-30). The direct industry effects are expressed as a multiplier of 1.0 in each of the three categories (output, income, and employment). Multipliers above 1.0 represent indirect effects of the industry. For example, at the Black Mesa Complex, as of 2005:

- One job supported 1.1 jobs elsewhere in the economy;
- One dollar paid for coal produced supported 0.4 dollars of production elsewhere in the economy; and
- One dollar of income earned by mine workers supported 0.4 dollars of income elsewhere in the economy.

Table 3-30 Industry Multipliers

Industry	Output	Income	Employment
Coal mining	1.4	1.4	2.1
Power generation and supply	1.3	1.5	2.1
Manufacturing and industrial buildings	1.5	1.4	1.5
Highway, street, bridge, and tunnel construction	1.6	1.5	1.5
Water, sewer, and pipeline construction	1.5	1.5	1.6
Other new construction	1.6	1.5	1.6

SOURCE: IMPLAN modeling completed by URS Corporation 2005

- NOTES: 1. The study area is the combined four-county area of Navajo, Mohave, Coconino, and Apache Counties in Arizona.
2. These industries were chosen because they most closely represent the industries in which direct jobs associated with existing conditions, project construction, and project operation are categorized.

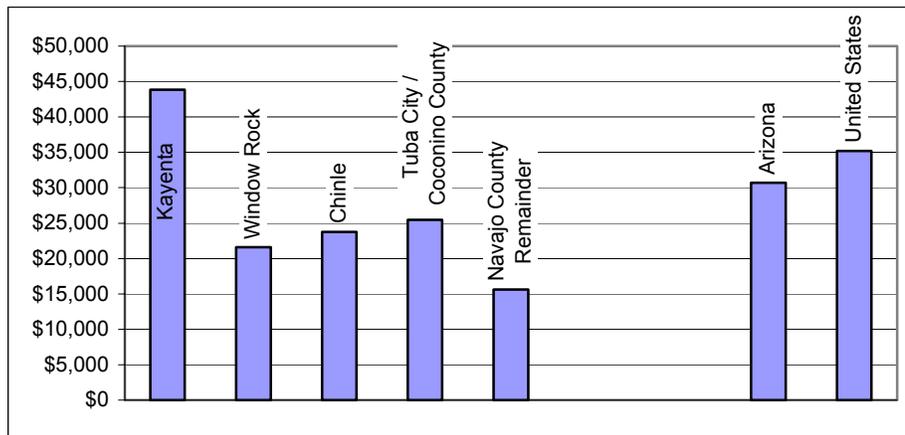
The Kayenta area has the highest per capita employment overall in the Hopi and Navajo areas, and among all of the unincorporated areas in Arizona, Kayenta's per capita employment overall and in the nonagriculture private sector was higher than average. Average nonfarm private-sector payroll per employee in the Kayenta area in 2001 was \$43,800, which was approximately 40 percent more than the state average. This was the highest figure among Arizona unincorporated areas (Figure 3-5). High wages paid in the mining sector are largely responsible for the high average (ASU Center for Business Research 2004b).

3.11.2.4 Fiscal Conditions

Peabody is responsible for many types of government payments, including taxes, fees, royalties, and others collected by Federal, State, and tribal agencies. OSM is responsible for collecting fees related to the Surface Mining Law, which provides for the restoration of land mined and abandoned or left inadequately restored before August 3, 1977. Under this program, production fees are collected from coal producers at all active coal mining operations. The fees are deposited in the Abandoned Mine Land (AML) Reclamation Fund, which is used to pay the reclamation costs of abandoned mine land projects. The legislative authority, otherwise set to expire on June 20, 2005, was extended through June 2006 as a part of the Fiscal Year 2006 Interior, Environment, and Related Agencies Appropriations Act (Public Law 109-54). The AML's long-term future is under discussion by the U.S. Congress. The Hopi Tribe and Navajo Nation receive grants on an annual basis funded by AML reclamation proceeds to fund reclamation of eligible mines (SWCA Environmental Consultants 2005). A variety of projects have been funded by AML grants including abandoned coal and uranium mine reclamation and assorted community

development projects. Another Federal tax paid by Peabody is the Black Lung Excise Tax, the proceeds of which are provided to the United Mine Workers of America Combined Benefit Fund. Peabody's payments for both the AML and Black Lung Excise Tax, from both the Kayenta and Black Mesa mining operations, totaled almost \$12 million in 2004.

Figure 3-5 Payroll per Employee, Private-Sector, 2001 Hopi and Navajo Areas



SOURCES: Arizona Department of Commerce/ASU Center for Business Research, 2004a, b, c. Estimated from U.S. Department of Commerce, Census Bureau, *Zip Business Patterns 2001*

NOTE: Apache County area data suppressed to avoid disclosure. Kayenta defined as all of ZIP Code 86033.

Peabody pays property and sales taxes to the State of Arizona (Table 3-31). The property taxes for the mines are paid to the State and redistributed through the county. It is estimated that about 85 percent of the property tax paid by Peabody is distributed back to Kayenta Unified School District. State sales tax is paid on coal sales, outside services, and materials and supplies. The revenue from the State sales tax is retained by the State and distributed through a number of funds based upon the approved State budget. Over the past few years, Peabody's sales taxes have averaged nine times the amount of the property taxes (refer to Table 3-31). Various State services are provided to residents within the study area influence, most notably through distributions back to local school districts.

Table 3-31 State of Arizona Taxes Paid by Peabody Western Coal Company

Year	Property Tax (\$ Million)	Sales Tax (\$ Million)	Total (\$ Million)
2001	1.7	12.0	13.7
2002	1.5	18.4	19.9
2003	1.7	14.3	15.9
2004	1.7	16.4	18.1
2005	2.0	18.7	20.6

SOURCES: Peabody Western Coal Company 2006; SWCA Environmental Consultants 2005

The expected property tax amount for 2006 for the Kayenta mining operation would be \$1.3 million, and the expected sales tax amount would be \$10.5 million. This estimate assumes that the Black Mesa mining operation has closed, there would be no changes in the rates of any of the payments, and the payments would be 64 percent of the 2005 total Peabody payments (i.e., proportional to the amount of coal provided by Kayenta over the past several years).

Peabody has been responsible for paying Navajo Nation taxes levied on the Black Mesa mining operation; however, Peabody has not paid taxes to the Navajo Nation for the Kayenta mining operation. This is because Peabody, as fuel supplier to the Navajo Generating Station, has taxes waived for the Kayenta mining operation under the Navajo Generating Station Indenture of Lease. This waiver is in full force through April 30, 2011, at which time there is a partial expiration.

The Office of Navajo Tax Commission administers the taxes that Peabody has paid for the Black Mesa mining operation (Table 3-32). The Possessory Interest Tax is a tax on the taxable value of a possessory interest granted by the Navajo Nation, which provides a right to be on Navajo land performing a particular activity. The most common types of uses are oil and gas leases, coal leases, rights-of-way, and business site leases. The Business Activity Tax is a tax on the net source gains (gross receipts minus deductions) from the sale of Navajo goods and services. The tax applies to goods that are produced, processed, or extracted within the Navajo Reservation, and on all services performed within the reservation. The Fuel Excise Tax went into effect in 1999, generating \$0.18 per gallon. The Navajo Sales Tax became effective on April 1, 2002, with a rate of 3 percent of gross receipts. The tax is imposed on all goods or services purchased within the reservation.

Table 3-32 Navajo Tribal Taxes Paid by Peabody Western Coal Company 1986-2005 (Black Mesa mining operation¹)

Year	Possessory Interest Tax (\$ Million)	Business Activity Tax (\$ Million)	Navajo Sales Tax (\$ Million)	Navajo Fuel Excise Tax (\$ Million)	Total (\$ Million)
1986-1990	9.1	8.8	N/A	N/A	17.8
1991-1995	10.8	14.8	N/A	N/A	25.6
1996-2000	9.8	11.8	N/A	N/A	21.5
2001	2.6	2.0	N/A	0.5	5.0
2002	2.2	3.2	0.1	0.5	6.1
2003	0.7	1.8	0.2	0.5	3.2
2004	0.7	2.0	0.3	0.5	3.5
2005	0.7	2.9	0.3	0.6	4.5
Total	36.6	47.3	0.9	2.6	87.3
Average per year	1.8	2.4	0.22	0.13	4.4

SOURCES: Peabody Western Coal Company 2006; SWCA Environmental Consultants 2005

NOTE: ¹ No Navajo Nation taxes have been paid for the Kayenta mining operation (see text).

Figures may not add to totals due to rounding.

Because Peabody's taxes are waived for the Kayenta mining operation, no Navajo Nation tax revenue is expected from Peabody in 2006.

The coal produced from the mining operations also is subject to three coal-mining leases approved by the Hopi Tribe, Navajo Nation, and Secretary of the Interior. The lease agreements provide for payment of royalties and bonuses to the tribes. The royalty rates were adjusted in 1987 and were adjusted for the Hopi lease in 1997. The bonuses were established and were first paid to each tribe in 1998. Table 3-33 identifies historical revenues to the tribes for royalties and bonuses related to coal extraction.

Table 3-33 Coal Royalties and Bonuses Paid by Peabody Western Coal Company: 1986-2005¹

Year	Coal Royalties				Coal Bonuses ²		
	Hopi Lease 5743 (\$ Million)	Navajo Lease 8580 (\$ Million)	Navajo Lease 9910 (\$ Million)	Overall Total (\$ Million)	Hopi (\$ Million)	Navajo (\$ Million)	Total (\$ Million)
1986 (least)	3.7	1.9	3.7	9.3	N/A	N/A	N/A
1987 (most)	4.3	43.1 ³	4.3	51.7	N/A	N/A	N/A
2005 (most recent)	14.7	28.9		43.6	1.8	3.5	5.3
Total	191.9	485.1		677.0	10.1	27.3	37.4
Average per year	9.6	24.3		33.9	1.3	3.4	4.7

SOURCES: Peabody Western Coal Company 2006; SWCA Environmental Consultants 2005

NOTES: ¹ Figures may not add to totals due to rounding.

² Bonuses began in 1998.

³ The \$43.1 million coal-royalty payment included an adjustment for royalty rates back to 1984.

The expected amounts of royalties for 2006 for the Kayenta mining operation would be \$9.4 million to the Hopi Tribe and \$18.5 million to the Navajo Nation (both leases). The expected amounts of bonuses for 2006 would be \$1.2 million to the Hopi Tribe and \$2.2 million to the Navajo Nation.

The lease agreements with the tribes provide for royalty payments for use of the N-aquifer water. The fees paid are based on the amount of water withdrawn from the aquifer. Table 3-34 summarizes the historical annual payments for water use royalties to both tribes, which have averaged more than \$1.7 million per year for each tribe. Payments in recent years have been about \$2.3 million annually per tribe.

Table 3-34 Water Royalties Paid by Peabody Western Coal Company: 1986-2004

	Hopi (\$ Million)	Navajo (\$ Million)	Total (\$ Million)
1986	0.02	0.02	.045
1987 (least)	0.02	0.02	.037
2003 (most)	2.3	2.3	4.5
2005 (most recent)	2.3	2.3	4.5
TOTAL	33.5	33.5	67.0
Average per year	1.7	1.7	3.4

SOURCES: Peabody Western Coal Company 2006; SWCA Environmental Consultants 2005

NOTE: Figures may not add to totals due to rounding.

While the Kayenta mining operation has yielded 64 percent of the coal, the Black Mesa mining operation has accounted for the majority of the water use, due to the coal-slurry plant and pipeline. In 2006, the Kayenta mining operation and the water necessary to keep the Black Mesa system in operating condition are expected to use about 26 percent of the amount of water used by the Black Mesa Complex in 2005, which would result in water royalties of \$0.6 million for each tribe.

The grand total of all of the payments described above to the tribes from 1986 to 2005 is shown in Table 3-35.

Table 3-35 Total Annual Payments to Hopi and Navajo Tribes: 1986-2005

Year	Hopi Reservation (\$ Million)	Navajo Nation (\$ Million)
1986	3.7	9.8
1987	4.5	51.4
1988	9.8	26.3
1989	10.3	26.3
1990	9.4	26.1
1991	11.0	29.8
1992	10.5	30.0
1993	10.6	35.8
1994	12.5	28.2
1995	13.8	27.2
1996	12.1	26.7
1997	11.9	29.1
1998	14.5	33.5
1999	12.8	34.4
2000	13.7	35.5
2001	15.1	37.1
2002	13.9	38.6
2003	13.6	35.0
2004	16.2	36.5
2005	18.7	39.2
TOTAL	238.3	636.4
Average per year	11.9	31.8

SOURCES: Peabody Western Coal Company 2006; SWCA Environmental Consultants 2005

- NOTES: 1. Figures may not add to totals due to rounding.
 2. Total of the annual payments detailed in Tables 3-29 through 3-31.
 3. Total does not include student scholarships, nor grant payments made to the tribes by the Federal government from the AML.

In some recent years, Peabody’s mining operations have been the single largest source of revenue in the Hopi and Navajo tribal budgets. Funds received by the tribes are distributed broadly to a number of tribal agencies, Hopi villages, and Navajo chapters. Coal revenues fund the bulk of the Hopi Government’s annual operating budget and the bulk of more than 500 jobs provided by the Hopi Tribe. On the Hopi Reservation, the Kayenta and Black Mesa mining operations historically have accounted for approximately 50 percent of tribal government revenues. In the 2003 preliminary budget, the figure is estimated to be about 54 percent of the total Hopi tribal revenues.

Kayenta and Black Mesa mining revenues represented 26 percent of the total Navajo Nation nongrant budget in 2003; all mines on the Navajo Reservation taken together accounted for 40 percent of the 2003 budget.

3.11.2.5 Public Utilities

The NTUA is the primary provider of water and electric utilities in most of the local area of influence. NTUA is an enterprise of the Navajo Nation, providing electric, natural gas, water, wastewater treatment, and solar energy to residents and businesses of the Navajo Reservation and limited areas of service to the Hopi Reservation. Generally, NTUA is the original developer and owner of its electric systems. Indian Health Services funds and constructs community water systems, then dedicates them to NTUA, while

commercial enterprises are responsible for construction of their own water connections. Community water systems exist in population centers such as Kayenta, Moenkopi, and Tuba City.

NTUA is exploring the feasibility of establishing improved power and water distribution systems in the immediate area of the Black Mesa Complex, beyond the systems developed for the operation of the mines. Consideration would need to be given to the availability of rights-of-way and accessibility to the many dispersed site home sites in the area (SWCA Environmental Consultants 2005). Many of the homes in the Black Mesa area do not have running water. Peabody makes available potable water at two water stands on the Black Mesa Complex to area residents who must haul water.

NTUA operates some centralized wastewater systems with lagoon treatment in the area, primarily for Navajo Housing Authority subdivisions, but the majority of homes on dispersed home sites use individual septic systems. Kayenta, Tuba City, and Moenkopi are all served by community wastewater systems.

NTUA purchases electrical power from outside the Navajo Reservation and transmits that power to homes across most of the reservation. APS provides electrical service to Tuba City and Moenkopi, where a high proportion of households have electric service.

The Kayenta and Black Mesa mining operations are a major user of power provided by NTUA. Over the time period of 1986 through 2004, the mines have been the source of 22 percent of NTUA's electric service revenue. As the overall NTUA system has grown, the mines' annual share of NTUA revenue has declined from 25 percent or more to less than 20 percent.

3.11.2.6 Education

The educational institutions at the kindergarten through high school level in the local area (Table 3-36) comprise four categories of schools: Arizona Unified School Districts, BIA Schools, BIA Contract Schools (funded by BIA but managed by the tribes), and Arizona Charter Schools. Shonto Preparatory School is both a BIA Contract School and an Arizona Charter School.

Table 3-36 Schools (grades K-12) in the Local Area

Name of District or School	Category	Grade Levels
Kayenta School District	Arizona Unified District	K-12
Tuba City School District	Arizona Unified District	K-12
Piñon School District	Arizona Unified District	K-12
Shonto Preparatory School	BIA Contract and Arizona Charter	K-12
Kayenta Community School	BIA	K-8
Chilchinbito Community School.	BIA Contract	K-8
Greyhills Academy (Tuba City)	BIA Contract	9-12
Moenkopi Day School	BIA	K-8
Dennehotso Boarding School	BIA	K-8
Kaibito Boarding School	BIA	K-8
Tonalea Day School	BIA	K-8
Tuba City Boarding School	BIA	K-8
Rough Rock Community School	BIA Contract	K-12

SOURCES: Arizona Department of Education 2005; SWCA Environmental Consultants 2005

Arizona schools' five-year graduation rate (2003) averaged 73 percent, compared to rates ranging from 51 percent to 87 percent for the schools in the mines' local area for which the rate was available (Arizona Department of Education 2005).

Tuba City, Kayenta, and Moenkopi have a higher proportion of high-school graduates among residents aged 25 and over than the overall rates for the Hopi (67.0 percent) or Navajo (57.0 percent). The State of Arizona's rate is 80.9 percent. The proportion of college graduates in Tuba City and Kayenta exceeds the 8.0 percent college graduation rate for the Navajo Nation. The other local communities have lower educational attainment among adults than is the case for the Hopi Tribe or Navajo Nation overall.

Peabody provides scholarship funds on an annual basis in the amounts of \$173,000 to the Hopi Tribe and \$186,000 to the Navajo Nation. The Hopi Tribe also has used \$750,000 of its coal bonus revenue for additional educational funding.

3.11.2.7 Health Care

Indian Health Services provides support for health services on the Hopi Reservation, with a new facility, Hopi Health Care Facility, at First Mesa in Polacca. The facility brings health care nearer to Hopi communities than what was previously available. The facility is partially dependent upon funding by the Hopi Tribe.

The Navajo Area Indian Health Services Office, located in Window Rock, administers clinics, health centers, and hospitals, providing health care to members of the Navajo Nation. Comprehensive health care is provided to the Navajo people through hospitals, health centers, and health stations. School clinics and Navajo tribal health programs also serve the community. A major portion of the Navajo Nation health care delivery system is sponsored by the Navajo Nation itself, which operates the Navajo Division of Health in Window Rock. Facilities located within the local area of influence include the Indian Health Services Tuba City Indian Medical Center and the Indian Health Services Kayenta Service Unit.

Peabody maintains a 24-hour emergency medical clinic at the mine complex, which is designed primarily to service mine personnel, but also is available for emergencies of local residents. The clinic's ambulance and the Peabody airstrip are used for medical-evacuation situations when the Kayenta airstrip may not be available due to inclement weather.

3.11.2.8 Public Safety: Law Enforcement and Fire Protection

The BIA and the Hopi Tribe (The Rangers) provide police services on the entire Hopi Reservation. The Navajo Department of Law Enforcement provides services throughout the reservation. The Navajo Department of Fire and Rescue Services and the local Kayenta Volunteer Fire Department provide fire and rescue services to residents of the Navajo Nation. The county sheriffs and Arizona Department of Public Safety also provide some service to the main reservation highways. BIA provides fire-response service, which is primarily responsible for fire services to Federal buildings. Peabody responds to fire emergencies using its pumper truck that is located at the mine complex medical clinic.

Wildland fire management on the Hopi and Navajo Reservations is primarily the responsibility of fire-management officers at the BIA regional agency offices that serve the two reservations. Both offices have agreements with the other participants in national interagency fire program management and wildland firefighting. In the Hopi and Navajo areas, the BIA works frequently with the BLM and the Forest Service, since the BLM and Forest Service manage much of the nearby public land.

3.11.3 Coal-Slurry Preparation Plant

The information describing existing social and economic conditions of the affected environment for the mines is applicable to the coal-slurry preparation plant (which currently is not in operation). The distribution of workers' residence locations was very similar to that for the mining operations. The 34 employees at the coal-slurry preparation plant received wages averaging \$28 per hour.

BMPI pays various taxes and fees, levied upon the coal-slurry preparation plant, to a number of governmental entities in the States of Arizona and Nevada and to the Navajo Nation. The information for the plant and pipeline is presented together in Table 3-37. More complete descriptions of the taxation system for those taxes paid by industry are discussed under Fiscal Conditions, Section 3.11.2.4. BMPI has not yet been advised by any of the State and local taxing authorities as to the effect of its shutdown upon its future taxes.

Table 3-37 States of Arizona and Nevada Taxes Paid by Black Mesa Pipeline, Inc., in 2004

State	County	Property Tax (rounded to nearest \$1,000)	Sales Tax (rounded to nearest \$1,000)
Arizona			37,000
	Coconino	187,000	N/A
	Mohave	59,9000	N/A
	Navajo	150,000	N/A
	Yavapai	61,000	N/A
Nevada	Clark	2,000	N/A

SOURCE: C. Sauser, Black Mesa Pipeline, Inc., 2005

3.11.4 Coal-Slurry Pipeline

The existing coal-slurry pipeline and proposed alignments cross portions of Navajo County (where the pipeline is entirely on the Hopi or Navajo Reservations), Coconino County (where the pipeline is partly on the Navajo Reservation), Yavapai, and Mohave Counties, Arizona, and Clark County, Nevada. The pipeline is now dormant until such time as the Black Mesa mining operation resumes.

The coal-slurry pipeline is almost entirely underground, and ordinary operations require few work trips or deliveries of supplies to maintain it. Therefore, there is typically little interaction between the pipeline operation and the region. However, there would be noticeable economic and social activity during reconstruction.

Seventeen staff members supported the pipeline operation while in operation, 10 with an office in Flagstaff. The employees of the pump station at the coal-slurry preparation plant are counted with the plant personnel. The other seven staff members operated the other three pump stations.

The Kingman reroute would relocate the pipeline away from areas where future major developments are planned, to areas with less potential for growth. The social and economic characteristics of the local areas along the Moenkopi Wash realignments and the Kingman reroute are the same as those in areas along the corresponding portions of the existing pipeline (Table 3-38), with the exception of Census Tract 9507.02 along the Kingman reroute, which has a higher proportion of persons in poverty than the remaining area.

Table 3-38 Local Area Population and Households (Pipelines and Well Field)^a

	Local Area	Project Component ¹	Total Population (2000)	Households (2000)
Navajo Chapters	Coal Mine Mesa	Coal-slurry pipeline; water-supply pipeline (western alternative)	374	121
	Cameron	Coal-slurry pipeline	1,231	311
	Leupp	Well field and water-supply pipeline	1,605	419
	Bird Springs	Well field and water-supply pipeline	829	200
	Tolani Lake	Well field and water-supply pipeline	755	196

	Local Area	Project Component¹	Total Population (2000)	Households (2000)
Hopi Land	Tribal census tract 9411, BG2	Coal-slurry pipeline	1,556	410
	Tribal census tract 9410, BG4	Coal-slurry pipeline	400	119
Kingman Areas	Census tract 9509	Coal-slurry pipeline	7,618	3,187
	Census tract 9507.02	Coal-slurry pipeline	7,332	2,856
	Census tract 9508	Coal-slurry pipeline	3,685	1,652
	Census tract 9506	Coal-slurry pipeline	6,513	2,658
	Census tract 9511	Coal-slurry pipeline	3,605	1,475
	Census tract 9510	Coal-slurry pipeline	10,376	3,783

SOURCE: U.S. Census Bureau 2000

NOTE: ¹The project component column indicates which project component's facilities would be in the area.

3.11.5 Project Water Supply

3.11.5.1 C Aquifer Water-Supply System

3.11.5.1.1 Well Field

The local area of influence for the well field (refer to Table 3-38) includes the Navajo Nation chapters of Leupp, Tolani Lake, and Bird Springs. The chapters share a community water system centered on Leupp.

The ratio of the dependent-aged population to the working-age population is 71.3 for the three-chapter local area overall, higher than that for either reservation overall, and much higher than the ratio for Arizona statewide (54.9). The American Indian population is 98.3 percent of the total population of the three-chapter local area. More information about the racial and ethnic makeup of the area is presented in Section 3.12.

As indicated in Table 3-39, services and information are the dominant sectors in the local area for the proposed well field. Construction and manufacturing also are well represented. Tooh Dineh Industries in Leupp, which assembles printed circuit boards, is the leading manufacturing business. The local area was a part of the "Tuba City/Coconino County" Hopi and Navajo area that was the subject of an economic base study (ASU Center for Business Research 2004a). According to that study, the employment per 1,000 residents and the payroll per employee in private-sector jobs in the area lagged behind the Kayenta area, the State, and the Nation.

3.11.5.1.2 C Aquifer Water-Supply Pipeline: Eastern and Western Routes

The eastern and western routes would pass through areas with economic profiles that are similar to one another. Both routes would cross the three chapters in the well field's local area. The eastern route would cross Kykotsmovi and sparsely populated areas of the Hopi Reservation, and Hard Rock and Forest Lake chapters. The western route would cross Coal Mine Mesa, Tuba City, Tonalea, Shonto, Kayenta, and Forest Lake chapters (refer to Tables 3-24, 3-26, 3-35).

Health care and public safety services are reservation-wide for the Hopi Tribe, so they are the same for the local area of the water-supply pipeline as they are for the local area for the mines, and are described in Section 3.11.2. There are some additional BIA schools in the local area of the water-supply pipeline. They include the following K-8 schools: Leupp School in Leupp, Hopi Day School and Rocky Ridge Boarding School in Kykotsmovi, Hotevilla Bacavi Community School in Hotevilla, and Second Mesa Day School in Second Mesa. Hopi High School serves the entire local area and is in Keams Canyon.

**Table 3-39 Local Area Employment: Percent Share by Industry Sector
(Coal-Slurry Pipeline and Project Water Supply)^a**

		Agriculture, Forestry, Fishing, and Hunting	Mining	Construction	Manufacturing	Retail and Wholesale Trade	Transportation, Ware- housing, and Utilities	Services and Information	FIRE ¹ and Rental/Leasing	Public Administration
Navajo Chapters	Coal Mine Mesa	0	0	22.8	12.3	8.8	0	56.1	0	0
	Cameron	7.2	0	27.6	0	22.2	0	33.8	3.4	5.8
	Leupp	0	0	27.2	14.1	0	4.3	46.1	0	8.3
	Bird Springs	11.4	0	11.4	10.3	0	3.3	41.3	4.9	17.4
	Tolani Lake	0	0	17.6	3.9	4.6	13.1	49	2.6	9.2
Hopi Land	Tribal Census Tract 9411, BG2	1.6	0	13.7	3.5	8	0	52.8	0	20.4
	Tribal Census Tract 9410, BG4	0	0	17.8	14.4	8.9	7.8	51.1	0	0
Kingman Areas	Census Tract 9509	1.1	0.3	9.6	11.6	16.1	7.4	45.2	2.1	6.6
	Census Tract 9507.02	0.2	0.3	13.7	12.9	14.9	4.9	46.9	3.2	3
	Census Tract 9508	5.2	2.6	10.8	8	19.4	8.1	34.9	4.4	6.5
	Census Tract 9506	1.3	0	7.2	6.5	13.4	8.5	56.4	2.9	3.7
	Census Tract 9511	0	0.3	10.9	6.5	16.2	5.5	51.4	2.1	7
	Census Tract 9510	0	0.2	7.4	14.1	15.6	8.5	42.9	3.4	8

SOURCE: U.S. Census Bureau 2000

NOTES: ¹FIRE = Finance, Insurance, and Real Estate.

Pertinent project components are identified in Table 3-35.

3.12 ENVIRONMENTAL JUSTICE

In accordance with Executive Order 12898, it is the responsibility of Federal agencies to identify and address “disproportionately high and adverse human health or environmental effects of its activities on minority populations and low-income populations.” The general purposes of the Executive Order are to (1) focus attention of Federal agencies on the human health and environmental conditions in minority and low-income communities with the goal of achieving environmental health; (2) foster nondiscrimination in Federal programs that substantially affect human health or the environment; and (3) give minority communities and low-income communities greater opportunities for public participation in, and access to public information on, matters relating to human health and the environment. One of the tasks in such an endeavor is to identify minority and low-income populations groups at geographic levels of analysis appropriate to the project under study.

An environmental justice population can be defined by one of two criteria: (1) minority and/or low-income persons within a defined area exceed 50 percent of the population, or (2) minority and/or low-income persons within a defined area exceed the minority and low-income persons in a larger community of which it is a part (e.g., a State, county, or other division) (CEQ 1997). The study areas for this analysis are the same as those considered in the analysis of social and economic conditions (Section 3.11).

Both the Hopi Tribe and Navajo Nation are minority communities. On the Hopi and Navajo Reservations, the share of population that is low income greatly exceeds the share of population that is low income in other communities, on the average, in the State or Nation. The Hopi Tribe and Navajo Nation each have negotiated lease agreements for the extraction of coal from the Black Mesa Complex. Several types of revenue from mining are used throughout the two reservations at the tribal and local community levels, for natural resources, human services, education, and other functions.

The most recent available census data on race and ethnicity were analyzed to identify minority populations that might be disproportionately larger than the general population in the county or the State. The Hopi and Navajo Reservations are predominantly American Indian (95 percent and 96 percent respectively) (Table 3-40). The smaller communities that comprise the portions of the reservation in the vicinity of the Black Mesa Project are also overwhelmingly minority populations, with a population that is 95.5 percent American Indian overall (Table 3-41).

An analysis of county-level data, some of which overlap with the reservations, affirms the presence of large minority populations. The percentage of American Indian residents in Apache County (77 percent), Coconino County (29 percent), and Navajo County (48 percent) exceeds the overall proportion of American Indians in the Arizona population (5 percent) (refer to Table 3-40). Although Clark County includes a slightly larger percentage of residents that are Black or African-American, Asian, some other race, or two or more races, the minority community is not concentrated in Laughlin, in the project vicinity. An analysis of census tracts in the vicinity of the project facilities near Kingman, Arizona does not identify any concentrated minority populations in that area (refer to Table 3-41).

Hispanic populations also are considered to be minorities, and the census data tabulate Hispanic ancestry as an ethnicity. Therefore, Hispanic people may be of any race. As illustrated in Table 3-40, Clark County has a larger percentage of Hispanic residents (22 percent) than the State of Nevada overall (19.7 percent), but the Laughlin area does not have a large Hispanic population. The share of Hispanic residents in the project's various local areas is much smaller than the State-level comparison populations (refer to Table 3-41).

Census data also were used to identify low-income populations, using thresholds for poverty as defined by the CEQ guidance. Census data were compared to other reliable estimates of poverty in order to assess poverty trends regionally and locally. According to the 2000 census data, the Hopi and Navajo reservations are disproportionately low-income (39 percent and 42 percent persons below the poverty line respectively, compared to nearly 14 percent for Arizona overall) (Table 3-42). Each of the individual counties in the region—with the exception of Yavapai County—exceeds the statewide proportion of persons below the poverty level (refer to Table 3-42).

It is likely that those living below the poverty line are undercounted for both the Hopi and Navajo, as is the case with the unemployed. For example, the 2000 Hopi Strategic Land Use and Development Plan indicated that nearly 61 percent of Hopi households have incomes below poverty level. The prevalence of poverty is consistent with the high unemployment rate found in the area (discussed in Section 3.11).

Poverty data also were analyzed for smaller geographic units. Nearly all of the Navajo Chapters have a higher percentage of individuals below the poverty level than the statewide percentage (13.6 percent) or the percentages in the overlapping counties (refer to Table 3-42 and Table 3-43). The Moenkopi District of the Hopi reservation has a similar proportion of persons below the poverty line (13.7 percent) to that of the State. Outside of the reservations, four census tracts in the Kingman area have higher percentages of persons below the poverty line than Mohave County (13.9 percent).

The small-area income and poverty estimates of the U.S. Census Bureau (U.S. Census Bureau 2002) is a consistent series of data that permits the estimates of the population in poverty to be compared from one year to the next. That series indicates the following trends in poverty population in the region from 1999 to 2002 (Table 3-44).

Other data series of poverty estimates yield slightly different results. Taken together, however, they all show persistent poverty in Apache and Navajo Counties, Arizona.

Table 3-40 Race and Ethnicity – Regional Level

	Counties						Tribal Areas		States	
	Apache	Coconino	Mohave	Navajo	Yavapai	Clark	Hopi Reservation	Navajo Reservation	Arizona	Nevada
Total population	69,423	116,320	155,032	97,470	167,517	1,375,765	6,946	180,462	5,130,632	1,998,257
Race										
One Race										
White <i>Percent of Total Population</i>	13,536 <i>19.5%</i>	73,381 <i>63.1%</i>	139,616 <i>90.1%</i>	44,752 <i>45.9%</i>	153,933 <i>91.9%</i>	984,796 <i>71.6%</i>	269 <i>3.9%</i>	4,316 <i>2.4%</i>	3,873,611 <i>75.5%</i>	1,501,886 <i>75.2%</i>
Black or African American <i>Percent of Total Population</i>	173 <i>0.2%</i>	1,215 <i>1.0%</i>	833 <i>0.5%</i>	857 <i>0.9%</i>	655 <i>0.4%</i>	124,885 <i>9.1%^c</i>	14 <i>0.2%</i>	138 <i>0.1%</i>	158,873 <i>3.1%</i>	135,477 <i>6.8%</i>
American Indian and Alaska Native <i>Percent of Total Population</i>	53,375 <i>76.9%</i>	33,161 <i>28.5%</i>	3,733 <i>2.4%</i>	46,532 <i>47.7%</i>	2,686 <i>1.6%</i>	10,895 <i>0.8%</i>	6,573 <i>94.6%</i>	173,987 <i>96.4%</i>	255,879 <i>5.0%</i>	26,420 <i>1.3%</i>
Asian <i>Percent of Total Population</i>	93 <i>0.1%</i>	910 <i>0.8%</i>	1,186 <i>0.8%</i>	322 <i>0.3%</i>	851 <i>0.5%</i>	72,547 <i>5.3%^c</i>	4 <i>0.1%</i>	113 <i>0.1%</i>	92,236 <i>1.8%</i>	90,266 <i>4.5%</i>
Native Hawaiian/Other Pacific Islander <i>Percent of Total Population</i>	39 <i>0.1%</i>	108 <i>0.1%</i>	168 <i>0.1%</i>	46 <i>0.0%</i>	138 <i>0.1%</i>	6,412 <i>0.5%</i>	1 <i>0.0%</i>	35 <i>0.0%</i>	6,733 <i>0.1%</i>	8,426 <i>0.4%</i>
Some other race <i>Percent of Total Population</i>	1,217 <i>1.8%</i>	4,801 <i>4.1%</i>	6,200 <i>4.0%</i>	3,067 <i>3.1%</i>	5,990 <i>3.6%</i>	118,465 <i>8.6%^c</i>	16 <i>0.2%</i>	461 <i>0.3%</i>	596,774 <i>11.6%</i>	159,354 <i>8.0%</i>
Two or more races <i>Percent of Total Population</i>	990 <i>1.4%</i>	2,744 <i>2.4%</i>	3,296 <i>2.1%</i>	1,894 <i>1.9%</i>	3,264 <i>1.9%</i>	57,765 <i>4.2%</i>	69 <i>1.0%</i>	1,412 <i>0.8%</i>	146,526 <i>2.9%</i>	76,428 <i>3.8%</i>
Ethnicity										
Total population: Hispanic or Latino <i>Percent of Total Population</i>	3,119 <i>4.5%</i>	12,727 <i>10.9%</i>	17,182 <i>11.1%</i>	8,011 <i>8.2%</i>	16,376 <i>9.8%</i>	302,143 <i>22.0%^c</i>	133 <i>1.9%</i>	2,296 <i>1.3%</i>	1,295,617 <i>25.3%</i>	393,970 <i>19.7%</i>

SOURCE: U.S. Census Bureau 2000

- NOTES:
1. Includes population on Hopi Reservation and off-reservation land in Arizona.
 2. Includes population on Navajo Reservation and off-reservation land in Arizona, New Mexico, and Utah.
 3. Probably not conclusive for study area.

Table 3-41 Race and Ethnicity – Local Level¹

	Hopi	Navajo Chapters														
	Moenkopi District	Black Mesa	Chilchinbito	Dennehotso	Forest Lake	Hard Rock	Inscription House	Kaibito	Kayenta	Oljato	Piñon	Rough Rock	Shonto	Tonalea	Tuba City	
Total Population	901	398	1,325	1,626	573	1,256	1,214	1,970	6,315	2,292	3,066	919	2,419	2,537	8,736	
Race (alone)																
White	13	2	13	12	1	25	36	11	327	61	114	13	37	19	421	
<i>Percent of total population</i>	<i>1.4</i>	<i>0.5</i>	<i>1.0</i>	<i>0.7</i>	<i>0.1</i>	<i>2.0</i>	<i>3.0</i>	<i>0.6</i>	<i>5.2</i>	<i>2.7</i>	<i>3.7</i>	<i>1.4</i>	<i>1.5</i>	<i>0.7</i>	<i>4.8</i>	
Black or African American	0	0	0	0	0	0	5	1	9	2	0	1	1	0	13	
<i>Percent of total population</i>							<i>0.4</i>	<i>0</i>	<i>0.1</i>	<i>0</i>		<i>0.1</i>	<i>0</i>		<i>0.1</i>	
American Indian or Alaska Native	871	393	1,296	1,586	566	1,214	1,154	1,949	5,856	2,204	2,910	899	2,339	2,492	7,990	
<i>Percent of total population</i>	<i>96.7</i>	<i>98.7</i>	<i>97.8</i>	<i>97.4</i>	<i>98.8</i>	<i>96.7</i>	<i>95.1</i>	<i>99.0</i>	<i>92.7</i>	<i>96.2</i>	<i>94.9</i>	<i>97.8</i>	<i>92.6</i>	<i>98.2</i>	<i>91.5</i>	
Asian	0	0	0	0	0	0	0	0	6	0	2	3	1	1	18	
<i>Percent of total population</i>									<i>0.1</i>		<i>0</i>	<i>0.32</i>	<i>0</i>	<i>0</i>	<i>0.2</i>	
Native Hawaiian/Pacific Islander	0	0	0	0	0	0	1	0	1	1	0	0	0	0	3	
<i>Percent of total population</i>							<i>0</i>		<i>0</i>	<i>0</i>					<i>0</i>	
Other	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Percent of total population</i>	<i>0.2</i>															
Two or more races	15	2	0	12	2	3	12	6	63	11	5	1	24	6	94	
<i>Percent of total population</i>	<i>1.7</i>	<i>0.5</i>		<i>0.7</i>	<i>0.3</i>	<i>0.2</i>	<i>1.0</i>	<i>0.3</i>	<i>1.0</i>	<i>0.5</i>	<i>0.2</i>	<i>0.1</i>	<i>1.0</i>	<i>0.2</i>	<i>1.1</i>	
Ethnicity																
Hispanic or Latino origin	0	1	16	16	4	14	6	3	53	13	35	2	17	19	197	
<i>Percent of total population</i>		<i>0.3</i>	<i>1.2</i>	<i>1.0</i>	<i>0.7</i>	<i>1.1</i>	<i>0.5</i>	<i>0.2</i>	<i>0.8</i>	<i>5.7</i>	<i>1.1</i>	<i>0.2</i>	<i>0.7</i>	<i>0.7</i>	<i>2.3</i>	

SOURCE: U.S. Census Bureau 2000

NOTE: ¹Kayenta and Black Mesa mining operations, places of residence of 90 percent of the employees.

Table 3-41 Race and Ethnicity – Local Level¹ (continued)

	Hopi		Navajo Chapters					Kingman Area						
	Tribal Census Tract 9411, BG2	Tribal census Tract 9410, BG4	Coal Mine Mesa	Cameron	Leupp	Bird Springs	Tolani Lake	Census Tract 9509	Census Tract 9507.02	Census Tract 9508	Census Tract 9506	Census Tract 9511	Census Tract 9510	City of Kingman
Total Population	1,556	400	374	1,231	1,605	829	755	7,618	7,332	3,685	6,513	3,605	10,376	20,069
Race (alone)														
White	33	6	8	20	15	3	3	6,534	6,272	3,238	5,767	2,904	8,977	17,119
<i>Percent of total population</i>	<i>2.1</i>	<i>1.5</i>	<i>2.1</i>	<i>1.6</i>		<i>0.4</i>	<i>0.4</i>	<i>85.8</i>	<i>85.5</i>	<i>87.9</i>	<i>88.5</i>	<i>80.6</i>	<i>86.5</i>	<i>85.3</i>
Black or African American	0	0	0	1	0	1	0	64	31	9	27	15	38	109
<i>Percent of total population</i>						<i>0.1</i>		<i>0.8</i>	<i>0.4</i>	<i>0.2</i>	<i>0.4</i>	<i>0.4</i>	<i>0.4</i>	<i>0.5</i>
American Indian or Alaska Native	1,475	383	364	1,139	1,548	817	740	113	78	92	61	101	146	329
<i>Percent of total population</i>	<i>94.8</i>	<i>95.8</i>	<i>97.3</i>	<i>92.5</i>	<i>96.4</i>	<i>98.6</i>	<i>98.0</i>	<i>1.5</i>	<i>1.1</i>	<i>2.5</i>	<i>0.9</i>	<i>2.8</i>	<i>1.4</i>	<i>1.6</i>
Asian	1	0	0	1	0	0	0	101	31	15	40	71	109	284
<i>Percent of total population</i>								<i>1.3</i>	<i>0.4</i>	<i>0.4</i>	<i>0.6</i>	<i>2.0</i>	<i>1.1</i>	<i>1.4</i>
Native Hawaiian/other Pacific Islander	0	0	0	0	0	0	0	8	8	7	7	7	12	27
<i>Percent of total population</i>								<i>0.1</i>	<i>0.1</i>	<i>0.2</i>	<i>0.1</i>	<i>0.2</i>	<i>0.1</i>	<i>0.1</i>
Other	1	0	0	0	0	0	0	7	5	19	7	1	9	17
<i>Percent of total population</i>								<i>0.1</i>	<i>0</i>	<i>0.5</i>	<i>0.1</i>	<i>0</i>		
Two or more races	0	0	0	26	15	3	1	97	162	74	97	84	164	328
<i>Percent of total population</i>				<i>2.1</i>	<i>0.9</i>	<i>0.4</i>	<i>0.1</i>	<i>1.3</i>	<i>2.2</i>	<i>2.1</i>	<i>1.5</i>	<i>2.3</i>	<i>1.6</i>	<i>1.6</i>
Ethnicity														
Hispanic or Latino origin	35	11	2	44	27	5	11	694	745	231	507	422	921	1856
<i>Percent of total population</i>	<i>2.2</i>	<i>2.8</i>	<i>0.5</i>	<i>3.6</i>	<i>1.7</i>	<i>0.6</i>	<i>1.5</i>	<i>9.1</i>	<i>10.2</i>	<i>6.3</i>	<i>7.8</i>	<i>11.7</i>	<i>8.9</i>	<i>9.2</i>

SOURCE: U.S. Census Bureau 2000

NOTE: ¹ Additional areas crossed by proposed linear facilities.

Table 3-42 Regional Income Characteristics

	County						Tribal Areas		State	
	Apache	Coconino	Mohave	Navajo	Yavapai	Clark	Hopi Reservation	Navajo Reservation	Arizona	Nevada
Per Capita Income	\$8,986	\$17,139	\$16,788	\$11,609	\$19,727	\$21,785	\$8,637	\$7,486	\$20,275	\$21,989
Median Family Income	\$26,315	\$45,873	\$36,311	\$32,409	\$32,409	\$50,485	\$15,875	\$23,209	\$46,723	\$50,849
Persons Below Poverty Level	25,798	20,609	21,252	28,054	19,552	145,855	2,702	65,001	698,669	205,685
Percent of Persons Below Poverty Level	37.8%	18.2%	13.9%	28.8%	11.9%	10.8%	38.9%	41.9%	13.6%	10.5%

SOURCE: U.S. Census Bureau 2000

Table 3-43 Local Income Characteristics

	Per Capita Income (in \$)	Median Family Income (in \$)	Persons Below Poverty Level	Percent of Persons Below Poverty Level
Kayenta and Black Mesa Mines				
Hopi Area				
Moenkopi	11,432	38,266	113	13.7
Navajo Chapters				
Black Mesa	4,622	15,000	187	40.2
Chilchinbito	5,745	26,029	647	47.3
Dennehotso	5,270	20,583	730	46.6
Forest Lake	3,638	9,479	264	62.3
Hard Rock	4,732	20,556	746	58.8
Inscription House	7,216	14,750	640	49.9
Kaibito	8,117	29,896	548	27.1
Kayenta	8,698	27,689	2,459	38.8
Oljato	7,468	21,094	822	38.0
Piñon	5,478	18,007	1,606	49.5
Rough Rock	5,237	18,482	491	50.7
Shonto	8,573	31,214	828	34.4
Tonalea	6,163	24,750	1,027	40.9
Tuba City	10,331	37,455	2,420	28.4
Hopi Area				
Moenkopi	11,432	38,266	113	13.7
Additional Areas Crossed by Linear Facilities				
Navajo Chapters				
Coal Mine Mesa	6,075	20,875	123	38.7
Cameron	6,055	20,278	597	43.4
Leupp	7,421	21,250	697	44.5
Bird Springs	7,844	23,981	265	35.1
Tolani Lake	6,749	28,606	269	33.8
Hopi Areas				
Tribal census tract 9411, BG2	7,298	19,211	834	52.8
Tribal census tract 9410, BG4	9,181	35,313	169	42.4
Kingman Area				
Census tract 9509	16,989	38,852	717	9.5
Census tract 9507.02	13,834	30,433	1,613	22.1
Census tract 9508	20,598	39,773	651	17.7
Census tract 9506	14,264	30,942	1,026	15.9
Census tract 9511	15,484	36,214	624	19.2
Census tract 9510	17,203	44,098	1,173	11.7
City of Kingman	17,181	41,327	2,207	11.6

SOURCE: U.S. Census Bureau 2000

Table 3-44 Trends in Percentage of People in Poverty by State and County, 1999 to 2002

State or County	1999	2002
Arizona	12.8	13.6
Apache County	30.5	28.3
Coconino County	15.9	15.4
Mohave County	15.1	15.7
Navajo County	23.6	24.3
Yavapai County	11.6	12.6
Nevada	10.2	10.1
Clark County	10.4	10.6

SOURCE: U.S. Census Bureau 2004

The Economic Research Service of the U.S. Department of Agriculture prepared a longitudinal study of poverty by county that yielded a map of persistent poverty counties, where 20 percent or more of persons were in poverty in each of the past four decennial censuses (1970-2000). Apache and Navajo Counties, Arizona, were designated as persistent poverty counties, while none of the other counties in the region were so designated.

3.13 INDIAN TRUST ASSETS

The United States has a trust responsibility to protect and maintain rights reserved by or granted to American Indian tribes by treaty, statutes, and executive orders. This trust responsibility requires Federal agencies to take actions necessary to protect Indian trust assets.

The Secretary of the Interior's Order Number 3215, dated April 28, 2000, addresses Principles for the Discharge of the Secretary's Trust Responsibility. That Secretarial Order cited the American Indian Trust Fund Management Reform Act of 1994 (Reform Act), Public Law 103-412, October 25, 1994, 108 Stat. 4239, as the most comprehensive and informative legislative statement of Secretarial duties in regard to the trust responsibility of the United States. A key section of that law indicates that the Secretary's proper discharge of the trust responsibilities of the United States shall include, but are not limited to, appropriately managing the natural resources located within the boundaries of Indian reservations and trust lands (25 U.S.C. 162a(d), cited in Babbitt 2000).

3.13.1 Indian Trust Assets Definition and Characteristics

Indian trust assets are defined as legal interests in assets that are held in trust by the United States Government for federally recognized American Indian tribes or nations. Assets have monetary value in which a tribe has a property interest. Examples of things that could be Indian trust assets include minerals, water rights, lands, hunting and gathering rights, other natural resources, or money. Examples of property interests, other than exclusive ownership, are leases or rights to use something. Indian trust assets can be real property, physical assets, or intangible property rights.

Indian trust assets do not include things in which a tribe has no legal interest. For example, off-reservation sacred sites in which a tribe has no legal property interest generally are not considered Indian trust assets.

Other important characteristics of the trust relationship between American Indian tribes and the United States are as follows:

- A trust has three components—the trustee, the beneficiary, and the trust asset(s). In the case of Indian trust assets, title to Indian trust assets is held by the United States (trustee) for the benefit of a tribe of individual Indian.
- Legal interest means there is a property interest for which a legal remedy may be obtained.
- Indian trust assets cannot be sold, leased, or otherwise alienated without the United States' approval. While most Indian trust assets are located on Indian reservations, they also can be located off-reservation.

Indian trust assets within the Black Mesa Project area include those that are held by the United States for the Hopi Tribe and the Navajo Nation. Indian trust assets to be considered for possible effects by the proposed Federal actions are minerals, water rights, lands, hunting and gathering rights, and other natural resources.

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 USDI. The leasing authority by which coal reserves that are Indian trust assets may be leased is at 25 CFR Part 396a and concerns leases of unallotted lands for mining purposes. It states the following:

“On and after May 11, 1938, unallotted lands within any Indian reservation or lands owned by any tribe, group, or band of Indians under Federal jurisdiction, except those specifically excepted from the provisions of sections 396a to 396g of this title, may, with the approval of the Secretary of the Interior, be leased for mining purposes, by authority of the tribal council or other authorized spokesmen for such Indians, for terms not to exceed ten years and as long thereafter as minerals are produced in paying quantities.”

The BIA performs a limited role in assisting tribes to litigate or seek to settle their water rights claims. In some cases, the BIA has been given a role in assisting tribes to implement a water rights settlement.

The source of Indian water rights is found in the 1908 Supreme Court decision of *Winters v. United States* (207 U.S. 564, 576 cited in McCarthy 2004), which held that the creation of the Fort Belknap Indian Reservation in Montana under a treaty entered into in 1888 by necessity implied the reservation of sufficient water rights to fulfill the purposes of the reservation.

A water right granted to a tribe under the Winters Doctrine is given a priority date no later than the time when the reservation was established and, unlike water rights permitted, licensed or adjudicated under State statutes, such rights under the Winters Doctrine cannot be lost through nonuse (Reclamation 2006b).

According to McCarthy (2004), “The Arizona Supreme Court has concluded that Federal reserved rights apply to both surface and subsurface sources of water, and that Federal reserved rights enjoy greater protection from groundwater pumping than do state water rights. (195 Ariz. 411, 422, 989 P.2d 750 (1999). The Wyoming Supreme Court had earlier declined to apply Winters rights to groundwater (753 P.2d 76, 99-100 [Wyoming 1988]). It is likely that the Supreme Court will ultimately decide this question.”

The BIA’s trust responsibilities include the approval of right-of-way grants across American Indian lands (25 CFR Part 169, Stipulations for Rights-of-way over Indian Land).

3.13.2 Indian Trust Assets Within the Affected Environment

3.13.2.1 Minerals

The Kayenta and Black Mesa mining operations are located on leased land within the boundaries of the Hopi and Navajo Reservations near Kayenta in Navajo County (refer to Map 1-2). All of the coal produced from these mining operations is an Indian trust asset and is produced subject to one of three coal-mining leases, which set forth such items as land rental rates, royalty rates for the coal, other fees, and additional terms. The leases, which have been amended many times over the years, are not a part of the LOM revision permit application.

One lease covers the 24,858 acres of the northern portion of the Kayenta and Black Mesa mining operations, where the Navajo Nation holds both surface and mineral land ownership. In 1964, that lease, No. 14-20-0603-8580, was approved by the Navajo Nation Tribal Council, executed by the Navajo Nation, and approved by the Secretary of the Interior.

The other two leases, both approved in 1966, cover the southern portion of the Kayenta and Black Mesa mining operations, where the tribes have joint and equal interests in the minerals that underlie the former Joint Use Area. Lease No. 14-20-0603-9910 was approved by the Navajo Nation Tribal Council and executed by the Navajo Nation and approved by the Secretary of the Interior. Lease No. 14-20-0450-5743 was executed by the Hopi Tribe and approved by the BIA.

The surface of the southern portion of the leasehold has been partitioned. Approximately 33,863 surface acres are in Navajo Nation ownership, while 6,137 surface acres are in Hopi Tribe ownership (Peabody 2002b).

3.13.2.2 Land

Infrastructure of the existing Black Mesa Complex occupies land that is an Indian tribal asset. BMPI holds two leases, one with the Hopi Tribe and the other with the Navajo Nation, for the 40-acre parcel occupied by its coal-slurry preparation plant. Other rights-of-way and easements contain the overland conveyor, Black Mesa and Lake Powell Railroad loading site, railroad, and power lines, for a total of 362 acres. BMPI holds two leases, one with the Hopi Tribe and the other with the Navajo Nation, for the 40-acre parcel occupied by BMPI's coal-slurry preparation plant.

A substantial portion of the rights-of-way connected to the existing components of the Black Mesa Project are on the Hopi and Navajo reservations. The existing coal-slurry pipeline, with a 50-foot-wide permanent right-of-way, crosses approximately 35 miles of the Hopi Reservation (occupying 212 acres) and 61 miles of the Navajo Reservation (occupying 370 acres).

3.13.2.3 Water

Rights to the surface water and groundwater that lie beneath the Hopi and Navajo Reservations are Indian trust assets of the Hopi Tribe and Navajo Nation. Section 3.4 provides a description of the water resources related to the Black Mesa Project and the current patterns of use of those water resources.

The Little Colorado River watershed comprises all of the existing Black Mesa Project components. The Hopi Tribe and the Navajo Nation claim water Indian trust assets as parties to the Little Colorado River water rights litigation entitled, *In re: The General Adjudication of all Right to use of water in the Little Colorado River System and Source* (Nos. 6417-033-9055 and 6417-033-9066, Consolidated). In the status hearing held May 12, 2006, on the Little Colorado River water rights litigation case, representatives of the Hopi Tribe and the Navajo Nation indicated ongoing negotiations concerning both groundwater and surface water rights (Arizona, Superior Court of the State of 2006).

3.13.2.4 Hunting and Gathering and Other Natural Resources

The Hopi Tribe and the Navajo Nation have rights to carry on hunting and gathering, grazing, and traditional uses on the reservations. Ongoing activities of hunting and gathering, grazing, and traditional uses are described other sections (e.g., Sections 3.9 and 3.10).

3.14 NOISE AND VIBRATION

Sound is created when an object vibrates and radiates part of its energy as acoustic pressure or waves through air, water, or a solid object. Noise is defined as unwanted or undesirable sound. Sound pressure levels are expressed in units called decibels (dB). Since the human ear does not respond equally to all sound frequencies (or pitches), sound levels may be adjusted, or weighted, to correspond to the frequency response range of human hearing and the human perception of loudness. Frequencies to which the human ear does not respond are filtered out when measuring and modeling noise levels. The A-weighted decibel (dBA) is the basic unit of sound used to describe the human response to noise from industrial and

transportation sources. Decibels are measured using a logarithmic scale. Because of this, sound levels cannot be added or subtracted directly. An increase (or decrease) in sound level of about 10 dB is usually perceived by the average person as a doubling (or halving) of the loudness. Sound levels of typical noise sources and noise environments are presented in Table 3-45.

Table 3-45 Sound Levels of Typical Noise Sources and Noise Environments

Noise Source or Environment	A-Weighted Sound Level (decibels)	Human Judgment of Noise Loudness
Shotgun blast in close range Jackhammer in close range	130	
Thunderclap Commercial jet take-off (200 feet away)	120	Threshold of pain
Motorcycle (25 feet) Propeller plane fly-over (1,000 feet) Diesel truck, 40 miles per hour (50 feet)	90	Loud
Passenger car, 65 miles per hour (25 feet) Vacuum cleaner (3 feet)	70	Moderately loud
Normal conversation (5 feet)	60	Comfortable
Bird calls (distant)	40	Quiet
Soft whisper (5 feet) Quiet bedroom	30	Audible
Normal breathing (0 feet) Rustle of leaves in the wind	10	Very faint
Normal breathing (5 feet)	0	Threshold of human hearing

SOURCE: URS Corporation 2003

Although the A-weighted sound level may indicate adequately the level of environmental noise at any instant in time, community noise levels vary continuously and include a mixture of noise from various sources. To account for this variation, a single descriptor called the equivalent sound level (L_{eq}) is used. L_{eq} is the average A-weighted sound level during a specific time interval. One of the most common intervals is a 24-hour day. This noise descriptor is called the day-night average equivalent noise level, or L_{dn} . L_{dn} includes a 10 dBA penalty applied to sound levels in the nighttime hours (10:00 p.m. to 7:00 a.m.) to compensate for people's increased sensitivity to noise during this period. The L_{dn} is used by agencies such as the U.S. Department of Housing and Urban Development, Federal Aviation Administration, and Federal Transit Administration. The U.S. Department of Housing and Urban Development considers exterior noise levels of 65 L_{dn} or less acceptable for new housing construction. This study will use applicable noise-impact criteria established by regulatory agencies to estimate project impacts.

Low frequency vibrations are normally felt rather than heard. Vibrations may occur as heavy equipment or trucks travel through an area or, more importantly for this project, from blasting. Blasting is used as part of the mining operations to fragment material for excavation and transport. The three major adverse effects of blasting are flyrock, air blast, and ground motion. Each of these effects is described below.

Other energy liberated from the blast is converted into vibrations as either ground motion or air overpressure (airblast). Ground motion is the principal vibration that will result from blasting, though airblast may be more noticeable because of the accompanying noise effects. Like other noises, airblast is measured in decibels; however, because the overpressure is normally at low frequencies and may be felt more than heard, measurements are not A-weighted like other noises. Instead, a flat or linear weighting is used. Ground motion is a wave motion spreading outwards from the blast, like ripples spreading outwards after a stone is dropped into water. This ground motion is measured as peak particle velocity and is used as an indicator of possible blast damage. No noise measurements or detailed field reconnaissance were conducted to measure existing noise sources or noise levels in sensitive areas. Precise data on existing

noise sources (type, number, locations, operating times, etc.) were not generally available at the time of this study. Therefore, assumed sound levels were based on sound levels typically associated with identified noise sources and types of land use settings. Typical source noise levels used for estimating existing noise conditions in the study area are given in Table 3-46.

Table 3-46 Source Noise Used for Estimating Existing Noise Levels¹

	Noise Source	Source-to-Receiver Distance (feet)	Noise Exposure Estimates ¹
Mining and Excavation-Related Noise Sources	Bucket loader	50	89
	Haul trucks (100 tons)	50	88
	Ore trucks (tractor-trailer)	50	88
	Water truck	50	91
	Front end loader	50	80
		300	70
	Fork lift	50	73
	Dozer	50	92
		300	77
	Rock drill	50	95
	Dragline crane	50	88
		300	73
	Scraper	50	92
		300	77
	Pumps	50	71
Generators	50	83	
Compressors	50	86	
Traffic – Related Noise Sources	Interstate highway ²	50	75
		200	65
		800 and up	50
	Roadways ³	50	70
		200	60
		400 and up	50
	Electric railroad ⁴	50	70
	Railroad lines ⁵	30	75
		240	60
800 and up		45	

SOURCES: Mining sources – Minor, Michael & Associates 2000

Transportation sources – Harris, Miller, Miller & Hanson Inc. 1995

NOTES: ¹All noise exposure estimates are based upon typical highway or vehicle operation. Railroad noise levels are described in L_{dn}; all others are in L_{eq} daytime.

²Highways with four or more lanes that permit trucks, with traffic at 60 miles per hour.

³Roads with traffic at 55 miles per hour, but without trucks.

⁴Typical for Black Mesa and Lake Powell electric railroad operations.

⁵Main line railroad corridors typically carrying 5 to 10 trains per day at speeds of 30 to 40 miles per hour.

The region of influence is the geographic area that could potentially be affected by changes in noise or vibration levels due to this project; it varies for different project components. For example, the region of influence where new or increased blasting at the mines is proposed may extend up to several miles from the source. However, the region of influence for less intensive noise and vibration sources, such as coal-slurry pipeline booster pumps or traffic, would be a few hundred feet or less. Noise impacts occur only where there are people or animals (noise-sensitive receptors) to hear it. Therefore, the region of influence for any noise impacts is directly related to the location of the receptors.

Existing ambient or environmental noise is generally a composite of noise from a wide variety of natural and manmade sources (including natural sounds, local and distant transportation and industrial sounds,

and sounds from local residential sources). Some land uses are considered sensitive to noise. Noise-sensitive receptors are land uses associated with indoor and outdoor activities that may be subject to stress or significant interference from noise. They often include residential dwellings, mobile homes, hotels, motels, hospitals, nursing homes, schools, churches, and libraries. Sensitive receptors in the study area were identified as part of the land use studies.

In general, the study area is very rural, sparsely populated, or uninhabited. However, dispersed noise receptors—people or animals—or sensitive areas such as individual or clustered homes, mobile homes, or other noise-sensitive land uses are present in some areas. Due to the absence of significant noise sources in the region, the ambient noise level throughout much of the study area is probably less than 50 dBA during daytime hours and 30 dBA at night. OSM's 1990 EIS estimated baseline background sound levels within the Black Mesa lease area as 33 to 43 L_{dn}. Typical noise sources would be jet planes overhead, off-road vehicles, barking dogs, and wind, and this environment generally would be considered comfortable to quiet.

Structures may be subject to damage by vibrations from blasting, or equipment and heavy truck operations. Of particular interest would be structures determined to be of historical importance or those with unique construction that might make them particularly susceptible to damage from vibrations. According to the cultural resources investigations conducted for this project, no such structures have been identified within the area of impact.

The discussions that follow:

- Describe the location, operation, and other important features of project components;
- Determine noise sources not associated with the project;
- Identify noise-sensitive receptors and describe their distance and direction from project components and other noise sources;
- Estimate existing sound levels based on identified noise sources and proximity to sensitive receptors; and
- Describe the existing noise environment.

For locations of sensitive receptors, refer to Section 3.9.

3.14.1 Black Mesa Complex

Noise-sensitive receptors include residences within and outside the Black Mesa Complex. As mining progresses over time, all residences within the mining operations area would be relocated. Currently, there are approximately 68 residences dispersed throughout the lease boundary. Of the 50 residences closest to the Kayenta mining operation, there are two main clusters: one located in the southern region, and one located in the east-central region, approximately 1 to 1.5 miles from the mining operations. This cluster is near the Black Mesa mining operation and consists of 18 homes that are dispersed throughout the area. More residences are located along the route of the proposed water-supply pipeline (the segment on the Black Mesa Complex). Residences outside the Black Mesa Complex consist of two clusters: one northwest of the lease area and one southwest. Receptors to the southwest are located near Indian Route 8034.

The existing noise environment in the vicinity of the mining operation and sensitive receptors is dominated by noise associated with mining operation including coal processing, blasting, and hauling. Surface blasting is conducted on an average of twice daily during weekdays, from sunrise to sunset and must be performed at least 1,000 feet from any residence. Blasting must abide by the standards set forth in

30 CFR 816.67, which states that overpeak sound-pressure levels cannot exceed 133 dB. Warning and all-clear signals audible for at least 0.5 mile are sounded before and after blasting. Except for emergency situations, blasting occurs according to a schedule that is published annually in a newspaper with general circulation in the mining area. Additionally, blasting schedules are delivered to individuals living within 0.5 mile of the blasting area. After the coal has been blasted, the pieces are loaded into trucks using excavation equipment. Two types of coal hauling are performed: on-site coal hauling and site-to-site coal hauling. Trucks perform on-site hauling and are a large source of traffic noise. The electric railroad performs site-to-site transportation from the Kayenta mining operation to the Navajo Generating Station near Page, Arizona. The coal bound for the Navajo Generating Station is loaded at this point just west of the intersection of Indian Route 41 and U.S. Highway 160. From about 50 feet away, typical electric railroad noise levels are approximately 70 dBA and truck noise levels are 88 dBA.

Flyrock is rock that is ejected into the air or along the ground from a blast. Flyrock is controlled by the blasting design and by limiting access in the vicinity of the blast. OSM regulations prohibit flyrock from being cast more than one-half the distance to the nearest dwelling, beyond the area of control, or beyond the permit boundary.

Airblast is regulated to a maximum level in dB at a particular frequency of sound. The limit established at any residence near the Kayenta and Black Mesa mining operations is 133 dB at 2 hertz or lower frequency. Ground motion is measured normally at residences near the Kayenta and Black Mesa mining operations, where the monitoring devices (seismographs) are seismically triggered to record levels of 0.5 inches-per-second particle velocity or higher.

The coal-haul roads associated with the Black Mesa mining operation converge upon the coal-slurry preparation plant site, which includes a pump station. This plant is 0.75 mile away from the closest sensitive receptor and has a projected noise level of 88 dBA at 50 feet due to haul-truck noise during operation, resulting in daytime noise levels at receptors of approximately 45 to 55 dBA, punctuated with occasional audible noise from blasting activity.

Noise sources not associated with the mining operation that contribute to the overall noise environment include the following:

- An aircraft facility within the Black Mesa Complex, north of the Peabody office facilities, that is 1 mile away from the closest noise-sensitive receptor;
- Indian Route 41; and
- Indian Route 8034.

Typical operations and resulting noise-level contributions of the aircraft facilities are not known at this time. Indian Route 41 has two homes directly adjacent to it (within 0.1 mile) with a presumed noise level at these sensitive receptors of 50 dBA during daytime hours. Indian Route 8034 is approximately 2.5 miles away from the closest identified sensitive receptor and likely is not making a significant contribution to noise levels perceived by that receptor.

Based on the noise sources described, existing sound levels at sensitive receptors are expected to range from 45 dBA to 50 dBA typical daytime noise levels, punctuated with occasional audible sounds from blasting activity. Noise levels due to aircraft facility operations are unknown at this time. Peabody has regular flights scheduled in the morning and evening unless there is inclement weather.

OSM Permanent Regulatory Program Sections 816.61-68 and 817.61-68, as published in the Federal Register on March 8, 1983, were designed to protect the general public from adverse effects of surface

mining, including blasting. These OSM regulations were designed to fulfill the intent of Congress in the Surface Mining Act to prevent (1) injury to persons; (2) damage to public and private property outside the permit area; (3) adverse impacts on any underground mine; and (4) change in the course, channel or availability of ground or surface water outside the permit area. OSM developed the Blasting Guidance Manual to assist in compliance with the Act. All permitted mining activity must comply with these OSM regulations.

Peabody has conducted a continuous ground vibration and air overpressure monitoring program since 1994. Peabody submitted monthly blasting reports to OSM that contain seismograph data including all ground motion and air overpressure records. Monitoring levels for ground movement and air overpressure have complied with OSM regulatory requirements since monitoring began; therefore, airblast and vibration impacts from the mining operation have not exceeded established OSM limits.

3.14.2 Coal-Slurry Pipeline

3.14.2.1 Coal-Slurry Pipeline: Existing Route

The majority of the land traversed by the existing pipeline is rural or undeveloped in character. However, there are dispersed residences located within 250 feet of the pipeline at 19 locations throughout the route, which also traverses the Kingman area through a rapidly developing suburban area of Kingman. Urban land uses also are near Seligman, Golden Valley, Bullhead City, and Laughlin.

The pipeline structures in the study area are typically located underground except for pump stations, which are housed inside buildings. Existing noise sources include the coal-slurry pipeline pump stations, I-40, other local roads, the BNSF Railroad, and commercial and industrial facilities.

Noise environments along the existing pipeline route likely include the following:

- Quiet, rural settings with sound levels of 45 to 50 dBA where noise sources such as roads are 1 mile or more away;
- 55 dBA areas where roads are less than 1 mile away;
- 65 dBA areas due to a combination of noises such as traffic and industrial uses for receptors less than 0.5 mile away, possibly ranging up to 75 dBA at the closest receptors, depending on the nature of industrial activities;
- 70 to 75 dBA areas where receptors are within about 0.5 mile of the railroad, and where there are both roads and railroad; and
- Areas at more than 75 dBA, where for receptors are in proximity to both I-40 and the railroad.

Vibration would be an issue only near transportation sources. According to the Federal Transit Authority (Harris, Miller, Miller, & Hanson, Inc. 1995), roadway vibrations are normally not an issue to residences 50 feet or more from roadway rights-of-way; therefore, residences near the study area roadways would notice noise much more than vibration effects. According to Federal Transit Authority's screening criteria, only residences within 200 feet of the right-of-way of a railroad carrying diesel locomotives may be potentially impacted by vibration.

3.14.2.2 Coal-Slurry Pipeline: Existing Route with Realignment (Agencies' Preferred Alternative)

Along the Kingman reroute, there is a community near the reroute between CSP Mileposts 4 and 7 that is mainly commercial with some residential uses. Sensitive receptors include three residences north of this section. Noise sources at this location include a power substation and the Kingman Airport, and industrial park to the north. Noise levels are 55 to 65 dBA L_{dn} . Four residences occur between reroute CSP

Mileposts 14 and 16. Noise sources here include the BNSF Railroad, the parallel I-40, and industrial land uses. The closest sensitive receptor is approximately 0.25 mile away from the industrial area and 0.5 mile away from I-40 and the railroad. The L_{dn} at the closest sensitive receptors is estimated at 45 to 60 dBA depending on the nature of the industrial activity.

Vibration issues are the same as discussed above in Section 3.13.2.1.

3.14.3 Project Water Supply

3.14.3.1 C Aquifer Water-Supply System

3.14.3.1.1 Well Field

The well field study area includes the C-aquifer well field and the first 14 miles of the water-supply pipeline. The well field site area is primarily rural in character. There are approximately 90 residences inside the well field study area and surrounding vicinity. Approximately 30 of these residences are within the study area, with an additional 10 residences on the periphery of the boundary (within 0.5 mile). The community of Leupp, with approximately 50 residences, is situated 2.5 miles north of the study area. In addition, the Canyon Diablo Railroad Ghost Town is of historical significance and may be considered a sensitive receptor.

Several transportation noise sources are present within the area, including the BNSF Railroad that passes the study area to the south, I-40, State Route 99, and several connecting roads. Additionally, there may be transformer noise associated with a power substation to the south adjacent to I-40 and a utility approximately 0.25 mile west of WSP Milepost 11.

Noise levels at the residences in the well field study area located along State Route 99 are, at most, 70 dBA. Sensitive receptors in the general area of the well field probably experience an L_{dn} of about 50 dBA. Residences in Leupp are exposed to an approximate L_{dn} of 70 dBA. Residences next to the railroad tracks would have an approximate L_{dn} of 75 dBA.

Vibration would be an issue only near transportation sources. According to the Federal Transit Authority's screening criteria, only residences within 200 feet of the BNSF tracks may be potentially affected by vibration.

3.14.3.1.2 C Aquifer Water-Supply Pipeline

3.14.3.1.2.1 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alignment)

The water-supply pipeline would originate in the well field, and the existing noise environment up to WSP Milepost 14 would be as discussed in the previous section.

Though the entire area is rural in character, with active agricultural land uses in some portions, there are noise-sensitive receptors in the vicinity of most of the pipeline route. With few exceptions these are residences, some dispersed and some clustered. The pipeline would pass within 250 feet of residences in 11 locations. There is also a church and cemetery in Leupp that would be within 250 feet of the route. Schools in Leupp would be located at least 500 feet from the route. Existing noise sources in the area are limited to roads and an industrial facility near Tonalea.

The west Kykotsmovi subalternative would traverse the more populated area of Kykotsmovi. The route would pass within 500 feet of residential, commercial, and institutional facilities (e.g., school, hospital), multiple times. This setting was not inventoried for a specific number of receptors. Existing sound levels, accounting for commercial operations and local roads and street traffic, are estimated at 55 to 50 dBA.

The east Kykotsmovi subalternative would pass within 500 feet of some residences (fewer than the west Kykotsmovi subalternative) and commercial facilities, but beyond 500 feet of the school and the hospital. The pipeline also would cross under high-voltage power lines multiple times.

No noise measurements were taken as part of this study, but based on data from similar settings as well as professional judgment, existing sound levels along the pipeline alternative routes was estimated by identifying the locations of noise sources and the proximity of sensitive receptors. Noise environments likely include the following:

- Quiet, rural settings with sound levels of 45 to 50 dBA where noise sources such as roads are 1 mile or more away;
- 55 dBA areas where roads are less than 1 mile away; and
- 65 dBA areas due to a combination of noises such as traffic and industrial uses for receptors less than 0.5 mile away, possibly ranging up to 75 dBA for the closest receptors depending on the nature of industrial activities.

Vibration would be an issue only near transportation sources, and only to residences within 50 feet of a roadway.

3.14.3.1.2.2 C Aquifer Water-Supply Pipeline Alignment: Western Route

The western route is the same as the eastern route until WSP Milepost 27, where it would deviate to the west. Only about half of the route is in proximity to noise-sensitive receptors. The other half would pass residential development in 13 locations.

The route would pass schools at Leupp and Tonalea and the church at Leupp (mentioned above in Section 3.13.3.2.1) at a distance beyond 500 feet. Existing noise sources include limited commercial uses and roads. The entire area is rural in character.

Background noise levels along the northern portion of the western route are estimated to be higher than those along the eastern route. Residences in the northern portion of the western route are located primarily adjacent to U.S. Highway 160 and the Black Mesa and Lake Powell Railroad; therefore, noise levels in this area could be expected to reach the 70 to 75 dBA level.

Noise environments likely include the following:

- Quiet, rural settings with sound levels of 45 to 50 dBA where noise sources such as roads are 1 mile or more away;
- 55 dBA areas where roads are less than 1 mile away;
- 45 to 60 dBA areas where residences are about 1 mile from apparent mining/extraction operations north of Leupp;
- 70 to 75 dBA areas where receptors are within about 0.5 mile of the railroad, and where there are both roads and the railroad; and
- 60 to 70 dBA areas near the Kayenta mining operation conveyor and railroad.

Vibration would be an issue only to residences within 50 feet of a roadway.

3.15 VISUAL RESOURCES

The visual resource inventory describes current visual conditions and includes an evaluation of existing visual conditions such as landscape character, scenic quality, and visual sensitivity. The BLM and Forest Service—as land-management agencies typically concerned with visual resources—have developed objective methodologies to assess the scenic quality of landscapes to help determine a project’s visual impact on the surrounding environment. These methodologies were used for Federal land, and were borrowed for use in assessing landscapes outside areas where formal guidelines apply. Visual classes derived from the BLM and Forest Service Visual Resource Management (VRM) plans were used to develop a consistent description of the scenic quality of the natural landscapes within the study area and a class was created for developed land (summarized in Appendix I and Map 3-18).

Viewpoints and project visibility were also an important part of the analysis, as well as a determination of the sensitivity of the viewers. Viewer sensitivity is a measure of the degree of concern about change in the visual character of a landscape. By assessing the types of viewers (e.g., recreational hikers in remote areas or residents that see the project from their houses—both viewers of high sensitivity), the land uses on land facing a project (e.g., natural recreation areas or residences), the volume (or numbers) of viewers, the duration of time spent looking at a view, and finally, the influence of adjacent land use on the view (e.g., the presence of an existing industrial facility within the viewshed) were determined.

Viewing distances also were considered. The following distance zones, derived from BLM methodology, are based on visual perception thresholds of the basic design elements: form, line, texture, and color. For example, as distance increases, details become less apparent and the elements of form and line become more dominant than color or texture. These distance zones or thresholds are defined based on relative visibility from travel routes or observation points within the study area as noted in Table 3-47.

Table 3-47 Distance Zone Definitions

Distance Zone	Distance (in miles)	Description
Immediate Foreground	0 to 0.25	Details are obvious. Texture and other aesthetic qualities of vegetation are normally perceived within this zone.
Foreground	0.25 to 0.50	Landform details are still perceptible but to a lesser degree.
Middleground	0.5 to 1	Foliage and fine textures cease to be perceptible. Vegetation begins to appear as outlines or patterns.
Background	Beyond 1 to 2	Texture and color are weak, and landform becomes the most dominant element.
Seldom Seen	Beyond 2	Topographic relief or vegetative screening obstructs views, or distances are beyond 2 miles.

For the purpose of describing existing conditions as a baseline for assessing potential effects from project actions, the visual region of influence is defined as the area wherein potential undesirable visual effects from construction, operation, and maintenance of the proposed project may be discerned. A 4-mile-wide study corridor, 2 miles on each side of the reference centerline, was used to inventory visual resources as it represents an approximate threshold for moderate to high visual impacts. In special locations identified by cooperating agencies, resources were studied beyond 2 miles. The visual region of influence includes a diverse range of largely undeveloped, natural landscapes. These landscapes are generally vast and expansive, permitting extensive views of undisturbed land. Developed areas include small villages, towns, and communities, and a few areas of major development such as Kingman, Seligman, and Bullhead City, Arizona.

Developed areas include communities, rural residences, agricultural land and ranches, mines and coal mining facilities, and other utility facilities. Communities ranging in size from modest-sized towns to small rural establishments and suburban environments were identified within the study corridors. Communities close to the study area corridor include Leupp, Kykotsmovi, Seligman, Kingman, and Bullhead City, Arizona; and Laughlin, Nevada. The eastern end of the study area crosses the Hopi and Navajo Reservations. Dispersed agricultural activity occurs throughout the Hopi Reservation in washes and along the smaller drainages.

The study area was characterized using physiographic provinces, or geomorphic regions that are broad-scale subdivisions based on terrain texture, rock type, and geologic structure and history. The Black Mesa study area is contained within two major physiographic provinces, Basin and Range and Colorado Plateau (and a transition zone between the two), which exhibit several unique landscape settings and viewing conditions. The Basin and Range province is distinguished by isolated, roughly parallel, north-south trending mountain ranges separated by closed (undrained) desert basins. The Colorado Plateau's major distinguishing features are landforms cut by wind and water erosion from the largely horizontal strata and the relatively high elevations of this province (Fenneman 1931).

Several different and unique landscape character types are evident throughout the two primary physiographic provinces (as described in the Forest Service's Landscape Character Types of the National Forests of Arizona and New Mexico Visual Management System manual). These were used to define five basic landscape character types within the study area: Navajo, Flagstaff, Grand Canyon, Tonto, and Mohave.

The Navajo landscape type, described as an area of young plateaus with broad open valleys, comprises a large portion of the study area including landscapes near Leupp and Cameron. Horizontal sandstone beds, eroded tablelands, cuestas, rock terraces, receding escarpments, shallow canyons, rolling desert plains, and dry washes are all characteristic of this landscape. Vegetation within this landscape is typically sparse and consists of piñon/juniper woodlands, plains grassland, salt brush, and sagebrush; bare soil and rock are common.

The Flagstaff landscape type is characterized as an undissected plateau containing extensive lava flows and volcanic cones. This type is evident in landscapes roughly west of Cameron to Seligman, Arizona. Vegetation is predominantly coniferous forest (montane conifer), mountain meadow grassland, plains grassland, and piñon/juniper woodland. Dry washes, riparian deciduous forests, and woodlands are common along watercourses.

The Grand Canyon landscape type is described as an area of high plateaus trenched by the Colorado River to form the Grand Canyon. This type is divided into two subtypes, plateaus and canyons, because of their physiographic differences. Plateaus are characterized as desert or forested plateaus, bisected by washes. The Hualapai and Coconino plateaus west of Seligman belong to the plateau subtype.

The Tonto landscape type encompasses the area between the Mogollon Escarpment and the Gila River. Generally, the landscape varies from desert plains and hills to forested plateaus and mountains. This type has two general subtypes, Sonoran Arizona Uplands and Upper Tonto, because of differences in physiography and vegetation. A section of the study area corridor west of Seligman is located within the Upper Tonto landscape and is characterized by some tilted fault block and dissected mountains. The area is primarily tablelands that have been carved from an extensive plateau. At higher elevations the dominant vegetation is coniferous forest. At lower elevations there is a prevalence of the piñon/juniper woodlands and isolated occurrences of oak woodlands, plains grassland, and desert grassland.

Map 3-18 Scenic Quality

Black Mesa Project EIS

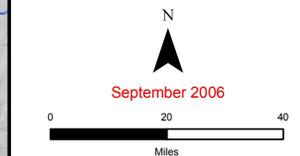
LEGEND

- Coal-Sturry Pipeline**
 - Existing Route
 - Realignments
 - (Existing route with realignment/reroute is the preferred alternative)
- Proposed Water-Supply Pipeline**
 - Eastern Route (preferred alternative)
 - Subalternatives (preferred alternative)
 - Western Route
- Other Project Features**
 - C-Aquifer Well Field
 - PS = Pump Station
 - Peabody Lease Area
- Scenic Quality**
 - Class A
 - Class B
 - Class C
 - Developed

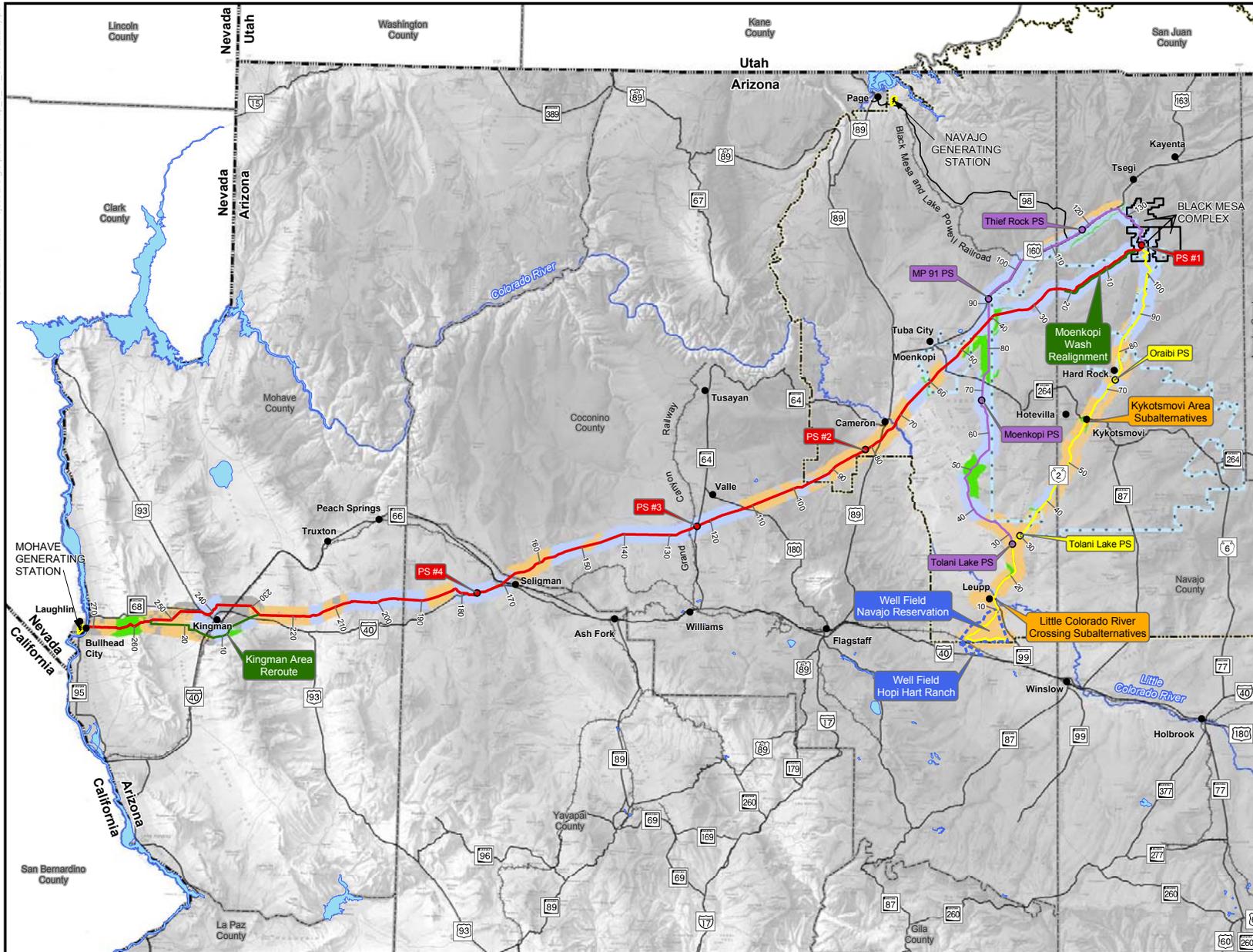
General Features

- River
- Lake
- Navajo Reservation Boundary
- Hopi Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route

SOURCE:
URS Corporation 1996, 2004, 2005



Prepared By:
URS



The Mohave landscape type, described as flat plains broken up by the Colorado River Valley and small ranges of tilted fault block mountains, is found in western Arizona and southern Nevada. This type can be jagged, with steeply sloped escarpments, bare rock with sharp ridges, and V-shaped ravines, or conversely, gentle dipping slopes. The vegetation is typically open with bare soil, or desert pavement and bare rock with creosotebush. Piñon/juniper woodlands are prevalent near foothills and mountains. Most land of the Mohave landscape character type has dry washes that drain to basins. The Colorado River, however, is a swift flowing river in a canyon varying in depth and remains the only perennial watercourse in the Mohave region. The study area corridor traverses the Mohave region at the western end of the coal-slurry corridor from Kingman, Arizona, to Laughlin, Nevada.

3.15.1 Black Mesa Complex

The Black Mesa Complex is located in the northern portion of the Navajo landscape type in an area characterized by rolling piñon/juniper woodlands, rock outcroppings, reclaimed mining land, and operational open pit mines (Table I-2 in Appendix I). The complex is located atop the Black Mesa, a major geographic feature of the Colorado Plateau. This extensive plateau rises to about 8,200 feet above MSL at its highest point. Reclamation from mining activities has transformed a large portion of the mesa from piñon/juniper to grassland. Several residences are located within the Black Mesa Complex. Depending on orientation, screening, and distance, the residents view active mine operations, swaths of reclaimed land, and/or natural landscapes. Ongoing mining operations are visible from some residences. New mining areas and facilities would be adjacent to existing and disturbed areas (e.g., mine pits, buildings, and roads).

The coal-slurry preparation plant, which currently is not operating, is located in the western part of the Black Mesa Complex, and the proposed coal-washing facility would be located nearby. The proposed coal-haul road would traverse between the western and eastern legs of Black Mesa Complex. The viewing conditions and the potential viewers of the proposed facilities would be the same as those described for Black Mesa Complex.

3.15.2 Coal-Slurry Pipeline

3.15.2.1 Coal-Slurry Pipeline: Existing Route

The existing pipeline route passes east to west through all five of the major landscape types, including areas of Navajo, Flagstaff, Grand Canyon Plateaus, Upper Tonto, and Mohave. Each possesses different characteristics of landform, vegetation, and water (Table I-3 in Appendix I).

Beginning at the Black Mesa mining operation and heading southwest, the existing pipeline route passes through the characteristic piñon/juniper woodlands of Black Mesa and crosses several washes, the most distinguished of which is the Moenkopi Wash. It traverses dissected, high desert plains, and significant landscape features such as Coal Mine Mesa, Tohnali Mesa, Adeii Eechii Cliffs, and Ward Terrace. After crossing the Little Colorado River, it continues southwest, along the southern end of Gray Mountain and the Little Colorado River Basin.

The Flagstaff and Grand Canyon Plateau landscapes were combined for analysis purposes because the pipeline crosses a relatively small portion of each. Within the Flagstaff landscape, the pipeline crosses through piñon/juniper woodlands and grasslands with lava outcrops. As the existing route crosses Cataract Canyon and enters the Grand Canyon Plateau landscape, the landscape becomes a dense concentration of piñon/juniper woodlands and grassland. The pipeline passes just north of the town of Seligman where the Aubrey Cliffs are a distinctive landmark in the general vicinity of the pipeline corridor.

The route parallels I-40 for approximately 7 miles along Upper Tonto landscape, and then veers northwest through the foothills of the Juniper Mountains. The existing route passes through dissected plains and enters a landscape of rolling piñon/juniper woodlands, as well as traversing the Cottonwood Mountains. The landscape is characterized by extensive plateaus, tablelands including mesas and buttes, and canyons of moderate depth. Mountains are jagged, with sharp angular peaks, upturned edges, and tilted fault blocks.

The bajadas and foothills of the Cottonwood and Peacock Mountains, and the Hualapai Valley—all characteristic of the Mohave landscape—precede the corridor into the City of Kingman, Arizona. Near Kingman, the pipeline route crosses the Cerbat Mountains, and development ranges from urban to rural from Kingman through the Sacramento Valley to the Black Mountains. The route then drops to a lower elevation and traverses desert basin landscape with scattered desert scrub as it begins entrance into the developed areas of Bullhead City, Arizona, and Laughlin, Nevada, to terminate at the Mohave Generating Station.

Dispersed residential viewers are within viewing distance of the existing pipeline route at varying locations along the corridor. The pipeline alignment is characterized by exposed soil, cleared vegetation, and intermittent signage/pipeline markers.

Low-density residential pockets within the foreground distance occur along the pipeline outside the more densely populated areas. In developed areas such as Kingman, many residences are located close to the existing pipeline route, but have some to full visual screening of the route. In the rural, low-density residential areas southwest of Cameron, the pipeline maintenance road is in full view of residents within the immediate-foreground or foreground distance zone.

Designated scenic routes and routes providing access to scenic areas are in proximity to the coal-slurry pipeline. From Williams, Arizona, heading north to the Grand Canyon, State Route 64 and the Grand Canyon Scenic Railroad both cross the pipeline route several miles due south of Valle, Arizona. Just west of Seligman, the existing route runs parallel to I-40 for approximately 7 miles, as it heads west to Kingman, Arizona. Viewers expecting scenic landscapes often travel these routes. The existing pipeline route crosses historic Route 66.

Recreational viewing opportunities occur along the existing pipeline route in several areas where viewers may engage in motorized and nonmotorized recreational activities. The sensitivity of viewers towards the scenic quality of an area depends on the area as well as the type of activity. Hikers, for example, would perhaps have higher expectations for scenery than off-highway vehicle (OHV) recreationists where the vehicle, rather than the scene, is the focus. Cerbat Mountain recreation areas accommodate several different types of recreation, and have views of the existing route depending on the orientation and location of the viewer.

The existing pipeline route crosses approximately 5 miles of Forest Service land in the northwestern corner of Kaibab National Forest in the Williams Ranger District. The Forest Service manages this land to accommodate a moderate level of modification, given the existing natural setting has been modified, the scenic quality is defined as Class B, and the lack of sensitive viewers.

The existing route also crosses several areas of BLM-managed land. The Mount Nutt Wilderness and Black Mountains ACEC near the Black Mountains east of Laughlin, Nevada, are designated by BLM as VRM Class I and II landscapes, respectively, which receive the highest amount of protection against changes that would impact a landscape's scenic quality (BLM 1993). BLM-managed land in the Cerbat Foothills Recreation Area is also designated as VRM Class IV (refer to Map 3-17) (BLM 1986).

3.15.2.2 Coal-Slurry Pipeline: Existing Route with Realignment (Agencies' Preferred Alternative)

The Kingman reroute within the Mohave landscape would cross the foothills north of the Hualapai Mountains for approximately 12 miles and begin to enter the Sacramento Valley area as it runs west. Development is situated within mountains and foothills in this landscape in the eastern segment of the reroute. As the reroute continues west through the Sacramento Valley, desert basin grassland is host to the scattered development therein (Table I-4 in Appendix I). The route would reconnect with the existing pipeline, as it enters the foothills of the Black Mountains. The Kingman reroute would pass through or adjacent to several residential areas within immediate-foreground to middleground distance zone from the following mileposts: Kingman reroute CSP Milepost 4 to 6, east of the Hualapai Mountains (within immediate-foreground to middleground viewing distances); Kingman reroute CSP Milepost 14 to 15, west of the Hualapai Mountains (0.5-mile south of the reroute); Kingman reroute SCP Milepost 15.5 to 16.5, a residential development (immediate-foreground views); and CSP Milepost 22 to 27 (immediate foreground to middleground views) (refer to Map 3-18).

The Kingman reroute would pass through BLM land with the following VRM classifications: VRM Class IV landscapes (which allow for high modification); VRM Class III landscapes (which allows for nondominant modifications to the existing landscape); and two small segments of VRM Class II landscapes (which allows for low modification of the existing natural landscape). The Mount Nutt Wilderness and Black Mountains ACEC near the Black Mountains east of Laughlin, Nevada, are designated as VRM Class I and II landscapes, respectively, which receives the highest amount of protection against changes that would impact a landscape's scenic quality (BLM 1993).

3.15.3 C Aquifer Water-Supply System

3.15.3.1 Well Field

The well field area would be located within the Navajo landscape type. The immediate landscape is barren, with an exposed reddish-brown soil. Vegetation is minimal with occasional occurrence of desert scrub brush during seasons of high rainfall. Occasional outcroppings of rock offer some visual diversity (Table I-5 in Appendix I).

Several rural residences are dispersed within the well field area. The lack of vegetation and topographic relief within the well field area provides vast, unobstructed views with very little screening. Residential viewers at WSP Milepost 3, just east of WSP Mileposts 4 and 7, and at WSP Milepost 10 would have foreground to background views of the proposed project facilities. Existing visual disturbances such as windmills, existing wells, and water storage tanks are present within the landscape as part of previous modifications to the landscape.

3.15.3.2 C Aquifer Water-Supply Pipeline

3.15.3.2.1 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

The eastern route would be located entirely within a Navajo-type landscape (Table I-6 in Appendix I). The route would traverse washes, desert plateaus, mesas, and piñon/juniper woodlands typical of Navajo landscapes. The route would begin at the well field area and cross the Little Colorado River near the community of Leupp. The Little Colorado River creates a distinctive path of eroded edges, vegetative patterns, and sandy beds, and can be identified from long distances because of color and texture contrasts of vegetation, water, and sand. The eastern route also would parallel and cross some distinctive washes such as the Dinnebito and Oraibi Washes; these washes are typically dry drainages that run during high rainfall and provide stringers of vegetation and varying degrees of cut banks adding texture, color, and line elements to the landscape. To the east is the Painted Desert, characterized by its relatively colorful flat topography and subtle land changes such as small washes, sandy areas, and randomly occurring rugged terrain. Several mesas appear on the route as it runs north to the Black Mesa Complex. The

Newberry, Garces, Second, Third, and Padilla Mesas feature varying degrees of mesa grassland, vegetation, and eroded cliffs and edges, providing contrasting colors and textures to the landscape.

The eastern pipeline route would pass residences located along the fringes of several communities, including Leupp, Kykotsmovi, and just east of Hard Rock. Dispersed rural residences in the area of the well field, along Indian Route 2, northeast of Newberry Mesa, east of the Many Bobcat Hills area, and within the Black Mesa Complex, also would be close to the route, and there are a few residences along the Oraibi and Dinnebito Washes and adjacent to Indian Routes 22 and 8029. Most of those residences would have views ranging from open to partially screened with immediate-foreground or foreground views of the proposed project facilities. The project would potentially be in view of several residences dispersed along the alignment within the middleground and background distance zones.

For the project, two potential 69kV power line corridors (north and south alternatives) and two substation locations have been identified west of the community of Leupp. The substations and power lines would draw power from a larger high-voltage power line and deliver it to the pump stations located along the pipeline. Once reaching the proposed pipeline, the 69kV line would travel south (to supply power to the well sites) and north (to possibly as far as WSP Milepost 73). The primary proposed pump stations would be located along the pipeline at approximately WSP Mileposts 30 and 73.

The eastern route would cross State Route 264 north of Kykotsomovi. The Navajo Transportation Plan identifies this route as a high sensitivity travel route; views from this route are typically panoramic of open desert plains and mesas. The eastern route also would be adjacent to existing moderate-sensitivity travel routes such as U.S. Highway 99 and Indian Routes 2, 22, 8029, and 41 for a large segment of the alignment. Scattered occurrences of distribution power lines are common along the transportation corridors and along secondary roads serving rural residences (Navajo Nation Department of Transportation 2003).

3.15.3.2.2 C Aquifer Water-Supply Pipeline: Western Route

The western route is identical to the eastern route until it diverges to turn northwest across the Navajo Reservation at WSP Milepost 27. Continuing from there northwest along the top of Newberry Mesa, it then would descend into Dinnebito Wash and travel toward the distinctive natural landmarks of Ward Terrace, Red Rock Cliffs, Adeii Eechii Cliffs, Tohnali Mesa, and Coal Mine Mesa. Continuing north, it would cross an eroding terrace and several miles within three canyons (Begashibito, Coal Mine, and Ha Ho No Gey Canyon). The northern end of the western route would pass through desert plains and several valleys (Red Lake and Kletha Valley), and would traverse the Black Mesa escarpment across rolling piñon/juniper woodlands at the top of the mesa as it enters the Black Mesa Complex (Table I-7 in Appendix I).

The western route has potential to be viewed by a number of residential viewers. From the point of deviation from the eastern route at WSP Milepost 27, the western route would, for the next 18 miles, pass multiple rural and/or dispersed residences within immediate-foreground and foreground distance zones, with very little screening of the proposed project facilities. Additionally, dispersed residences along this segment are within foreground and middleground distance zones.

Some residences on the Moenkopi Plateau would be within the immediate foreground distance zone of the route. As it continues north, the route would pass residences within the middleground to background distance zones, and farther north, heavy concentrations of residential development along U.S. Highway 160 (between WSP Mileposts 91.5 and 127) would be within the immediate-foreground to background distance zones. Turning southeast and entering the Black Mesa Complex, it would pass residences within the complex with partially screened middleground to background views, before terminating at the Black Mesa mining operation.

The western route would be in proximity to two designated high-sensitivity travel routes—State Route 264 and U.S. Highway 160. It would cross State Route 264 at approximately the western WSP Milepost 71.5 and parallel U.S. Highway 160 for nearly 40 miles to connect with the Black Mesa Complex. Views from these travel routes are generally open and panoramic (Navajo Nation Department of Transportation 2003).

3.16 TRANSPORTATION

The study area for transportation includes the Black Mesa Complex, proposed well field, and a 2-mile-wide study corridor (1 mile on each side of the reference centerline) along proposed linear facilities (the coal-slurry pipeline, water-supply pipeline routes).

Roads, railroads, airports, and airstrips serve the transportation needs of visitors and area residents, businesses, and industries. A broad regional surface transportation network stretches from the Hopi and Navajo Reservations and extends through northern Arizona to Laughlin. The two major transportation corridors intersected by the project are U.S. Highway 89 from Flagstaff to Page (two lanes with passing lanes) and the transcontinental east-west I-40 from Kingman to Winslow (four lanes divided). U.S. Highway 89 serves as a major road traveled by visitors to the popular Grand Canyon National Park. Primary transportation corridors in the study area, mainly two-lane roads, are presented in Table 3-48. Local community and access needs throughout the study area are met by American Indian reservation routes, BIA routes, State and county roads (i.e., secondary roads), and unimproved roads.

Table 3-48 Primary Transportation Corridors

Project Region	Transportation Corridor	Communities/Cities Connected by Transportation Corridor	Notes
Eastern	U.S. Highway 160	Tuba City to Kayenta	2 lanes
	Arizona Highway 264	Window Rock to Tuba City-Moenkopi	2 lanes
	Indian Reservation Route 2	Leupp to Kykotsmovi	2 lanes
	Arizona Highway 99	Leupp to Winslow	2 lanes
	BIA 4 "Turquoise Trail"	The northern terminus of Arizona Highway 87 at Second Mesa with the southern terminus of U.S. Highway 163 at Kayenta	2 lanes – only partially complete
	BIA 41	U.S. Highway 160 to Piñon, Arizona	2 lanes, partially unpaved
	Indian Route 6930	Canyon Diablo Historic Highway 99	2 lanes, unpaved
	Indian Route 4	State Route 264 at Second Mesa to Piñon, Arizona	2 lanes, does not cross proposed water supply line
Eastern to Western	I-40	Holbrook to Needles	4 lanes
Central	U.S. Highway 89	Flagstaff to Page	2 lanes
	Arizona Highway 64	Williams to Tusayan to Cameron	2 lanes
	U.S. Highway 180	Flagstaff to Valle	2 lanes, designated scenic
Central and Western	Historic Route 66	Ash Fork to Golden Shores	2 lanes, designated a historic route and a National Back Country Byway
Western	U.S. Highway 93	Kingman to Hoover (Boulder) Dam	2 lanes
	Arizona Highway 68	Kingman to Laughlin	2 lanes
	Arizona Highway 95	Laughlin to Needles	2 lanes

NOTE: The table represents primary transportation corridors within northern Arizona regions. The Black Mesa Project does not cross all identified transportation corridors.

The study area can be divided into three distinct regions: (1) the eastern region (the Hopi and Navajo Reservations and the land north of I-40 near Winslow), (2) the central region (including the towns of Seligman and Valle), and (3) the western region (including the incorporated cities of Kingman, Bullhead City, and Laughlin).

The partially completed “Turquoise Trail” (also called Indian Route 4) is located in the eastern region of the project area within northeastern Arizona on the Hopi and Navajo Reservations. This important roadway is intended to connect the existing northern terminus of Arizona Highway 87 at Second Mesa with the existing southern terminus of U.S. Highway 163 at Kayenta. When completed, the road will provide direct access to the Black Mesa Complex from the Hopi Reservation communities, allowing Hopi people direct access to the Peabody mining operation at the complex for employment (refer to Section 3.11). The trail also will serve as an access corridor for proposed rights-of-way, facilitate north-south travel on the eastern side of the reservation, and enhance the regional travel network (Hopi Office of Community Planning & Economic Development 2001). Funds were authorized in 2006 by the Federal Highway Administration to be distributed to ADOT to continue construction of the Turquoise Trail.

Railroads within the study area include the BNSF Railroad (a major U.S. common carrier from Chicago to Los Angeles), the Grand Canyon excursion train, and the Black Mesa and Lake Powell Railroad that hauls coal to the Navajo Generating Station from the Kayenta mining operation.

Two airports near the study area are located in the Cities of Kingman and Bullhead City. The Kingman Airport is located in northeast Kingman and is classified as a commercial airport. Laughlin/Bullhead City International Airport is a full service regional airport with daily flights across the country (Bullhead City 2002). It is located within northern Bullhead City and is classified as a non-hub primary commercial service airport (Bullhead City 2002). One active airstrip, Bedard Field, is located within Black Mesa Complex. There are also airfields and airstrips located near the study area in Cameron, Kingman, Kayenta, Tuba City, Leupp, Chinle, Shonto, Rocky Ridge, Piñon, Polacca, and Seligman. Heliports are located near medical facilities within the Cities of Kingman and Bullhead City.

3.16.1 Black Mesa Complex

Indian Route 41 provides access to the Black Mesa Complex. The route extends from the junction of Arizona Highway 564 and U.S. Highway 160, approximately 21 miles southwest of Kayenta, and enters the Black Mesa Complex from the west. It acts as the main transportation artery within the mine area, with connecting side roads granting access to all Black Mesa Complex facilities. Continuing southeastward, Indian Route 41 exits the Black Mesa Complex approximately 30 miles north of Piñon, Arizona (Peabody 1986). Other roads on the Black Mesa Complex serve as access for local residents (including school buses). In winter months, Peabody plows snow from these roads as needed.

Peabody has constructed or upgraded both primary and ancillary roads within the Black Mesa Complex. The primary roads include coal-haulage and mine-vehicle roads a minimum of 50 feet wide, and coal-haulage, mine-vehicle, and dragline deadheading roads approximately 150 feet wide (OSM 1990). To gain access to mine facilities in remote sites, on-highway vehicles most frequently use ancillary roads. There are two types: two-lane roads a minimum of 24 feet wide, and single-lane roads with a minimum width of a dozer blade or a motor-grader blade. The single-lane roads usually follow the natural topography and were established by area residents prior to mining activities (OSM 1990). Transportation within the Black Mesa Complex also includes a conveyor-belt system and airstrip.

Approximately 592 acres on the Black Mesa Complex have been disturbed to accommodate coal-haul roads (OSM 1990). The proposed coal-haul road would travel on land outside the Black Mesa Complex to

connect the J23 coal resource area with the currently unpermitted area of the Black Mesa Complex. The route would be within the Hopi Reservation.

The haul-road network within the Black Mesa Complex is broken up into numerous segments; the present haul road network in the permanently permitted area of the Black Mesa Complex is 10 miles long and the present haul road network in the currently unpermitted area of the Black Mesa Complex is about 8 miles long.

The Black Mesa and Lake Powell Railroad that hauls coal from the Kayenta mining operation to the Navajo Generating Station near Page, Arizona, is located west of the Black Mesa Complex and north of U.S. Highway 160.

The original airstrip facilities located on the Black Mesa Complex are abandoned (the Black Mesa Pipeline, Inc., airstrip). The existing airstrip on the Black Mesa Complex, Bedard Field, was constructed on reclaimed spoil in the J-3 area; this is the only active airstrip within the Black Mesa Complex. Facilities include a paved access road, a paved runway that extends approximately 7,500 feet long and 80 feet wide, a paved tie-down area, a parking area with storage buildings, and various other structures related to the airstrip. Access is provided to the proposed coal-washing facility site and the coal-slurry preparation plant through the road network on the Black Mesa Complex, as well as by Indian Route 8434 (south of the Black Mesa Complex).

3.16.2 Coal-Slurry Pipeline

3.16.2.1 Coal-Slurry Pipeline: Existing Route

The existing coal-slurry pipeline route crosses and parallels primary and secondary roads along its route from the Black Mesa Complex to Laughlin. A network of dispersed, unimproved roads provides access to remote houses and areas on the Hopi and Navajo Reservations. Larger cities, such as Kingman, Bullhead City, and Golden Valley, contain many highly traveled or local access roads that are crossed or paralleled by the route.

In the eastern region, within the Black Mesa Complex, the existing route crosses Indian Route 41 and, as the coal-slurry pipeline leaves the Black Mesa Complex, it crosses and parallels unimproved roads for several miles past the Black Mesa Complex. Indian routes paralleled and/or crossed between CSP Mileposts 4 and 97 include Indian Route 6, Indian Route 6250, and Indian Route 6730, among many other unimproved roads.

In the central region, the existing pipeline route continues west from the Navajo Reservation and crosses through Kaibab National Forest. It parallels an unimproved access road through the forest for 5 miles before crossing U.S. Highway 180 as the highway leaves the forest. The Kaibab National Forest portion of U.S. Highway 180 is considered scenic.

The existing pipeline route crosses Arizona Highway 64 near CSP Milepost 123. Continuing southwest, near Seligman in Yavapai County, Arizona (CSP Milepost 171), the existing pipeline route parallels the north side of I-40, a major east-west travel corridor. At CSP Milepost 178, the pipeline route departs the I-40 corridor, crossing and/or paralleling unimproved roads until it enters the City of Kingman, where it is buried beneath Gordon Drive (CSP Mileposts 234 to 237).

In the western region, the existing pipeline route passes through the City of Kingman, Sacramento/Golden Valley, and Bullhead City. It crosses Arizona Highway (Route) 66 near the City of Kingman. U.S. Highway 93 parallels and then crosses the existing pipeline route near CSP Milepost 242.

As it enters Bullhead City from the east, the pipeline route crosses two of the city's main arterial corridors: U.S. Highway 95 and Bullhead Parkway. Silver Creek Road, located south of the pipeline right-of-way, is the only connection between these two roads. The pipeline then crosses under the Colorado River and enters Laughlin, Nevada, where it crosses Casino Drive, between CSP Mileposts 270 and 271.

The existing pipeline crosses under a runway of the Laughlin/Bullhead City International Airport near CSP Milepost 270.

The BNSF Railroad crosses the pipeline route at CSP Mileposts 170 and 234. The Grand Canyon Railway crosses the pipeline route at CSP Milepost 125.

The existing route crosses two roadways identified for improvement by the Arizona Department of Transportation (ADOT): U.S. Highway 89 and Arizona Highway 64 (ADOT 2004).

ADOT plans to widen U.S. Highway 89 to four lanes (from highway Milepost 442 to Milepost 482), raise the median, and add three new interchanges with intermittent turn lanes. U.S. Highway 89 crosses the existing pipeline near CSP Milepost 78, within the area of improvements. Arizona Highway 64 (highway Milepost 185 to Milepost 235) is planned for additional paved shoulders, widening of some segments to four lanes, additional turn lanes, and construction of several passing lanes (ADOT 2004). Arizona Highway 64 crosses the existing pipeline near CSP Milepost 123, an area identified for improvements.

In addition, ADOT is currently in the process of deciding on a corridor for the realignment of Arizona Highway 95. The alternative corridors are generally located east of Bullhead City and west of the Mount Nutt and Warm Springs wilderness areas from Arizona Highway 68 to I-40. The existing coal-slurry pipeline route would cross ADOT's current preferred corridor for the Arizona Highway 95 reroute near CSP Milepost 265.

The City of Kingman has approved a project to add a third lane to Gordon Drive. In addition, the existing pipeline may cross (near CSP Milepost 230) the proposed north-south road associated with interchange improvements at I-40 and Rattlesnake Wash.

3.16.2.2 Coal-Slurry Pipeline: Existing Route with Realignments (Agencies' Preferred Alternative)

The Moenkopi Wash realignments would cross only unimproved roads. The Kingman reroute would cross and parallel typical city roads leading to residential areas and it would cross U.S. Highway 93. I-40 would be crossed by the Kingman reroute (and paralleled by the BNSF Railroad).

The City of Kingman has indicated that there is a plan for a new traffic interchange on I-40 at Rattlesnake Wash (located in proximity to Milepost 2 of the Kingman reroute). The north-south connecting road would also intersect the reroute at Milepost 2.

3.16.3 C Aquifer Water-Supply System

3.16.3.1 Well Field

The transportation network that extends through the well field includes secondary Indian Routes, including Indian Route 6930 and Arizona Highway 99. I-40 is located approximately 1 mile south of the well field. The BNSF Railroad passes through the southwestern corner of the Navajo portion and just north of the Hopi Hart Ranch portion of the well field.

3.16.3.2 C Aquifer Water-Supply Pipeline

3.16.3.2.1 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

The eastern pipeline route would begin at the well field and parallel Indian Route 6930, Arizona Highway 99, and Indian Route 2 for portions of its route. For approximately 4 miles, the eastern route would travel approximately 1 mile west of Indian Route 2 just south of the community of Kykotsmovi. The western subalternative would be located beneath the main roadway through the community of Kykotsmovi, and would cross Arizona Highway 264 as it exits the community. The eastern subalternative would be located beneath Indian Route 2, bypassing Kykotsmovi on its eastern edge, and also would be located beneath Arizona Highway 264 for less than one-half mile before it exits the community. Exiting the community of Kykotsmovi, it would continue north along Indian Route 2. There would be approximately 3 miles of the eastern route that would not follow an existing transportation corridor.

The eastern pipeline route would parallel the Turquoise Trail, a transportation corridor and potential utility corridor. (This portion of the Turquoise Trail is paved.) It would then parallel an unimproved route, and then Indian Route 41, within a disturbed transportation corridor.

3.16.3.2.2 C Aquifer Water-Supply Pipeline: Western Route

The western route would be identical to the eastern route to WSP Milepost 27 where the western route diverges. The route would then parallel dispersed, unimproved roads for approximately 65 miles before joining with U.S. Highway 160.

Approximately 20 percent of the route would not parallel an existing transportation corridor, though it would occasionally cross transportation corridors in these segments. The western route also would parallel the Black Mesa and Lake Powell Railroad along the U.S. Highway 160 portion of its route.

3.17 RECREATION

Northern Arizona offers mountains, lakes, deserts, canyons, and forests with a wide variety of recreational opportunities. Major tourist attractions are the Grand Canyon National Park, Colorado River, Lake Mead National Recreation Area, Lake Powell/Glen Canyon Recreation Area, Navajo National Monument, and Monument Valley. Developed and semi-developed campgrounds, day-use picnic areas, and trailheads are available for recreation in the region.

Recreation in the study area is managed by American Indian tribes (Hopi and Navajo), the Forest Service, BLM, AGFD, counties, and cities. OHV use, hiking, wildlife viewing, camping, hunting, mountain biking, and horseback riding are popular recreational activities in the study area. The Colorado River is a center of much recreational activity, including boating (a primary activity).

The study area for recreation includes the Black Mesa Complex and a 1/8-mile buffer on either side of the reference centerline (although areas outside of this were mapped) along proposed linear facilities (the coal-slurry pipeline and water-supply pipeline). Recreational areas were identified from community, city, and county land use plans in addition to BLM and Forest Service resource management plans and guidelines. Field review confirmed recreational uses in many areas.

According to the National Wild and Scenic Rivers System, no component of the Black Mesa Project would cross a designated wild and scenic river within the State of Arizona (National Park Service 2005b); however, components of the project would cross several major transportation corridors that lead to visited recreation areas.

3.17.1 Black Mesa Complex

The location of Kayenta, Arizona, along the Colorado Plateau (approximately 15 miles northeast from the center of the Black Mesa Complex), places it amid geological and archaeological features that stimulate tourism throughout northeastern Arizona. Two of these attractions nearest Kayenta are Navajo National Monument (approximately 15 miles west of Kayenta) and Monument Valley Navajo Tribal Park (22 miles north of Kayenta) (Map 3-19).

No specific data are available on the use of the Black Mesa Complex for recreation. Residents report that the area is sparsely used for sightseeing (OSM 1990). Possible recreational activities may include hiking and game or bird hunting.

The Moenkopi Wash area may be the more prominent location for game hunting, commercial trapping, bird watching, and photography. Hiking may occur to a limited extent north of the Black Mesa Complex near the rim of Black Mesa. The area of Black Mesa near the Black Mesa Complex is closed to all big game hunting (Peabody 1986).

There are no recreational resources in the immediate vicinity of the coal-slurry preparation plant or the proposed coal-washing facility located on the Black Mesa Complex, or the proposed coal-haul road.

3.17.2 Coal-Slurry Pipeline

3.17.2.1 Coal-Slurry Pipeline: Existing Route

Recreational opportunities along the existing pipeline route are generally located in designated areas (i.e., special management areas); however, trails (including historical trails) and other nondeveloped areas are located throughout northern Arizona. Virtually all of the land along the existing route provides open space for dispersed recreational activities.

The Hopi Tribe, Forest Service, City of Kingman, Mohave County, BLM, Bullhead City, and AGFD manage recreational uses along the existing alignment. No developed or designated recreational areas are located along the existing route on the Navajo Reservation.

The existing route crosses through Blue Canyon Special Management Area, located in the northwestern part of the Hopi Reservation. The area, managed by the Hopi Tribe, totals approximately 36,860 acres and was dedicated to conservation and outdoor recreation purposes, as described in the Hopi land use and development plan. However, the area has not yet been developed. Residents of Third Mesa currently use the land within the special management area for traditional gatherings (Hopi Office of Community Planning & Economic Development 2001). The existing route crosses through the special management area for approximately 1 mile. The Hopi Tribe also has identified environmental reserve areas. These areas constitute woodland areas, the Blue Canyon Special Management Area, riparian areas, and washes.

The Kaibab National Forest is composed of three separate land areas located in north-central Arizona. Most of the area is piñon/juniper woodland, and is valuable wildlife habitat for mule deer, elk, pronghorn antelope, and turkey. The existing pipeline route crosses the Williams Ranger District, which lies in a designated utility corridor within Coconino County near CSP Mileposts 113 to 117. The 5-mile-long

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Map 3-19 Recreation/Special Designations

Black Mesa Project EIS

LEGEND

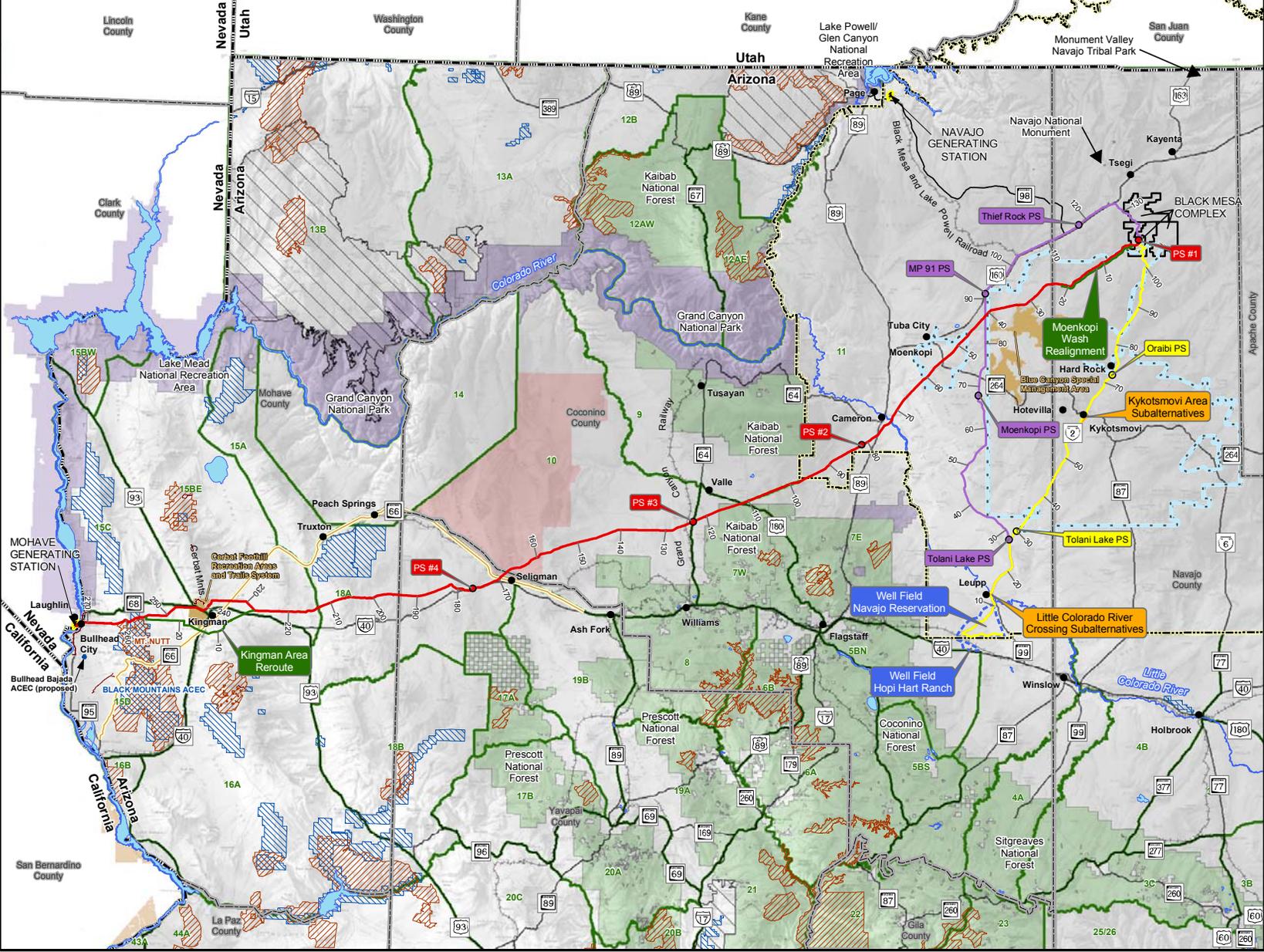
- Coal-Sturry Pipeline**
 - Existing Route
 - Realignments

(Existing route with realignment/reroute is the preferred alternative)
- Proposed Water-Supply Pipeline**
 - Eastern Route (preferred alternative)
 - Subalternatives (preferred alternative)
 - Western Route
- Other Project Features**
 - C-Aquifer Well Field
 - PS = Pump Station
 - Peabody Lease Area
- Recreation**
 - AGFD Game Management Unit and Number
 - Wilderness Area
 - BLM Area of Critical Environmental Concern
 - BLM National Monuments
 - Recreation Area
 - National Forest
 - National Park
 - Big Boquillas Ranch
 - Historic Route 66
 - Trail
- General Features**
 - River
 - Lake
 - Navajo Reservation Boundary
 - Hopi Reservation Boundary
 - State Boundary
 - County Boundary
 - Interstate/U.S. Highway/State Route

SOURCES:
URS Corporation 2005, 2006
Arizona State Land Department 2005
Mohave County 2005
Bureau of Land Management 2005

September 2006

Prepared By:
URS



pipeline segment that passes through the Kaibab National Forest is mostly classified by the Forest Service as Roaded Modified³ with a small portion of the route located in the Roaded Natural area.

The existing route parallels one public park in the City of Kingman near CSP Milepost 237. A second public park is located 0.5 mile away from the pipeline, also near CSP Milepost 237. The section of BLM land located just outside of Kingman (between CSP Mileposts 237 and 238) is designated for open space preservation (City of Kingman 2003). There are some areas within the City of Kingman that are open to OHV use.

The Cerbat Foothills Recreation Area is located between Kingman and Sacramento Valley along the existing route between CSP Mileposts 240 and 242. The recreation area is co-managed by the City of Kingman and the BLM Kingman Field Office, with funding from the Trails Heritage Fund (which is managed by Arizona State Parks), and includes a trail system. The trails system consists of the Camp Beale Loop Trail, Castle Rock Trail, Badger Trail, Monolith Garden Loop Trails (construction complete in 2005), and the Camp Beale Spring Historic Site. The trail system accommodates recreational uses such as equestrian, hiking, and bicycling. Motorized vehicle use is limited to designated roads and trails within the Cerbat Foothills Recreation Area.

The community of Golden Valley shares its border with the Cerbat Foothills Recreation Area. The large amounts of undeveloped land in the community have served as defacto open space for the local residents for hiking, horseback riding, and off-road driving, as well as for undesignated uses such as trash dumping (Mohave County 2002).

The Mount Nutt Wilderness Area, just west of Kingman and managed by the BLM Kingman Field Office, is paralleled intermittently by the existing route between CSP Mileposts 257 and 262. The wilderness area lies within the Black Mountains, and is home to bighorn sheep. Recreational activities supported by the area include camping, climbing, hiking and backpacking, horseback riding, hunting, and wildlife viewing. The Mount Nutt Wilderness Area is closed to OHV use. The pipeline parallels, but is not within, the wilderness area boundary.

The Black Mountain Ecosystem Management ACEC also is managed by the BLM. The Black Mountains provide a complex mix of resource values for wildlife, livestock, wild burros, and people. The presence of wilderness, rich mineral deposits, important wildlife habitat, a wild burro area, and abundant recreation opportunities can lead to conflicting uses in key areas of the Black Mountains. The Black Mountains Ecosystem Management ACEC was proposed to focus management attention on resolving these conflicts. OHV use, hunting, rockhounding, and wilderness hiking are a few of the recreational activities that take place within the ACEC (BLM 1993). The existing route is within a designated utility corridor in the ACEC between CSP Mileposts 256 and 259. The Colorado River Heritage Greenway Trail is a 30-mile multiple-use trail that extends from Lake Mead to the Colorado River Nature Center in Bullhead City. The trail, which will link five parks within Bullhead City, represents an important north-south link through the community. The purpose of the trail project is to treat the Colorado River within the boundaries of Bullhead City as an urban greenway that will provide residents and visitors with educational, recreational, and scenic experiences on a network of paths and trails (Bullhead City 2002). The Colorado River Heritage Greenway Trail passes over the existing pipeline at CSP Milepost 270.

³ These terms are from the Forest Service Recreation Opportunity Spectrum, a planning framework that allows Forest Service managers to describe and provide a range of recreation opportunities from highly developed areas (Urban, Rural, Roaded Natural, Roaded Modified) to areas with little or no development (Semi-primitive Motorized and Nonmotorized Primitive).

Bullhead City, Arizona, and Laughlin, Nevada, lie on either side of the Colorado River. The river provides numerous recreation opportunities, including boating, jet skiing, swimming, day use/picnic facilities, and beaches. Laughlin has several large casinos located adjacent to the river, which provide walking trails for casual enjoyment and views of the river's activities. There are areas within Bullhead City that are open to OHV use.

The AGFD manages hunting within Arizona by dividing the State into GMUs. GMUs crossed by the existing route include 7, 9, 10, 18A, 15B, and 15D. GMUs 7, 9, and 10 are located along the existing route between Cameron and Seligman. GMUs 18A, 15B, and 15D are located along the existing route between Seligman and Bullhead City (refer to Map 3-13). Primary game species hunted within these GMUs include mule deer, elk, turkey, antelope, bighorn sheep, quail, and javelina. Other species hunted within the GMUs are dove, waterfowl, black bear, mountain lion, and tree squirrel. Table 3-49 lists the average annual number of permits issued by AGFD since 2000 in areas crossed by the existing route.

Table 3-49 Average Annual Number of Permits Issued by Arizona Game and Fish Department Between 2000 and 2005

GMU	Antelope	Bighorn sheep	Elk	Javelina	Merriam's Turkey	Mule/White Tailed Deer
7(W)	60	-	1,515	-	175	2,130
9	31	-	996	-	40	970
10	20 ¹	-	1,675	-	-	850
18A	100	-	10	200	-	800
15B	7 ²	13	-	-	-	390 ²
15D	-	6	-	-	-	-
Total	318	19	4,196	200	215	5,140

SOURCE: Arizona Game and Fish Department 2005d

NOTES: ¹ 100 permits for archery combined with GMU 18A and 18B.

² Combined with 15A.

- Data not available for the average number of permits issued.

The Great Western Trail, a 2000 Millenium Trail, is a 3,000-mile-long north-south backcountry route extending from Canada to Mexico providing recreational opportunities. The trail is immediately south of the existing pipeline right-of-way.

Big Boquillas Ranch, owned by the Navajo Nation in fee, is open for sportsmen use, which includes big game hunting (deer, elk, turkey, antelope, and bighorn sheep), small game hunting (predators and prairie dogs), camping, bird watching, photographing wildlife, and sight seeing (Arizona Elk Society 2005). Hunting within the ranch is managed by AGFD (Begay 2005). The existing route crosses through the Big Boquillas Ranch between CSP Mileposts 159 and 170 (refer to Map 3-17).

San Francisco Peaks Scenic Road is 31-mile-long portion of U.S. Highway 180 (highway Milepost 224 to Milepost 255) that stretches from Flagstaff to a few miles before the junction with State Highway 64. This segment of scenic road was designated by the ADOT on January 12, 1990 (U.S. Department of Transportation Federal Highway Administration 2005). Also located in Kaibab National Forest, the road is a highly traveled route to the Grand Canyon. The officially designated scenic portion of the road ends soon after Red Mountain, which is located in Coconino National Forest. U.S. Highway 180 crosses the pipeline corridor on State Trust Land. Highway 64 crosses the pipeline corridor on State Trust Land.

The Grand Canyon Railway travels from Williams to the South Rim of the Grand Canyon and crosses the existing route near CSP Milepost 125. The Grand Canyon Railway owns a significant portion of the 65 miles of track and operates on a right-of-way through land administered by the Forest Service and

National Park Service (Grand Canyon Railway 2005). The railway offers wildlife viewing and sightseeing aboard a vintage train (Grand Canyon Railway 2005).

3.17.2.1.1 Coal-Slurry Pipeline: Existing Route with Realignment (Agencies' Preferred Alternative)

The Moenkopi Wash realignments would not cross any designated recreational areas. The portion of the reroute from CSP Milepost 2 to 3 is located within the Black Mesa Complex where recreational activities are not designated. Residents report that the area is sparsely used for sightseeing (OSM 1990). Possible recreational activities may include game or bird hunting.

The Kingman reroute would cross Historic Route 66 at reroute CSP Milepost 13, and one park/open space area is located within Golden Valley about 0.5 mile from the pipeline alignment near reroute CSP Milepost 21. A major development approved both north and south of the reroute, Golden Valley Ranch, will include parks and open space areas adjacent to the alignment.

3.17.3 C Aquifer Water-Supply System

3.17.3.1 Well Field

According to the Leupp Chapter Land Use Plan, Old Leupp and Sunrise are historically significant scenic areas located just north of the proposed well field. These areas offer undeveloped options for recreation, tourism (sightseeing), and academic research. The historically significant Canyon Diablo site is located in the southwestern corner of the Navajo portion of the proposed well field just north of the BNSF Railroad and Indian Route 6930. Currently, visitors are allowed to tour the ruins at these locations on their own (Navajo Nation Division of Community Development 2005).

The Painted Desert, known for its scenic vistas and badlands, is a large geographic area that extends from the Grand Canyon to the Petrified Forest National Park. It is located on the Navajo Reservation, private land, and national parks. A portion of the Painted Desert that is located on the Navajo Reservation lies within the well field area and offers dispersed recreation opportunities such as undeveloped areas for hiking and sightseeing.

3.17.3.2 C Aquifer Water-Supply Pipeline

3.17.3.2.1 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

Land on the Navajo Reservation that would be crossed by the eastern route is not designated for recreational opportunities; however, the alternative crosses through the Painted Desert, where dispersed recreation activities may occur (e.g., hiking, sightseeing). The Hopi Tribe designated the primary washes (e.g., Oraibi, Moenkopi, Dinnebito) for conservation and specific recreational opportunities. The eastern route would parallel and cross these washes that run through the reservation.

The Little Colorado River flows northwest across the planning area, and would cross the eastern route just east of the Community of Leupp. The river has no developed recreation areas inside the study area; however, its deep gorges may provide dispersed recreation opportunities for localized hiking (during dry months), wildlife viewing, and sightseeing.

3.17.3.2.2 C Aquifer Water-Supply Pipeline: Western Route

There are no developed recreation opportunities located along the western route. U.S. Highway 160 (which is parallel to the western route from WSP Mileposts 92 to 126) is a highly traveled access route to Navajo National Monument and Monument Valley. The western route also would cross through the Painted Desert, where dispersed recreation activities may occur (e.g., hiking, sightseeing).

3.18 HEALTH AND SAFETY

Activities conducted at an industrial facility carry an inherent risk. Typical risks encountered include exposure to dust, noise, heat stress, and chemicals, as well as the opportunity for accidents due to working directly with or in proximity to large equipment. However, the establishment of appropriate policies and procedures and the monitoring of those procedures to ensure that they are properly observed help to reduce the risk involved.

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

- The Federal Mine Safety and Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164. Enforced by the Mine Health and Safety Administration (MSHA), and administered by the U.S. Department of Labor.
- The Surface Mining Control and Reclamation Act of 1977 (SMCRA) (30 U.S.C. 1201 et seq.).
- The Clean Water Act, (Federal Water Pollution Control Act [33 U.S.C. 1251 to 1387]).
- The Clean Air Act of 1970 (CAA) as amended 1990.
- The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 U.S.C. 9601 et seq. Also known as “Superfund.”
- The Superfund Amendments and Reauthorization Act of 1986, Title III, embodying the Emergency Planning and Community Right-to-Know Act.
- Resource Conservation and Recovery Act (RCRA), as amended – 42 U.S.C. Sec. 6901 et seq.

3.18.1 Black Mesa Complex

Safety practices observed at the Black Mesa Complex and all associated facilities were identified by review of the policies and procedures established by the MSHA. All mining operations’ safety plans and procedures are based on guidance developed by MSHA. The agency develops and enforces safety and health rules applying to all mines in the United States; helps mine operators who have special compliance problems; and makes available technical, educational, and other types of assistance. MSHA works cooperatively with industry, labor, and other Federal and State agencies toward improving safety and health conditions for all miners.

3.18.1.1 Safety Policies, Procedures, and Enforcement

Safety policies and procedures established at the Black Mesa Complex are directly based upon guidance provided by the U.S. Department of Labor through MSHA (Holgate 2005). The CFR for the Mine Safety and Health Act of 1977 consists of 199 Parts in 30 CFR that outline the policy and procedures for safety at mining operations. Part 77, Mandatory Safety Standards, Surface Coal Mines and Surface Work Areas of Underground Coal Mines, establishes mandatory safety standards, including requirements for equipment safety specifications and maintenance, handling and safety procedures, fire protection, and use of explosives and blasting. Part 77 forms the basis for the various safety plans developed and maintained at the Black Mesa Complex (MSHA 2005a). Based on the criteria identified in Part 77, a series of safety plans has been prepared to address each aspect of work performed at the mines (Holgate 2005). Other key sections of the safety CFR used extensively by the Safety Department at the Black Mesa Complex to establish safety policies and procedures are:

- Notification, Investigation, Reports and Records of Accidents, Injuries, Illnesses, Employment, and Coal Production in Mines (30 CFR 50);
- Occupational Noise Exposure (30 CFR 62);
- Mandatory Health Standards—Surface Coal Mines and Surface Work Areas of Underground Coal Mines (30 CFR 71); and
- Criteria and Procedures for Proposed Assessment of Civil Penalties (30 CFR 100) (United States Department of Labor, MSHA 2005a).

Continual training is a key component in ensuring safety at the mines. Introductory and ongoing training classes are held regularly for new and current employees in accordance with the Federal Mine Safety and Health Act guidance (Holgate 2005).

Despite every effort to establish and enforce detailed safety procedures, accidents and injuries can sometimes occur. A first aid station is located at the site to address any immediate injuries that can be remedied locally. In the event of a more serious accident, a medical evacuation (Med Evac) helicopter and paramedics are available 7 days a week, 24 hours a day to airlift an injured person to the nearest hospital (Holgate 2005).

The requirements of the Mine Safety and Health Act dictate that MSHA make at least two safety inspections each year at every surface mine. These visits can occur without notification, and at any time of the day or on any day of the week. While the Safety Department at the Black Mesa Complex is ultimately responsible for compliance with safety requirements, the department managers of each group are responsible for ensuring that all safety regulations are followed.

3.18.1.2 Hazards and Contaminants

Blasting. Hazards associated with blasting include explosives handling by workers and proximity to the blast site. Blasting operations at the Black Mesa Complex are conducted according to Federal law, applicable regulations, and the approved permit application. No blasting is conducted within 0.5 mile of an occupied dwelling. Since Federal law and regulation both allow mining to within 300 feet of such a structure, the permit requirements are more stringent than Federal law and regulations. Blasts are monitored for air blast and ground vibration by five permanent seismographs located throughout the permit area. Blasting records are submitted and reviewed monthly by OSM. In the event of a violation, Federal enforcement action is taken (OSM 2005a).

To prevent injury to people and damage to property both within and outside of the permit area, notices of the blasting schedule are distributed to all citizens within the permit area and within 0.5 mile outside the permit area. Prior to the detonation of each blast a warning signal is sounded that must be audible within a range of 0.5 mile of the point of the blast, as required by the regulations at 30 CFR Part 816.66(b). This is to alert residents and workers where a blast is to be detonated. After the blast, an all-clear signal is sounded when the area is clear. All blasting operations are restricted to the daytime hours between sunrise and sunset (OSM 2005a).

Air Quality. Mining involves drilling and shearing of large quantities of minerals. If the appropriate precautions are not taken, the clouds of dust raised in displacing these materials can damage the lungs, particularly after years of exposure (refer to Section 3.6, Air Quality). In accordance with requirements of the Mine Safety and Health Act, all applicable precautions are observed at the Black Mesa Complex to ensure worker health and safety (Holgate 2005).

Persons living in the vicinity of the mining operations also are subject to the air quality effects of mining operations. Peabody has operated an air-quality monitoring program since 1980 in accordance with Federal regulations. Airborne particulates and dust are monitored at 12 different sites located throughout the leased area, based on wind patterns, mining activity, and location of residences. Quarterly and annual air quality monitoring reports are prepared by Peabody to ensure compliance with air quality requirements (OSM 2005b).

Transportation. Traffic accidents can occur on pit ramps or routes of travel that are within the mining and spoil grading areas. The safe operation and maintenance of haul trucks, water trucks, rubber-tired end loaders, and other surface mining machinery is emphasized in the regulations in the Mine Safety and Health Act of 1977. Weather can be a factor in traffic accidents at the mine; frequent freezing and thawing can loosen formerly solid rock on the highwalls, road cuts, and portal faceups. Appropriate signage and traffic control are monitored as part of the safety procedures at the Black Mesa Complex in accordance with the MSHA regulations.

A private airport for the use of Peabody personnel is located in the reclaimed J-03 area. The airport facilities include an approximately 7,500-foot-wide paved runway and a small airplane tie-down, taxiway, and storage building area. The facilities were designed, constructed, and are maintained to comply with all applicable local and Federal regulations.

Natural Hazards. Environmental conditions at and near mining operations that could present serious hazards include seasonally extreme temperatures and potential flash flooding, rugged terrain, and remoteness. The project area is found in a generally arid to semi-arid climate with a dry season occurring in May and June. The monsoon season generally begins in July, producing potentially heavy rains and flash flooding. Winter snowfall occurs over most of the project area beginning in October and November, sometimes creating hazardous conditions.

Along with weather extremes, the presence of venomous or otherwise dangerous wildlife can be a hazard to workers, residents, and visitors. Several species of venomous reptiles and arthropods (including insects and spiders) occur in the area. There also are various species of rattlesnakes, scorpions, spiders, and bees in the area. Common sense and care around locations where these animals may be found generally avoids unfortunate encounters between these species and humans.

Solid Waste. A solid waste landfill was operated by Peabody at the J-03 area until its closure in 1997. A reclamation plan for the landfill is being implemented, and a solid-waste vendor will haul the solid waste located in the landfill off site to a regulated landfill. Upon completion, a closure plan will be prepared. No active solid-waste facilities are located in the lease area. All solid waste is removed from the site by regulated contractors and transported to off-site municipal landfills.

Hazardous Materials and Wastes. A hazardous material is any material (biological, chemical, physical) that has the potential to cause harm to humans, animals, or the environment. A hazardous material is defined in 30 CFR Part 1910.1200 as any substance or chemical that is a health hazard or physical hazard, including chemicals that are carcinogens, toxic agents, irritants, corrosive, sensitizers; agents that damage the lungs, skin, eyes, or mucous membranes; chemicals that are combustible, explosive, flammable, oxidizers; and chemicals that in the course of normal handling, use, or storage may produce toxic dusts, gases, fumes, vapors, mists, or smoke (National Institute for Occupational Safety and Health 2005).

No hazardous materials are used for mining and processing of coal at the Black Mesa Complex. Some routine cleaning products and water-soluble solvents are maintained in the support structures in limited quantities (Chischillie 2005).

Mining operations require maintenance activities for equipment and machinery used in the processes. Safety Kleen parts washers containing cleaning solvents are located at the Black Mesa mining operation area in the preparation plant, truck shop, welding shop, at a contractor's on-site location, and in the human resource area. Parts washers are located at the Kayenta mining operation area in the preparation plant, truck shop (two units), and welding shop. Bays containing an aqueous solution of soap and water are located at the Black Mesa truck shop and at the Kayenta truck shop and preparation plant. All of the parts washers are serviced and the wastes are removed by the contractor, Safety Clean, every 8 weeks with the exception of the Black Mesa aqueous solution washer, which is serviced every 16 weeks. Parts washers are located on the drag line at the Kayenta mining operation, and waste is placed in drums for removal. Approximately 90 to 125 drums are removed every 90 days (Chischillie 2005).

The main waste streams found at the Black Mesa mining operation are grease, grease and debris, grease/oil/solvent, greasy rags, and used solvent. These wastes are collected and removed every 8 weeks. As a result of fire training that has been conducted, a waste stream consisting of fire retardant with diesel gas was removed in 2003. Other waste streams occurring less often at the Black Mesa mining operation are used paint and analysis material from the laboratory consisting of magnesium and perchlorate. A waste stream of Nyloband adhesive used for beltline splicings at the Kayenta mining operation occurs occasionally (Chischillie 2005).

Two 10,000-gallon used-oil tanks are located at the Black Mesa mining operation. One is used to accumulate used oil while the other filled tank is out of service for testing and removal of the contents. Two other tanks, approximately 5,000 gallons each, serve the same function for used antifreeze. Both products are serviced by ThermoFluids located in Phoenix, Arizona (Chischillie 2005).

Several products are recycled at the Black Mesa mining operation area, including fluorescent lamps (4-foot and 8-foot lengths), high-pressure sodium light bulbs, and mercury vapor light bulbs. These are removed from the site yearly. Used batteries also are recycled at Black Mesa, and are removed on an as-needed basis by Napa Service located near Shiprock, Arizona (Chischillie 2005).

A 5,000-gallon above-ground Jet A fuel tank is located at the new airport facility in the J-03 area to service the aircraft. The tank is constructed of steel and is housed in a spill-proof concrete containment area. The tank was constructed in 1986 and no violations or spills have occurred since its installation (Armstrong 2005).

3.18.2 Coal-Slurry Pipeline

The existing coal-slurry pipeline extends 273 miles from the Black Mesa Complex to the Mohave Generating Station in Laughlin, Nevada. Four pump stations are located in undeveloped areas at intervals along the pipeline. With the exception of the Kingman and Laughlin areas, the pipeline route passes through areas that are rural and undeveloped. The coal-slurry pipeline route crosses a number of major thoroughfares carrying a substantial volume of traffic, including county roadways, U.S. highways, state routes, Indian routes (Hopi, Navajo), and a number of private roadways.

The coal-slurry pipeline, which operated from 1970 through 2005, was operated and maintained in accordance with American Society of Mechanical Engineers Code B31.11, Slurry Transportation Piping System, and standard procedures established by the pipeline owners to ensure safe operation and integrity of the pipeline. The existing pipeline is protected from corrosion with external coating and a cathodic protection system designed in accordance with the National Association of Corrosion Engineers standard RP-01-69-92. The operation and maintenance of the pipeline was and would continue to be performed by qualified and trained employees. Personnel were and would be capable of monitoring the pipeline's operating conditions as well as controlling flows and pressures through the pipeline. Field operations

personnel inspect and conduct routine maintenance of the pipeline facilities regularly. The pipeline also is inspected by aerial surveillance regularly.

There have been 31 pipeline failures of varying types and sizes during the 35 years the coal-slurry pipeline has been in operation; however, only one event occurred in the first 20 years of operation that was not the result of human error (e.g., third-party backhoe excavation accidents, operator error with a control valve). Some of these failures appeared to be the result of corrosion acting on poor quality pipe. Extensive wall thickness losses have been observed in random joints of the pipe. Adjacent joints, produced by the same mill and with the same specifications and wall thickness, exhibited widely different corrosion rates. Remote pressure-monitoring devices were installed after the pipeline had operated for some time that would prevent many of the leaks that occurred initially and would prevent many potential leaks in the reconstructed system.

The existing pipeline has reached its design life of 35 years. For that reason, the new pipeline is proposed. However, the potential for rupture along the route is possible. In the event of rupture, the rupture is detected by control personnel, the flow is stopped to minimize the amount of coal slurry spilled, and the location of the rupture is identified and that segment of pipeline is isolated. If needed, the slurry in that segment of pipeline is pumped into a pond, designed and constructed for that purpose, at the closest pump station along the pipeline. Erosion, subsidence, and flooding issues could occur as a result of a rupture and there could be the possibility of personal injury. Safety procedures have been established to respond immediately to a rupture event once it is detected.

Facilities at the pump stations include pump houses, a water well, a cooling tower, a water pond, and coal-slurry pond. Chemicals used at the facility include ethylene glycol (for pump temperature control), a liquid oxygen scavenger (to prevent rust in the pipeline), oil, paint, and various greases and lubricants. Chemical wastes at the pump station are collected and hauled off site by a licensed contractor for disposal (Solberg 2005).

3.18.3 C Aquifer Water-Supply System

The proposed C aquifer water-supply system well field is situated near the community of Leupp, Arizona, which is a rural community on the Navajo Reservation. A small community of approximately 50 residences is located to the north of the well field. From the well field, the proposed water supply would convey the water to the Black Mesa Complex through areas that are rural and undeveloped with the exception of the community of Kykotsmovi. No large commercial or industrial facilities are located in or near the proposed well field or along the proposed pipeline route.

**ENVIRONMENTAL
CONSEQUENCES**



4.0 ENVIRONMENTAL CONSEQUENCES

This chapter provides a description of the effects on the environment that potentially could occur under each alternative group of actions described in Chapter 2. The chapter begins with a summary of the terms used for the impact assessment and then, for each resource, describes the impacts that could result from each alternative.

The information about the existing condition of the environment from Chapter 3 was used as a baseline by which to measure and identify potential impacts from the project. The EIS team considered and incorporated mitigation, where appropriate, before arriving at the impacts described here.

An impact, or effect, is defined as a modification to the environment brought about by an outside action. Impacts vary in significance from no change, or only slightly discernible change, to a full modification or elimination of the environmental condition. Impacts can be *beneficial* (positive) or *adverse* (negative). Impacts can be *short-term*, or those changes to the environment during and following ground-disturbing activities that generally revert to predisturbance conditions at or within a few years after the ground disturbance has taken place. *Long-term* impacts are defined as those that substantially would remain beyond short-term ground-disturbing activities.

For the mining operations, short-term impacts are those that would occur from the time when mining begins in a unit through reclamation when vegetation has been re-established. The mining operation continually advances with contemporaneous reclamation activities. That is, earth material excavated from a coal-producing unit is deposited to backfill the adjacent previously mined unit. When the unit has been backfilled, the area is regraded and revegetated. When vegetation has been re-established, limited use of the land may be allowed. This sequence continues until all of the coal has been removed from a given coal resource area (Appendix A-1). Long-term impacts are those that would persist beyond or occur after reclamation.

For the coal-slurry pipeline and water-supply system, local short-term impacts of the project are those that would occur during construction of the pipelines (and water-supply well field) plus a reasonable period for reclamation (i.e., a total of about 5 years). Long-term impacts are those that would persist beyond or occur after the 5-year construction and reclamation period.

An action can have direct or indirect effects, and it can contribute to cumulative effects. *Direct effects* occur at the same time and place. *Indirect effects* are later in time or farther in distance, but still reasonably foreseeable. *Cumulative effects* result from the proposed action's incremental impacts when these impacts are added to the impacts of other past, present, and reasonably foreseeable future actions, regardless of the agency or person who undertakes them (Federal or non-Federal).

Also in identifying impacts, the vulnerability of resources is considered. The status of a resource, resource use, or related issue in this regard is evaluated against the following:

- *Resource significance*: a measure of formal concern for a resource through legal protection or by designation of special status.
- *Resource sensitivity*: the probable response of a particular resource to project-related activities.
- *Resource quality*: a measure of rarity, intrinsic worth, or distinctiveness, including the local value and importance of a resource.

- *Resource quantity*: a measure of resource abundance and the amount of the resource potentially affected.

Several resources are more conducive to quantification than others. For example, impacts on vegetation can be characterized partly using acreage, and air quality can be measured against air quality standards. Evaluations of some resources are inherently difficult to quantify with exactitude. In these cases, levels of impact are based on best available information and professional judgment.

For purposes of discussion and to enable use of a common scale for all resources, resource specialists considered the following impact levels in qualitative terms. The terms *major*, *moderate*, *minor*, *negligible*, or *none* that follow, consider the anticipated magnitude, or importance, of impacts, including those on the human environment.

- ***Major***: Impacts that potentially could cause irretrievable loss of a resource; significant depletion, change, or stress to resources; or stress within the social, cultural, and economic realm. Degradation of a resource defined by laws, regulations, and/or policy.
- ***Moderate***: Impacts that potentially could cause some change or stress (ranging between significant and insignificant) to an environmental resource or use; readily apparent effects.
- ***Minor***: Impacts that potentially could be detectable but slight.
- ***Negligible***: Impacts in the lower limit of detection that potentially could cause an insignificant change or stress to an environmental resource or use.
- ***None***: No discernible or measurable impacts.

Impacts are described for the major project components (Black Mesa mining complex, coal-slurry pipeline, and C aquifer water-supply system) under Alternative A. Under Alternatives B and C, the coal-slurry pipeline would not be reconstructed nor operate in the future, and the C aquifer water-supply system would not be built; thus, no adverse or beneficial impacts associated with these components would occur under Alternatives B and C.

Tables 4-1, 4-2, 4-3, and 4-4 are summaries of the areas affected by the three Black Mesa Project alternatives. Table 4-1 presents the acres associated with right-of-entry. Table 4-2 presents the acres associated with the OSM permit for the Black Mesa Complex and the acres that have been disturbed by mining through 2005, the acres proposed for mining from 2006 through 2026, and the acres that could be mined after 2026. Table 4-3 is a summary of the existing and proposed rights-of-way acreages associated with the coal-slurry pipeline. Table 4-4 is a summary of the proposed rights-of-way acreages associated with the C aquifer water-supply system.

Table 4-1 Black Mesa Complex Right-of-Entry Acreages

Right-of-Entry Documents	Acres
Joint Hopi/Navajo coal leases numbers 14-20-0603-9910 and 14-20-0450-5743	40,000
Navajo only coal lease number 14-20-0603-8580	24,858
Conveyor, railroad, power lines rights-of-way and easements	362
Coal-slurry preparation plant lease	40
Existing right-of-entry area total	65,260
Proposed new coal-haul road right-of-way¹	127
TOTAL Existing and Proposed Right-of-Entry Area	65,387²

NOTES:

¹ Area shown on Drawing 85360, SW Sheet in the LOM application.

² The total existing and proposed right-of-entry area is larger than the 63,057 acres proposed for the permit area under the LOM revision. The difference is the 2,330-acre area in the northeast corner of Navajo lease No. 14-20-0603-8580, which is not proposed to be within the permit area because it contains no mineable coal.

Table 4-2 Black Mesa Complex Permit and Disturbance Acreages

Area	Permit Area	Area Disturbed Through 2005	Proposed 2006-2026 Disturbance	Foreseeable Post-2026 Disturbance¹
Existing OSM permit area	44,073	14,940	8,062	6,518 ²
Additional area proposed in LOM revision ³	18,984	6,965	5,467 ²	5,960
OSM Permit Area Alternative A⁴	63,057	21,905	13,529	7,398
OSM Permit Area Alternative B⁵	63,057	21,905	8,062	12,865
OSM Permit Area Alternative C⁶	44,073	14,940	8,062	0⁷

NOTES:

¹ This is the area in which mining is reasonably foreseeable although not specifically proposed in the LOM revision, and which is evaluated in the cumulative impacts assessment. Under Alternatives A and B, mining all remaining reserves within the existing leases to supply Navajo Generating Station is reasonably foreseeable beyond 2026; however, under Alternative A, the continued operation of Mohave Generating Station is not reasonably foreseeable due to no foreseeable source of cooling water after 2026. Under Alternative B, the Black Mesa mining operation would not be approved (i.e., would not be resumed), but it is reasonably foreseeable that all coal reserves within the leases would be mined after 2026 to supply the Navajo Generating Station. Under Alternative C, the Black Mesa mining operation would not be approved (i.e., would not be resumed), and the Kayenta mining operation would cease after the currently permitted coal reserves are depleted (i.e., the Kayenta mining operation would not continue past 2026).

² The LOM revision proposes mining coal reserve areas within the existing OSM permit area that are not currently approved for mining (e.g., J-23 and J-28), and the acreages of those coal reserve areas are included in both the (1) Additional Area Proposed in LOM Revision Proposed 2006-2026 Disturbance and (2) Existing OSM Permit Area Foreseeable Post-2026 Disturbance.

³ Includes 127 acres for the proposed new coal-haul road right-of-way.

⁴ This would be the OSM permit area and disturbance acreages if the LOM revision is approved.

⁵ This would be the OSM permit area and disturbance acreages if the LOM revision is conditionally approved.

⁶ This would be the OSM permit area if the LOM revision is disapproved.

⁷ Although it is reasonably foreseeable under Alternative C (disapproval of the LOM revision) that Peabody would request future permit revisions to mine all remaining coal reserves within the lease area, the cumulative impacts of such foreseeable future permitting would be addressed under Alternative B; thus, Alternative C assumes that none of the currently unpermitted coal reserves within the leases would be mined after 2026 for the purpose of evaluating cumulative impacts under a disapproval of all future mining (other than that which is currently approved in the existing permit).

Table 4-3 Black Mesa Coal-Slurry Pipeline Existing and Proposed Rights-of-way Acreages

Affected Area	Existing Permanent Right-of-way ¹	New Permanent Right-of-way ¹	Total Permanent Right-of-way	New Temporary Right-of-way ²	Total Right-of-way
Existing route (273 miles)	1,655	0	1,655	496	2,151
Existing route with realignments Agencies' Preferred Route					
• Existing route (245 miles)	1,485 ³	0	1,485	445	1,930
• Moenkopi Wash realignments (1 mile)		6	6	2	8
• Kingman reroute (28 mile)		170	170	51	221
Pump stations⁴	160	0	160	0	160
TOTAL Coal-Slurry Pipeline: Existing	1,815	0	1,815	496	2,311
TOTAL Coal-Slurry Pipeline: Realigned	1,645	176	1,821	498	2,319

SOURCE: Black Mesa Pipeline, Inc. 2006

NOTES:

- ¹ Permanent right-of-way would be 50 feet wide for length of the pipeline.
- ² An additional 15-foot-wide temporary right-of-way (adjoining the permanent right-of-way for the length of the pipeline) would be required for construction, with a few exceptions along short stretches of rough terrain where up to 100 feet would be needed.
- ³ Existing right-of-way for sections of pipeline that would be abandoned due to realignment would be relinquished in accordance with right-of-way conditions for relinquishment.
- ⁴ The existing right-of-way for the pump stations would not change nor would additional temporary construction right-of-way be needed to accommodate pump-station upgrades that may be implemented (e.g., pump replacements).

Table 4-4 C Aquifer Water-Supply System Proposed Rights-of-way Acreages

Affected Area	Permanent Right-of-way	Additional Temporary Right-of-way	Total Right-of-way
Well Field: 6,000 af/yr			
12 wells ¹	1	11	12
Access roads, collector pipelines, power lines for 12 wells ²	60	36	96
Additional distribution power lines for 12 wells ²	0	47	47
Water-storage tank ³	1	2	3
Electrical substation ⁴	1	2	3
Well Field; 11,600 af/y			
21 wells ¹	1	19	20
Access roads, collector pipelines, power lines for 21 wells ²	80	48	128
Additional distribution power lines for 21 wells ²	0	67	67
Water-storage tank ³	1	2	3
Electrical substation ⁴	1	2	3
Water-Supply Pipeline: Eastern Route (Agencies' Preferred Route)			
Pipeline, power line, access road corridor (108 miles) ⁵	264	397	661

Affected Area	Permanent Right-of-way	Additional Temporary Right-of-way	Total Right-of-way
Pump stations (2) ⁶	1	4	5
69KV transmission line ⁷	370	0	370
Additional right-of-way for access roads ⁸	4	0	4
<i>Water-Supply Pipeline: Western Route</i>			
Pipeline, power line, access road corridor (137 miles) ⁵	337	505	842
Pump stations (4) ⁹	2	8	10
69KV transmission line ⁷	655	0	655
Additional right-of-way for access roads ¹⁰	38	0	38
TOTAL 6,000 af/yr Eastern Route	702	499	1,201
TOTAL 11,600 af/yr Eastern Route	722	539	1,261
TOTAL 6,000 af/yr Western Route	1,095	611	1,706
TOTAL 11,600 af/yr Western Route	1,115	651	1,766

SOURCE: Southern California Edison Company 2006

NOTES:

- ¹ Each well site would require temporary construction right-of-way of 200 feet by 200 feet (0.9 acre) and permanent right-of-way of 50 feet by 50 feet (0.06 acre).
- ² The collector pipelines and well-field distribution power lines would share the same right-of-way as the access roads where possible (40 feet wide for temporary construction right-of-way and 25 feet wide for permanent right-of-way). Some spans of distribution power lines would be outside of the access road right-of-way. The distribution power line would be owned by NTUA and have a 30-foot tribal right-of-way centered on the line; thus, only temporary right-of-way acreages are shown.
- ³ The water storage tank would require temporary right-of-way of 300 feet by 300 feet for construction (2.1 acres) and permanent right-of-way of 215 feet by 215 feet (1.1 acres).
- ⁴ The electrical substation would require temporary right-of-way of 295 feet by 295 feet for construction (2.0 acre) and permanent right-of-way of 200 feet by 200 feet (0.9 acre).
- ⁵ The temporary right-of-way for pipeline construction would be 30 feet wide and the permanent right-of-way would be 20 feet wide. The pipeline right-of-way would be contiguous with rights-of-way for existing roads to the extent possible and the pipeline's access roads and power lines would share the pipeline right-of-way.
- ⁶ Each pump station would require temporary right-of-way of about 295 feet by 295 feet for construction (2.0 acres). Tolani Lake pump station would require a permanent right-of-way of about 170 feet by 150 feet (0.6 acre), and Oraibi pump station would require a permanent right-of-way of about 165 feet by 190 feet (0.7 acre).
- ⁷ The 69kV transmission line serving the pump stations would have a 50-foot-wide right-of-way.
- ⁸ Additional 5 feet of pipeline right-of-way would be needed between WSP Mileposts 72 and 77 and for about 2 miles at Dinnebito Wash (where the pipeline is not next to a road) to accommodate the access road.
- ⁹ Each pump station would require temporary right-of-way of about 295 feet by 295 feet for construction (2.0 acres) and permanent right-of-way of about 170 feet by 150 feet (0.6 acre).
- ¹⁰ Additional 5 feet of pipeline right-of-way would be needed between WSP Mileposts 33 and 59, 71 and 91, 126 and 139, and 4 miles total at wash crossings (where the pipeline is not next to a road) to accommodate the access road.

Also considered, and described at the end of the chapter, are (1) the conservation measures, (2) summary of mitigation measures (including best management practices), (3) short-term uses versus long-term productivity, (4) irreversible and irretrievable commitment of resources, (5) indirect effects associated with resuming operation at Mohave Generating Station, and (6) cumulative effects.

4.1 LANDFORMS AND TOPOGRAPHY

4.1.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.1.1.1 Black Mesa Complex

The impact on landforms and topography resulting from mining activities in the permit area is extensive and permanent, and would continue under Alternative A through the proposed life of the mine. Removal of the coal would drastically alter topographic features such as slope gradient and surface drainage patterns. Surface mining of overburden and subsurface coal resources would continue to remove up to 250 feet of rock and drastically modify topographic and landform features, such as hills, slopes, and surface drainage patterns, while forming highwalls in the mining pits and temporary spoil stockpiles of crushed overburden rock. The narrow, deep washes would not be altered because coal on the steep sides of many washes has been burned in place as a result of natural processes.

Site restoration is an important part of the mining process. Restoration to the approximate original contour is required and includes backfilling pits and grading highwalls and spoil to approximate the original shape, topographic relief, and major drainage patterns. Reclamation operations are required to be contemporaneous with mining operations. Backfilling and grading of mined areas generally would begin when four spoil ridges have accumulated and would continue as mining progressed until the final pit is backfilled and the entire mined area is regraded. Restoration to the approximate original contour would re-establish the drainage pattern of the mined area to approximate original conditions and conform to drainage in the surrounding unmined areas, to minimize the impact on topography and landforms. Generally, regraded mined land will have the same general landform as the land had before mining but without any steep slopes (i.e., not steeper than 3 horizontal to 1 vertical [3h:1v]).

To promote slope stability where necessary, highwall slope steepness would be reduced to 3h:1v or less. Embankments for sediment-control dams and ponds, and for existing and future roads, would range from 1.5h:1v or less in cuts in unmined areas to 4h:1v or less in fill areas. These features would be stable with regard to landslides and slumping resulting from slope failures.

There would be long-term impacts on landforms and topography resulting from coal mining. The impact on landforms and topography is permanent but the disturbance is mitigated by site restoration. The restored area generally would have gently rolling hills with smoother contours and less topographic relief than the original topography, and no pronounced landforms (e.g., no cliffs, steep buttes, or narrow canyons). The flatter topography would make the reclaimed area more suitable for multiple land uses.

Disturbance from construction of the coal-washing facility would occur within approximately 2 acres superficially and is not expected to affect landforms and topography.

Construction of the coal-haul road would result in disturbance within approximately 127 acres along a 2-mile-long corridor. Embankments for the road would range from 1.5h:1v in cuts in unmined areas to 4h:1v for fill areas. These features would be stable with regard to landslides and slumping. By using approved construction methods to maintain the slope stability, there would be no significant impacts on landforms and topography.

4.1.1.2 Coal-Slurry Pipeline

Alternative A would result in no impact on landforms and topography where reconstruction of the coal-slurry pipeline would follow the existing coal-slurry pipeline route. Along the coal-slurry pipeline Moenkopi Wash realignment and Kingman reroute, construction would be restricted to a 65-foot-wide right-of-way, and the trench would be backfilled and regraded to conform to the original topography. During construction, alterations to the topography or cutting into landforms would be avoided to the extent practicable. Thus, there would be negligible to no impact on landforms and topography along the Moenkopi Wash realignments and Kingman reroute.

In the unlikely event of a pipeline failure, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of coal slurry would stop. The volume of slurry released would depend on the location of the leak on the pipeline (top of the pipe versus bottom of the pipe), and the terrain where the leak occurs (a flat location versus on a slope). Using historical data on slurry pipeline releases, BMPI estimates that the amount of slurry released may range from an average of 100 cubic yards (or less) to a maximum of about 565 cubic yards. The maximum coal slurry release would cover approximately 0.7 acre with 6 inches of nontoxic coal fines, while the fresh water in which the coal is entrained would soak into the ground (see Appendix A-2). Minor localized erosion of the land would result if the release occurred on a slope.

4.1.1.3 C Aquifer Water-Supply System

Construction of the well field would not require alteration of the topography. Construction of the water-supply pipeline and associated access roads, where needed, whether the eastern or western alternative is selected, would be restricted to a 65-foot-wide right-of-way, and the trench would be backfilled and regraded to conform to the original topography. Alterations to the topography or cutting into the landforms would be avoided to the extent practicable. There would be negligible to no impact on landforms and topography along the preferred pipeline alternative route. There would be impact on landforms and topography along the alternative pipeline route right-of-way because there is more topographic relief that would require more cut and fill where the pipeline route would cross the Adeii Eechii Cliffs, Ward Terrace, and Coal Mine Canyon. Construction of the two pump stations would result in surface disturbance, but no impact on landforms or topography is anticipated.

It is unlikely that the water-supply pipeline would fail. The pipeline would be steel pipe, concrete-mortar lined, and tape wrapped, or epoxy or polyurethane coated, for corrosion protection. In the unlikely event of a pipeline failure, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of water would stop. In the event of a failure, some flooding would occur in topographic lows and drainage channels. If failure were to occur on a steep slope, there would be minor impact by localized erosion and the possibility of damage of a cliff face or slope.

4.1.2 Alternative B – Approval of the LOM Revision Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

4.1.2.1 Black Mesa Complex

Under Alternative B, the overall impact on landforms and topography would be the same as those under Alternative A, except that the area disturbed would be much less; that is, 8,062 acres disturbed by mining between 2006 and 2026 rather than the 13,529 acres under Alternative A. Also, 127 acres would be disturbed by construction of the coal-haul road. The Black Mesa mining operation would cease. Reclamation of the mined portion of the Black Mesa mining operation area would conform to the reclamation methods described above and result in a postmining land surface with approximately the original shape, topographic relief, and drainage patterns as the premining topography. By using approved

construction methods the reconstructed slopes and drainage patterns would have no significant impact on landforms and topography.

4.1.3 Alternative C – Disapproval of the LOM Revision (No Action)

4.1.3.1 Black Mesa Complex

Under Alternative C, the overall impact on landforms and topography would be the same as those under Alternative B, except no additional acreage would become a part of the permitted area. The coal-haul road would not be constructed.

4.2 GEOLOGY AND MINERAL RESOURCES

4.2.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.2.1.1 Black Mesa Complex

4.2.1.1.1 *Surface Mining*

Geology Resources. Under Alternative A, mining would remove about 250 feet of overburden (noncoal-bearing rocks above the coal seams) and interburden (noncoal-bearing rocks between the coal seams) on approximately 13,529 acres in the Black Mesa Complex. The existing geology in the upper 250 feet of the mined areas, consisting of sedimentary rock lithology and a gently sloping structure, would be disturbed permanently.

Under Alternative A, the surface and shallow subsurface geology would be modified substantively by mining activities. The open pits would be backfilled with unconsolidated, crushed rock from the strata overlying the coal seams that have been mined. This material would have grain sizes ranging from fine-grained sand and clayey shales to boulders. It would be graded to approximate the original topographic contours. The unconsolidated backfill material would not be placed on steep slopes where geologic hazards such as landslides can develop. The unconsolidated fill would impact the lateral continuity of water-bearing sedimentary rocks to depths of 250 feet and severely reduce or eliminate groundwater flow in the saturated zones of the Wepo Formation. Groundwater modeling assumed that the Wepo aquifers and unconsolidated fill alluvial aquifers were continuous and groundwater flow would be directed to the face of the pit.

Mineral Resources – Coal. By law and regulation, coal-mining activities must be conducted in a manner that maximizes recovery of the coal resources and protects coal resources remaining after mining (Appendix A-1). Mining activity at the Black Mesa Complex removes coal seams in the Wepo Formation. The USGS estimates that 4.8 billion tons of coal are present in the Wepo Formation in the Black Mesa area. An average thickness of 20 feet of coal would be extracted from multiple coal seams in the Wepo Formation. Peabody estimates that approximately 11.6 percent of the coal reserves would be lost during mining activities due to normal overburden stripping. The impact of this permanent loss of coal resources is considered normal given current mining technology and stratigraphic nature of the coal being mined. Coal resources in the Wepo Formation would be produced. There would be no impact on coal resources in the Toreva Formation and Dakota Sandstone because they are below 250 feet and cannot be mined by surface mining methods.

Uranium and Vanadium. Uranium and vanadium deposits, found in the Salt Wash Member of the Jurassic Morrison Formation, the Triassic Chinle Formation, and the Toreva Formation, would not be impacted by the proposed coal mining because they underlie the Wepo Formation. These deposits would remain available for future development. However, exploitation of these resources is not likely in the reasonably

foreseeable future because the Navajo Nation Tribal Council passed legislation to prohibit uranium mining activities on the Navajo Reservation.

Oil and Gas. Oil and gas resources are produced primarily from Paleozoic sedimentary formations in the Paradox Basin northeast of Black Mesa. Although inadequately tested, correlative formations may contain economic deposits of oil and gas in deep sedimentary rocks underlying the Black Mesa Complex. Exploration for those resources would be restricted during the life of the mine; however, there are no oil and gas or coalbed methane exploration activities anticipated for the area. Oil and gas resources would not be impacted by the proposed coal mining because, if present, they would occur in formations below the mineable coal seams. These resources are not likely to be exploited in the reasonable foreseeable future, and would remain available for future exploration on Black Mesa.

Paleontological Resources. There are abundant plant and animal fossils in the Cretaceous-age coal-bearing strata that outcrop on Black Mesa. Paleontological resources in those strata have been studied and are well documented. Outcrops of trace fossils, such as footprints, also have been recorded. No unique fossil collection areas have been identified in the proposed mining area; therefore, impact on unique and important fossil specimens in the proposed mining area is not anticipated.

4.2.1.1.2 Coal-Washing Facility

Construction of the coal-washing facility would disturb approximately 2 acres and is not expected to affect geologic or mineral resources because, other than coal, none are known to exist in the area.

4.2.1.1.3 Coal-Haul Road

Construction of the coal-haul road is not expected to affect geologic or mineral resources because, other than coal, none are known to exist in the area.

4.2.1.2 Coal-Slurry Pipeline

No known geological or paleontological resources are expected to be impacted by reconstruction of the pipeline. Because of the narrow pipeline temporary or permanent rights-of-way, none of these resources would be excluded from use or made permanently inaccessible during the life of the pipeline.

Although moderate-to-high potential for the presence of oil and gas resources exists along several portions of the coal-slurry pipeline alignment, exploitation of these resources is not likely in the reasonably foreseeable future because the lack of information on oil and gas resources in this area results in a significant risk for exploration. Exploration and development would not be inhibited by the presence of the pipeline, which is in a narrow corridor.

There is high potential for coal resources in the Black Mesa Basin along the coal-slurry pipeline alignment. Based on Peabody's proposed LOM revision, exploitation of these coal resources is not likely in the reasonably foreseeable future. High potential for uranium and vanadium mineral resources exists in the Cameron District. However, exploitation of these resources is not likely in the reasonably foreseeable future because the Navajo Nation Tribal Council voted on legislation to prohibit uranium mining activities on the Navajo Reservation.

The coal-slurry pipeline could be affected by swelling clays that are commonly encountered in volcanic ash deposits of the Chinle Formation. These swelling clays could cause soil shifting and cracking that could damage the pipeline. However, this potential for pipeline damage would be minimized or eliminated through appropriate design, engineering, and construction of the pipeline.

4.2.1.3 C Aquifer Water-Supply System

As discussed in Chapter 3, there are no known geological resources or economic mineral resources in the area of the proposed well field; therefore, it is anticipated that implementation of Alternative A would result in no impact on known mineral and geological resources within the C-aquifer well field or along either the eastern or western alternative routes of the water-supply pipeline because those resources would remain accessible from outside the narrow pipeline corridor. Thus, none of these resources would be excluded from use or made permanently inaccessible.

In the unlikely event of a pipeline failure some flooding would result in topographic lows and drainage channels. If failure were to occur on a steep slope, there could be minor impact by localized erosion.

There is high potential for the presence of oil and gas resources beneath the C aquifer well field and in some areas along either alternative route of the water-supply pipeline. However, exploitation of these resources is not likely in the reasonably foreseeable future because the lack of information on oil and gas resources in this area results in a significant risk for exploration. Exploration and development would not be inhibited by the presence of the pipeline due to the narrow width of the corridor.

There is high potential for coal in the Black Mesa Basin along either alternative route of the water-supply pipeline. However, based on Peabody's proposed LOM revision, exploitation of these resources is not likely in the reasonably foreseeable future and would not be inhibited by the presence of the pipeline. There is no known interest in exploitation of the coal resources along the pipeline.

The water-supply pipeline could be impacted by swelling clays that are commonly encountered in volcanic ash deposits of the Chinle Formation. These clays could cause soil shifting and cracking that could damage the pipeline. However, this potential for pipeline damage would be minimized or eliminated through appropriate design, engineering, and construction of the pipeline.

There are no known geological or unique paleontological resources within the areas to be disturbed; therefore, no impact on these resources is expected by construction or operation of the pipeline.

4.2.2 Alternative B – Approval of the LOM Revision Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

4.2.2.1 Black Mesa Complex

Under Alternative B, the overall impacts on geologic and mineral resources would be similar to those described under Alternative A, but coal resources at the Black Mesa mining operation area (approximately 72 million tons) would remain unmined (but available for potential future mining, if pursued).

4.2.3 Alternative C – Disapproval of the LOM Revision (No Action)

4.2.3.1 Black Mesa Complex

Under Alternative C, the overall impact on geologic and mineral resources would be the similar to those under Alternative B, but coal resources at the Black Mesa mining operation area would remain unmined (but available for potential future mining, if pursued) and the coal-haul road would not be constructed.

4.3 SOILS

4.3.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.3.1.1 Black Mesa Complex

4.3.1.1.1 *Surface Mining*

Surface mining activities drastically disturb soil resources. The topsoil and suitable subsoil would be removed and stockpiled for reclamation following backfilling and regrading of the mined areas.

Approximately 13,529 acres would be disturbed by surface mining activities. The permit to conduct surface coal mining operations includes requirements to conduct surface reclamation and soil restoration operations on the disturbed land as part of the mine closure. OSM guidelines for reclamation programs and projects identify soil and slope conditions that must be considered during reclamation including soil pH and acid-forming spoils, sodic zones, toxic substance occurrence in soil, percent and length of slope, and slope stability. Slope reclamation operations generally include regrading, smoothing, and slope contouring to approximate the original topographic contours. Peabody prepared an approved Surface Stability and Drainage System Development Plan to re-establish a more stable and controlled drainage pattern. Restoration of the drainage pattern would be followed by restoration of soil, topsoil, and vegetation.

Soil Loss. Soil restoration is important because it reclaims the ground surface, promotes revegetation that stabilizes slopes in the area, retains water on slopes, mitigates runoff and erosion, and restores the productivity and capability of the reclaimed lands. Erosion and soil loss from regraded and revegetated slopes were predicted using both the Revised Universal Soil Loss Equation (RUSLE) and SEDIMOT II. In accordance with SMCRA, Peabody prepared an approved Minesoil Reconstruction Plan to minimize erosion by using the best technology currently available (BTCA). The BTCA practices used to reduce soil loss would vary depending on topography, soil chemical and physical properties, and revegetation success. BTCA practices include reclaiming slopes with material having low erosion potential; then terracing, ripping, and contour furrowing; followed by mulching and/or cover cropping.

Following mining operations, the potential for erosion of redistributed soil would be minimized by regrading slopes to approximate original contours. Mechanical manipulation of the surface topography to stabilize the surface and control erosion would be accomplished by terracing, ripping, contour furrowing, and other methods. By implementing the approved Surface Stability and Drainage System Development Plan and BTCA practices, the impact of soil loss by erosion on newly reclaimed and terraced slopes would range from 1 to 3 tons per acre per year (tons/acre/yr) depending on the slope length and gradient, compared to 5 to 125 tons/acre/yr on slopes where no terraces or BTCA practices other than contour seeding are implemented (LOM Plan 2002). The soil loss on restored land would be approximately 3 to 9 tons/acre/yr after 10 years, which is less than the 7 to 22 tons/acre/yr that can be expected on undisturbed slopes.

Soil Suitability. The LOM revision identifies that 13,529 acres would be disturbed. By salvaging topsoil and suitable spoil from disturbed areas prior to mining, Peabody estimates that is salvageable soil within the upper that approximately 1.9 feet of this acreage that is available for reclamation purposes (LOM Plan 2003). The Minesoil Reconstruction Plan proposes to salvage the topsoil (as defined in 30 CFR Part 701.5i) together with suitable subsoil and underlying unconsolidated material to provide a topsoil mixture suitable for reclamation. Salvaged material is either redistributed immediately or stockpiled for use as topsoil on future regraded areas. Topsoil stockpiles are protected from wind and water erosion by seeding the stockpiles and placing berms around the perimeter of the stockpile.

As summarized in Section 3.3, during the past 15 years Peabody has collected and evaluated soil resources data to examine the suitability of soil and overburden to be used in reclamation. Graded spoil is sampled and inventoried to determine how much topsoil and/or supplemental plant growth material is needed to create a 4-foot-deep nontoxic, nonacid-forming root zone. Spoil suitability for use in the root zone is based on several soil parameters including: sodic zones that have elevated SARs, salinity, pH, and acid-forming potential (LOM Plan 2004).

Implementation of the Minesoil Reconstruction Plan would identify and characterize the location and depth of spoils unsuitable for restoration. Those areas containing unsuitable graded spoil would be covered with suitable topsoil or spoils material to a thickness based upon the depth at which unsuitable materials were encountered. Graded suitable overburden material would be covered with up to 12 inches of soil. Implementation of the Minesoil Reconstruction Plan would result in the creation of a 4-foot nontoxic, nonacid-forming root zone capable of restoring or exceeding the predisturbance productivity of the disturbed areas.

Soil Productivity. Long-term soil erosional stability would be maintained by an effective and permanent vegetative cover. The original soil profile would be lost permanently. Although the reclaimed (postmining) land cannot be restored to premining productive use immediately due to the long timeframe required for plant succession in the arid climate, productivity would be maximized by reclamation procedures that create a suitable 4-foot-deep plant root zone over the entire reclaimed area and establish an effective, diverse, and permanent vegetative cover. The LOM plan reports that historical overgrazing on Black Mesa has degraded the productivity of the soil. Soil reconstruction and revegetation would be undertaken to restore the land to productive use and, in the long term, soil productivity should exceed premining capability (LOM Plan 2000).

Construction of the coal-washing facility would result in disturbance of soils within an approximately 2-acre area. The facility would be isolated by stormwater control structures and procedures from discharging any sediment load to adjacent receiving waters. Any incidental erosion would be corrected as part of routine maintenance. Soil reconstruction and revegetation would occur following mine closure would allow for resumption of the premining grazing use. In the long term, soil productivity would exceed premining capability (LOM Plan 2000).

Construction and operation of the coal-haul road would result in disturbance of soils within an approximately 127-acre area. The proposed road would cross Red Peak Wash and adjacent tributaries. It would be constructed to comply with OSM and tribal standards for surface-mine-site transportation facilities, including proper drainage for the road itself and crossings over existing streams, diversions, and drainage structures. Any incidental erosion caused by the road would be corrected as part of routine maintenance. Dust suppression, using tanked and sprayed nonpotable water, would be a normal maintenance procedure. Soil restoration and revegetation would occur following mine closure that would restore the road corridor to productive use and, in the long term, soil productivity should exceed premining use (LOM Plan 2000).

4.3.1.2 Coal-Slurry Pipeline

A 65-foot-wide swath of soils was disturbed during construction of the pipeline in the 1960s. Under Alternative A, soil within the 65-foot-wide temporary construction right-of-way (approximately 2,319 acres) for the coal-slurry pipeline would be disturbed during reconstruction. The topsoil and subsoil would be segregated during excavation and stockpiled. Disturbed land would be reclaimed following construction of the pipeline in accordance with approved procedures (Section 4.19 and Appendix A-2). Soil reconstruction and revegetation would be implemented to restore the pipeline right-of-way to

productive use. Unsuitable material that would affect soil productivity would be backfilled beneath a 4-foot-deep root zone of suitable material. Therefore, the impact of disturbing the soils would be mitigated.

In the unlikely event of a pipeline failure, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of coal slurry would stop (Appendix A-2). The volume of coal slurry released to the surface would depend on the location of the leak on the pipeline (top of the pipe versus bottom of the pipe), and the terrain where the leak occurs (a flat location versus on a slope). Using historical data on Black Mesa coal-slurry pipeline releases, BMPI estimates that the amount of slurry released may range from an average of 100 cubic yards (or less) to a maximum of about 565 cubic yards. The maximum coal slurry would cover approximately 0.7 acre with 6 inches of nontoxic fines, while the fresh water in which the coal is entrained would soak into the ground. Typically, the slurry would leak to the surface and flow in a narrow meandering path, the direction and length of which would depend on the terrain. The release generally would be confined to a local area and minor localized soil erosion would result if the release occurred on a slope. If the volume of the release was sufficient to warrant mechanical removal of the coal, the potential damage to the soil or ground surface caused by the removal of the deposit may outweigh the benefit of removing the coal. This would have to be determined by the appropriate agency and/or landowner and BMPI on a site-specific basis.

4.3.1.3 C Aquifer Water-Supply System

Construction of the well field facilities (i.e., wells, access roads, collector pipelines, power lines, substation, water-storage tank) would disturb soils of up to approximately 160 acres for the 6,000 af/yr alternative (for 12 wells) and up to approximately 220 acres for the 11,600 af/yr alternative (for 21 wells). Construction of the water-supply pipeline and associated facilities (i.e., pipeline, power line, access roads, pump stations) would disturb up to approximately 1,040 acres for the eastern pipeline alternative and up to approximately 1,545 acres for the western pipeline alternative. Construction areas would be cleared of vegetation, the topsoil would be removed and segregated for use in reclamation, and, for the pipelines, the subsoil would be excavated for the trench. Following placement of the pipeline in the trench, the trench would be backfilled with the subsoil (a minimum of about 36 inches of cover). The site and corridor contours would be restored to conform to adjacent areas. The topsoil would be replaced and the disturbed area would be reseeded. The primary short-term impact on soils, the potential for accelerated soil erosion, would be minimized using best management practices and mitigation (described in Section 4.19 and Appendix A-3).

The above-ground facilities would occupy their locations long term while the pipeline rights-of-way can be returned for appropriate land uses.

Along the water-supply pipeline routes, susceptibility for soil-induced corrosion of concrete is low. Corrosion is not anticipated since the steel pipe is concrete-mortar lined and tape wrapped, or epoxy or polyurethane coated, for corrosion protection. In the unlikely event of a pipeline failure, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of water would stop. Some flooding would occur in topographic lows and drainage channels. If failure were to occur on a steep slope, there would be minor impact by localized erosion and the possibility of damage of a cliff face or slope. Damage would be repaired by maintenance and/or response crew.

4.3.2 Alternative B – Approval of the LOM Revision Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

4.3.2.1 Black Mesa Complex

Under Alternative B, the overall impacts on soil resources would be similar to those described under Alternative A, except that the Black Mesa mining operation would not resume and, consequently, fewer acres would be disturbed by mining (i.e., 8,062 acres between 2006 and 2026 instead of 13,529 acres under Alternative A). Construction of the coal-haul road would disturb 127 acres. The mined areas of the Black Mesa mining operation would be reclaimed. Although the reclaimed (postmining) land cannot be restored to premining productive use immediately due to the long time period required for plant succession in the arid climate, long-term productivity would be maximized by reclamation procedures that create a suitable 4-foot-deep plant root zone over the entire reclaimed area and establish an effective, diverse, and permanent vegetative cover. Peabody would undertake soil reconstruction and revegetation to restore the land to productive use and, in the long term, it is anticipated that soil productivity would exceed premining capability (LOM Plan 2000).

4.3.3 Alternative C – Disapproval of the LOM Revision (No Action)

4.3.3.1 Black Mesa Complex

Under Alternative C, the overall impacts on soil resources would be similar to those described under Alternative B. Approximately 8,062 acres would be disturbed by mining between 2006 and 2026 instead of 13,529 acres under Alternative A; however, the coal-haul road would not be constructed. Construction of the coal-haul road would disturb 127 acres. Approximately 5,467 acres that were projected to be mined on the Black Mesa mining operation area under Alternative A would not be impacted under this alternative. Reclamation would begin on approximately 2,500 disturbed acres on the Black Mesa mining operation area. Although the reclaimed (postmining) land cannot be restored to premining productive use immediately due to the long timeframe required for plant succession in the arid climate, productivity would be maximized by reclamation procedures that create a suitable 4-foot-deep plant root zone over the entire reclaimed area and establish an effective, diverse, and permanent vegetative cover. The soil reconstruction and revegetation activities would restore the land to productive use, and soil productivity would exceed premining use.

4.4 WATER RESOURCES (HYDROLOGY)

Impacts on surface-water and groundwater quantity and quality can occur as a result of coal mining and the construction of pipelines and other surface facilities. These activities have the potential to impact the flow and quality of surface water and the shallow groundwater system. Impacts are measured by changes in water flows and water quality and are generally limited to an area within a few miles of the mining operations or construction site.

Impacts on surface water and groundwater due to pumping of the C and/or N aquifers for mining-related and coal-slurry pipeline water supplies are the result of changes in the water levels in the aquifers. These changes can occur over relatively large areas, especially in the confined portions of the aquifer systems.

Data and measurements used to assign degrees of impact are discussed in Appendix H. Potential impacts on surface water and groundwater for each alternative are described below.

Federal Water Resources Permits Applicable to All Alternatives. The proposed project actions and the alternative actions are subject to Federal permitting requirements for protecting the Nation's surface water resources. The regulatory authorities and responsibilities of the appropriate Federal, tribal, and State

agencies are discussed in this section. Applications for appropriate permits would be made during the project design phase when site-specific details are available. Coordination with the USACE and other regulatory agencies would continue through project design in order to assure that the assumptions made in this document would be met.

Section 404 of the Clean Water Act (33 USC 1344) prohibits the discharge of dredged or fill materials into “waters of the United States” without a permit from the USACE. The USACE may issue Individual Permits or Nationwide Permits, depending on the type and magnitude of project impacts. Because the Black Mesa Project is being evaluated in this EIS, the USACE has advised that project activities would be covered under Nationwide Permits 12 (utility line activities), 21 (surface coal mining activities) and, possibly, 14 (linear transportation projects) (USACE 2004a, 2004b, and 2005). This determination assumes that no wetlands would be affected by the project, all crossings of jurisdictional waters would be perpendicular and involve only temporary impacts, and that a preconstruction notice is provided to the USACE. These permits would cover activities associated with construction of the water-supply system and coal-slurry pipeline, and any necessary access roads, as well as modifications at the Kayenta and Black Mesa mining operations. Nationwide Permits carry specific conditions that must be met in order to assure water-quality standards (USACE 2002), and these conditions would be included in project design specifications.

Section 401 of the CWA (33 USC 1341) requires that discharge of dredged or fill materials does not cause or contribute to a violation of State Water Quality Standards (AAC R18-11-1). Authority for water-quality certification under Section 401 in Arizona is delegated to the USEPA for waters of the U.S. occurring on tribal lands and to the ADEQ for other locations. Work conducted under Nationwide Permits 12, 14, and 21 requires water-quality certification by the appropriate agencies.

Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) prohibits obstruction or alteration of navigable waters of the United States without permission of the USACE. For this project, a Section 10 permit, if needed, would apply to the coal-slurry pipeline crossing of the Colorado River. The USACE would evaluate the need for a Section 10 permit based on project design and construction requirements. Preliminary discussions conducted as part of the EIS studies indicate that the pipeline should be installed using horizontal boring under the Colorado River, with at least 50 feet between the bed of the river and the boring entry point, and that contingency plans must be in place (USACE 2004a and 2005).

4.4.1 Alternative A (Agencies’ Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.4.1.1 Black Mesa Complex

4.4.1.1.1 Surface Water

Kayenta and Black Mesa mining operations must comply with SMCRA and CWA regulations, which require that surface-water runoff from constructed surfaces be controlled to “prevent, to the extent possible using the best technology currently available, additional contributions of suspended solids to streamflow, or runoff outside the permit area.” The CWA requires that discharges to streams meet all applicable water-quality standards. OSM-approved procedures for controlling sediment transport include berms, terraces, sediment ponds, and other energy dissipative channel structures that allow water to pond and sediment to accumulate. To support the Kayenta and Black Mesa mining operations, Peabody’s LOM application proposes 158 impoundments to exist in 2005 and an additional 104 future ponds as part of the LOM revision. Of these 262 impoundments, Peabody proposes to retain 51 as permanent impoundments in the post-mining reclaimed landscape, which would be transferred with other mine facilities to the tribes

when Peabody relinquishes the leases (refer to Map 3-7). In addition, there would be numerous water-control berms.

Surface-water management activities related to mining operations can cause three potential impairments to water use on and off of the leasehold:

- Degradation of surface-water quality by adding suspended sediment, dissolved pollutants, or otherwise poor-quality water to existing stream flows.
- Changes in channel geometry, morphology, or location due to changes in flow hydraulics or hydrology.
- General diminution of flow due to increased channel- or pond-bottom area contact and resultant infiltration, or through evaporation from the surface of ponds or channels.

These potential impacts are discussed below.

Degradation of Surface-Water Quality. Surface-water quality must be protected by handling earth materials and runoff in a manner that minimizes the formation of acidic or toxic drainage, prevents additional contribution of suspended solids to stream flow outside the permit area to the extent possible using the best technology currently available, and otherwise prevents water pollution (30 CFR 816.41(d)(1)). To comply with this requirement, sedimentation structures are built near the disturbed area to impound surface-water runoff and sediment. Peabody is authorized to discharge the retained surface water while maintaining compliance with NPDES permit AZ0022179. Discharge of the impounded surface water may be necessary to maintain the appropriate designed storage capacity after the storm event, or surface-water discharge may result when the surface-water runoff exceeds the design storm-flow event.

Some sedimentation control structures are designed not to discharge, and are proposed to be retained for livestock watering as part of the approved post-mining landscape. The 2004 and 2005 Annual Hydrology Reports (Peabody 2004, 2005c) contain comparisons of water quality collected at ponds during each reporting period with recommended livestock drinking-water standards. Although both reports show that some water-quality samples from the ponds have constituents that are higher than one or more recommended standards, most can be explained by contributions from groundwater sources or high suspended solids from recent runoff that will lessen over relatively short periods of time due to settling. A few are anomalous compared with the historical water-quality record for each pond and with respect to the entire water-quality data set collected from all ponds. As of the end of 2005, there have been 488 water-quality samples collected since 1986 from 84 proposed permanent impoundments and temporary sediment ponds. During this period, a few of the impoundments proposed in the LOM plan revision application have shown water quality in excess of recommended water-quality parameters. Permanent impoundments must meet specific performance standards as outlined in 30 CFR 816.49(b), including having water quality suitable for the intended post-mining land use (livestock grazing). Peabody will be required to submit information to OSM to demonstrate that each of the permanent impoundments meets the performance standards. If any of the impoundments do not meet the performance standards, OSM will not approve them to be retained in the post-mining landscape.

As discussed in Section 3.3, seeps have developed downstream from some sedimentation ponds. Since the onset of mining, some 220 sediment ponds have been constructed, and seeps have been observed below 33 sediment ponds since the onset of sediment pond construction in 1972. Seeps occur intermittently at the sediment ponds depending on the amount and duration of water impounded in each pond. As of 2005,

70 sediment ponds had been reclaimed, and of those 70 reclaimed structures, seeps had been observed historically below three.

An assessment of the hydrologic implications of seeps was presented to USEPA in the 1999 Seepage Monitoring and Management Report. This was the first of seven annual reports submitted to USEPA in accordance with the Seepage Management Plan, and the report presented detailed hydrologic impact assessments including comparisons of 1999 seep monitoring results with historical data, statistical trend analyses, and mixing calculations. The assessments indicated that no significant impacts had occurred on the prevailing hydrologic balance, although some seeps monitored in 1999 exceeded some of the livestock water-quality standards. Peabody concluded the seeps had little potential to impact the prevailing hydrologic balance for three principal reasons. First, the pH of the water controls the solubility and transport of most trace elements. Other than at the immediate area of the seeps, the pH of surrounding ground and surface water is alkaline. Most metals that become soluble in low-pH seep water are rapidly lost to a solid phase (precipitation) over a short distance down gradient. Second, some of the constituents of concern are already as high or higher in the natural groundwater and surface water systems. Last, seep flow rates and associated total chemical loads are relatively small in comparison to the flow rates and chemical loads typically measured in alluvial groundwater and surface water runoff below the seeps.

During 2005, seeps were observed at 20 of the sediment ponds that were inspected, 17 of which also have NPDES-permitted outfalls. Of those 17 sediment ponds, five exhibited seep water quality that had at least one exceedence of a livestock standard. Five of the six sampled seeps (two seeps below one pond were sampled) exceeded the livestock standard for pH. The livestock standard for selenium was exceeded at one seep, standard for aluminum was exceeded at one seep and the livestock standard for TDS may have been exceeded at one seep (refer to Table 3-3). At the remaining 12 sediment ponds, which also have NPDES-permitted outfalls, seeps met livestock water-quality standards. Flow rates of the seeps monitored in 2005 were well within the historical range of seep flows (less than 0.0003 gpm up to 15.6 gpm). Likewise, the number of ponds exhibiting poor seep water quality during 2005 and the values of those constituents that exceeded water-quality standards were well within the historical ranges.

Under the current Seepage Management Plan, Peabody dewater sediment ponds at the earliest practicable opportunity to prevent seeps, and constructs fences around the areas below dams to prevent livestock from accessing those seeps that have not met livestock water quality standards. In addition, Peabody has planted willows and cattails in the area below one particular dam to reduce downstream flow from several seeps. These activities have proved to be effective to some degree. However, fencing provides only a limited measure of protection for livestock access, and does not completely protect the beneficial use of seep water for livestock and wildlife. Peabody recently applied to USEPA to renew its NPDES permit, and USEPA is currently reviewing the renewal application. As part of the renewal process, USEPA and Peabody plan to jointly develop and evaluate new and modified seep management measures to improve the effectiveness of the Seepage Management Plan and to ensure compliance with the CWA. The improved management measures would be applied at all NPDES sediment ponds with poor seep water quality, including proposed permanent impoundments. If approved by USEPA, Peabody would remove temporary sediment ponds with seeps exhibiting poor water quality when reclamation of their upstream watersheds is completed, which is expected to eliminate the seeps associated with those temporary ponds. The renewed NPDES permit is expected to require continued implementation of the modified Seepage Management Plan, including pond inspections and reporting of the monitoring results.

Peabody also would use design and construction methods for new sediment ponds to minimize seeps by identifying geo-chemically inert materials for constructing the embankments, compacting the embankments to meet engineering design standards, and siting embankments at locations with low permeable geologic units to the extent practicable. Future ponds to be built during the life of mining that

would serve as NPDES outfalls would be subject to the requirements of the modified Seepage Management Plan in the renewed NPDES permit. Future ponds where seeps develop would be evaluated in accordance with the Seepage Management Plan. Therefore, the impacts of the existing seeps associated with existing sediment ponds and future seeps that may occur below new sediment structures are considered to be minor.

Changes in Channel Morphology. Design and operation of the sedimentation ponds would result in a sediment load below equilibrium with the natural hydraulic regime of many washes and channels on the Black Mesa Complex. Erosion of the sides and substrate of the wash would be expected for a short distance downstream of any discharge point, as the stream regained geomorphic equilibrium. Pond-discharge structures are designed in anticipation of this behavior, and allow the water (using grade-control structures, gabion aprons, and bank stabilizers) to attain equilibrium in a gradual and nondestructive fashion. In all cases, erosional scouring of sediment would reach equilibrium before the washes exit the Black Mesa Complex. In addition, failures to meet performance standards are monitored and corrected by Peabody staff as they are observed, confirmed by regular OSM and tribal inspection, and monitored by BIA to ensure compliance with lease terms and conditions.

Diversions of natural stream flow also are designed to preserve geomorphic stability and prevent uncontrolled or destructive erosion and sedimentation. All diversions on the Black Mesa Complex are developed using quantitative hydraulic modeling programs (e.g., SEDIMOT II) that simulate the geometry required to maintain geomorphic equilibrium in a natural channel. Where this is not possible, short, specific structures (such as grade-control structures) are designed and constructed in the channel to correct the problem. Similar to the pond discharges, these channels and structures are regularly inspected and maintained by Peabody staff and reviewed by OSM and tribal inspectors.

Peabody would ensure any impacts of the mine drainage system on the natural stream patterns in the affected environment would be confined to the Black Mesa Complex. Because these variations would be far less than the natural variability of these washes and would include a small proportion of the affected washes within the permit area, the impact of the mine on the geometry, morphology, or location of the natural stream patterns is expected to be negligible outside the permit area.

Diminution of Flow. Sediment ponds are designed to detain water long enough to allow settling of suspended sediment to settle before the water is released into the local drainage, and surface-water impoundments retain water permanently. Further, contour furrows and terraces on reclaimed slopes are placed in the path of runoff to decrease the amount of or slow down water that would have entered the surface-drainage system. Use of sediment ponds results in some amount of surface water being lost, either through infiltration into the ground or evaporation from the surface of the ponded water. This lost potential surface flow represents a diminution of surface-water quantity at the permit boundary, relative to the reaches of the local drainage system that are not under a sediment-management system. Loss of runoff also occurs where many originally existing streams in the permit area are diverted from their channels in order to allow surface-mine excavations and reclamation to proceed. The effect of this volumetric loss on downstream water quantities (principally Coal Mine, Moenkopi, and Dinnebito Washes) was examined as part of the Chapter 18, Probable Hydrologic Consequences of the permit application package (Peabody 1986, amended 2005).

The examination concluded that the volume of water retained or detained by the drainage control structures is a very small proportion of the total runoff in the affected watersheds. At the point of maximum temporary impoundment construction, approximately 0.7 percent of the Dinnebito drainage area and 2.8 percent of the Moenkopi drainage area would be impounded. After mining, about 0.5 percent of the Dinnebito Wash and 2.2 percent of the Moenkopi Wash watershed areas would be impounded

permanently. The permanent impoundments are estimated to result in a diminution of flow at the lower end of Dinnebito and Moenkopi washes of about 1 and 5 percent, respectively, of the average annual runoff (Peabody 1986, amended 2005). Assuming a similar ratio of impoundment area to flow loss, the maximum diminution of flow at the lower end of the basins is estimated to be 1.4 percent for Dennebito wash and 6.4 percent for Moenkopi Wash, volumes that would be difficult to detect using available streamflow measurement technology.

The analysis described above assumes no transmission loss of flow between the Black Mesa Complex and the downstream USGS streamflow gage near Moenkopi. In fact, measurements indicate that loss through infiltration is very high in Moenkopi Wash, with rates of about 1 inch per hour (Peabody 1986, amended 2005). Using a 644 acre-foot volume (equal to the total impounded volume for 1998 to 1999), the analysis indicated that the flow could travel about 45 miles downstream before it was completely absorbed by the bed material. This is short of the 70 miles to the first downgradient use location at the town of Moenkopi, where most irrigation operations are located. This estimate is supported by measurements from a storm event on July 27, 1998 where 206.7 acre-feet of water were gaged at the permit boundary of Moenkopi Wash, and 14 acre-feet were measured at the USGS gage near the Town of Moenkopi from July 27 to 29, 1998.

Given these observations, it appears that the small amount of surface-water flow lost by the mining operations would be small compared to the amount naturally lost through infiltration in the wash. The change of stream flow would be difficult to measure, leading to the conclusion that there would be negligible to no surface-water quantity impacts from surface-water diversion, impoundments, and sediment ponds on the mining operations areas.

4.4.1.1.2 Groundwater

4.4.1.1.2.1 Impacts on the Wepo and Alluvial Aquifers

On the Black Mesa Complex, groundwater occurs in the more permeable beds within the Wepo Formation and within the alluvium associated with the stream channels. Mining can have potential impacts on these aquifers as follows:

- Dewatering of the coal seam and shallow aquifers by exposure of the pit walls;
- Diversion of shallow groundwater movement by structures such as dams and pit walls;
- Impairment of the water quality through infiltration of poor-quality surface water; and
- Impairment of water quality by leaching spoils and migration to adjacent groundwater aquifers.

As of 2005, there were 25 Wepo and 32 active alluvial aquifer monitor sites being monitored for water level and water quality (Peabody 2005c).

Mining of coal seams and interbedded porous rock frequently results in the exposure of saturated zones and discharge of groundwater to the pit face or sides (Peabody 1986, amended 2004). Several of the Wepo Formation coal seams are saturated. Peabody has monitored the quality and quantity of Wepo aquifer water since the initiation of mining. Peabody modeled the potential impact of mine dewatering on the alluvial and Wepo aquifer wells. Water-level drawdowns of up to 65 feet by 2013 were predicted. However, actual water-level drawdowns in 2004 were typically an order of magnitude less than predicted, suggesting that the modeling is conservative, even given the additional 9 years in the modeling period. In 2004, measured drawdown had exceeded historic fluctuations by more than 5 feet in 5 of the alluvial wells and 2 of the Wepo wells (Peabody 1986, amended 2004).

Some local wells or springs would be mined out. However, under these circumstances, Peabody would be required to provide alternative water supplies in as close a proximity to the original supply as practicable. Upon completion of backfilling, regrading, and revegetation, the replaced spoil would resaturate and a new, different hydrogeologic regime would be established on the reclaimed land. Some springs would return to availability and some would not, in an individually unpredictable fashion. Based on estimates of the hydrogeologic behavior of similarly reclaimed land, porosities and hydraulic conductivity should increase. However, this does not mean that water levels would return to original levels. It is likely that there would be some minimal impact on local groundwater levels in the coal seam and shallow and alluvial aquifers on the reclaimed and adjacent lands during mining. After reclamation is complete, the hydrologic regime would reach a new equilibrium.

The Wepo and alluvial aquifers do not provide water of suitable quality for domestic use. The quality for stockwatering is marginal. Where shallow groundwater wells have been impacted by mining, Peabody has provided alternative supplies. Two windmill wells have been removed by mining and one additional windmill well will be removed in the future. Peabody has committed to replacing all three wells. Peabody has installed two water stands that provide free potable (N aquifer) water to the public on a 24-hour, 7-day basis. Overall the impact on the use of the shallow groundwater system due to mine dewatering is considered negligible.

Surface-water flow events supply recharge to alluvial aquifers associated with the stream channels. Reducing flows in washes might be expected to decrease the amount of recharge; however, the impoundment of water and subsequent seepage of pond water into the banks and substrate of the ponds locally enhance recharge. Although it is difficult to quantify, only a small proportion of the premining runoff would actually evaporate or be consumed by mine activities. Therefore, it is expected that reduction in recharge, if any, would be of immeasurable scale and there would be negligible impact on the quantity of recharge to the alluvial aquifers from mining activity.

Chemical reaction of groundwater with spoil material (i.e., broken and crushed rock) has the potential for creating groundwater of a lower quality than would happen in an unmined subsurface environment. This is because the reactions common in these settings are enhanced by the greater surface area and oxygen flux afforded by the broken rock and enhanced porosity of the spoil. Dissolution of salts on the surfaces of shales and clays could raise the specific conductivity of the spoil groundwater. Several studies suggest a 50 to 130 percent increase in dissolved solids in similar western spoil aquifers (Peabody 1986, amended 2005).

Acid reactions in the spoil water also are likely. However, there are sufficient carbonate materials and alkaline salts available in the overburden materials to neutralize most acid production from the oxidation of sulfides. All but one of the overburden core samples taken on the leasehold had excess neutralization potential. These cores also indicate that there are not high concentrations of metals in the overburden. As acid water comes in contact with the alkaline overburden the pH drops and metals that are present tend to precipitate. This is supported by the analysis of ground water in the Wepo and Alluvial aquifer monitoring wells; metals in these wells generally do not exceed livestock watering standards (Peabody 1989, revised 2003).

Although there are specific procedures in the mine plan to reduce acid-forming materials, and the presence of carbonate material in the Wepo over- and inter-burden is sufficient to achieve neutrality, some local pockets of acidic water could be formed. This could result in the release of sulfate and sulfide-associated trace elements as these reactions proceed toward equilibrium. These chemical reactions could result in some minor-to-moderate water-quality impacts on local wells, increasing the levels of salinity

and trace elements to a level that decreases their usability. Peabody would be required to provide alternative water supplies to any wells rendered unusable due to violation of water-quality standards.

Similarly, the spoil water also could discharge to the surface water as springs or seeps. Some degradation of surface-water quality could result, particularly in the vicinity of the spring itself. However, the impact on the surface-water flows would be minor in volume compared to stormwater runoff. As noted above, discharges from springs with low pH water are neutralized by the alkaline soils. Since streams are intermittent and generally flow only after precipitation events, any poor-quality spring water discharges tend to be diluted by the much larger stream flows. Stream flow events tend to carry high sediment loads and are generally not suitable for use by livestock, resulting in little potential exposure of livestock to poor quality spoil water.

Finally, the opposite condition, degradation of groundwater by infiltration of surface water, also is a possible impact from surface-mining activities. Controlled surface water would be allowed to infiltrate to the shallow subsurface in impoundments, sediment ponds, or diversions. Increases in some soluble ions (Ca, Mg, Na, SO₄ and HCO₃) and TDS would occur. The potential for formation of acid and trace metal migration is minimal due to the high carbonate content of the soil materials. The magnitude of the impact to the groundwater quality should be limited to the immediate pit areas due to low transmissivity and groundwater gradients in the shallow aquifers (Peabody 1986, revised 2003).

Runoff from shops or other facilities using petroleum products and hazardous materials is controlled under Peabody's SPCC plan. This plan specifies measures for handling and controlling these materials as well as clean-up procedures in the event of a spill.

The coal-washing facility would use water from the C or N aquifer, depending on the final selection between these options. In either case, the volumes of water used would be consistent with the production of high-quality coal required by the Mojave Generating Station. The facility would use various water-saving and recycling technologies. Initially, the plant would require approximately 330 acre-feet of water. A moisture balance on the entering coal, exiting clean coal, and waste would result in an annual deficit of 324 acre-feet, to be supplied by either aquifer. In the LOM revision, an estimate of 500 af/yr (from the C aquifer or the N aquifer) has been evaluated. The coal-washing facility would be constructed near the existing coal-processing facilities. Runoff from the facility would be contained in the existing NPDES-permitted sediment ponds. The coal-washing facility is designed to recycle water, with essentially no process water discharge. A small, nondischarging surge pond would be constructed adjacent to the plant to contain water that may be drained periodically from plant tanks during repairs. The SPCC plan would be modified to address this pond. Coal waste initially would be disposed in the N-06 pit for approximately 3 years, and then new waste would be disposed in the J-23 pit for the remaining 14 years. A study commissioned by Peabody to evaluate the short- and long-term effects of this plan on the hydrologic balance of the affected environment concluded that the coal-wash refuse is no more likely to interact with groundwater or produce poor quality leachate than regraded spoil material, and that any adverse effects would be temporary and immeasurable (Western Water & Land, Inc. 2003). The study concluded that there would be a negligible impact from the coal-wash refuse disposal, as proposed.

The study relied on surrogate core samples and leachate tests to provide chemical data to assess impacts, because actual wash plant refuse material from the coal-washing facility would not be available until operations resume at the Black Mesa mining operation in 2010. A degree of uncertainty was introduced to the study results because the core samples were not expected to have the same physical characteristics as the refuse material and were not subjected to a washing process.

As a result, Peabody would develop and submit for regulatory approval a refuse sampling and disposal plan that would be incorporated into the mining permit. The plan would be implemented when the coal-washing facility begins operating. The plan would consist of periodic sampling of refuse based upon the source (pit and seam) of run-of-mine coal being processed to ensure a representative cross-section of the refuse material is sampled. Samples would be analyzed for the same chemical constituents (including trace elements) employing the same analytical techniques used to analyze the core samples as described in the study. The analytical data results would be compared to the chemical data assessed in the study. If the analytical results from coal wash refuse samples exceed concentrations from the initial core samples, new model simulations would be conducted using the new data and the same models used to predict impacts in the study. If the coal-washing refuse sample data and model results do not deviate from the study data and model results, the refuse would be disposed in the pits (N-06 and J-23) using standard practices currently outlined in the permit application. If the data and model results deviate significantly from the study and indicate the potential for greater impacts, Peabody would implement special refuse-disposal procedures such as placing the refuse in pit areas over preconstructed liners consisting of compacted clay spoil and capping the refuse with compacted clay spoils, or mixing the refuse with greater volumes of specially-handled spoil having chemical characteristics suitable for diluting or neutralizing the refuse. Locations where special disposal procedures are implemented would be surveyed and recorded. Following final grading and re-seeding, a down gradient spoil-monitoring well would be installed, and monitoring of water levels and chemistry would be conducted at frequencies and for parameters as described in the plan and approved by OSM to confirm the special disposal procedures are effective.

The coal-haul road, shown on Figure 2-1, would be constructed and maintained in full compliance with Peabody's OSM and tribal standards for surface-mine-site transportation facilities, including proper drainage for the road itself and for crossings over existing streams, diversions, and drainage structures. Dust suppression, using tanked and sprayed nonpotable water, would be a normal maintenance procedure.

Impacts on groundwater quantity and quality from construction and maintenance of the road would be similar to those from existing roads, and are expected to be negligible. The impact on surface-water quantity would be to increase, slightly, the amount of runoff over that from undisturbed land. Stormwater runoff from the coal-haul road would be treated by implementing best management practices (BMPs) as described in Peabody's Storm Water Pollution Prevention Plan (SWPPP). The SWPPP is required by Peabody's coverage under the Multi-Sector General NPDES Permit for Storm Water, and the existing SWPPP would be modified to include the new coal-haul road. Implementing BMPs along the new coal-haul road as part of the SWPPP would result in negligible impacts on downstream surface water.

4.4.1.2 Coal-Slurry Pipeline

Short-term disturbances to surface-water drainages and, in rare instances, the shallow groundwater system would result along the coal-slurry pipeline right-of-way during construction. The primary impact would be a short-term increase in sedimentation resulting from excavation of the trench and vehicular construction traffic. Impacts would be confined largely to the pipeline right-of-way and would be negligible.

In the unlikely event of a pipeline failure, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of coal slurry would stop (Appendix A-2). The volume of coal slurry released to the surface would depend on the location of the leak on the pipeline (top of the pipe versus bottom of the pipe), and the terrain where the leak occurs (a flat location versus on a slope). Using historical data on Black Mesa coal-slurry pipeline releases, BMPI estimates that the amount of slurry released may range from an average of 100 cubic yards (or less) to a maximum of about 565 cubic yards. The maximum coal slurry would cover approximately 0.7 acre with 6 inches of

nontoxic fines, while the fresh water in which the coal is entrained would soak into the ground. Typically, the slurry would leak to the surface and flow in a narrow meandering path, the direction and length of which would depend on the terrain. The release generally would be confined to a local area and the impact would be short term and, in the majority of instances, negligible on surface-water resources. If the volume of the release was sufficient to warrant mechanical removal of the coal, the potential damage to soil or drainage caused by the removal of the deposit may outweigh the benefit of removing the coal. This would have to be determined by the appropriate agency and/or landowner and BMPI on a site-specific basis.

One of the potential risks associated with horizontal boring under a watercourse, such as the Colorado River, is the escape of drilling mud into the environment as a result of release, tunnel collapse, or rupture (from excessive drilling pressure) of mud to the surface. If the rupture occurs in the watercourse, the fine clay particles would disperse and settle on the bottom of the watercourse. Ruptures may be difficult to detect underwater, but the potential for a rupture would be minimized through proper geotechnical practices, adequate drill planning and execution, careful monitoring, and use of appropriate equipment and response plans in the unlikely event that a rupture were to occur. During operation, it is unlikely that the pipeline would fail and release slurry into the watercourse. Based on historical performance of the existing pipeline (Appendix A-2), no failures and consequent leaks occurred in or near the river during the 35 years of operation. Considering this and the proposed reinforced conceptual design of the pipeline, failures are not anticipated. In the unlikely event of a release, the extent of the impact is uncertain as such a determination would depend on the amount of slurry released and the conditions of the watercourse (e.g., flow rate). Generally, the nontoxic fines released would be suspended in the water, carried an uncertain distance by the current, and disperse over the bottom of the watercourse. This impact on water would be a short-term and negligible.

There would be no impacts on the deep groundwater aquifers during construction or operation.

4.4.1.3 Project Water Supply

Water demands for the mining operations, coal-slurry pipeline, and coal-washing facility would be supplied by groundwater from either a combination of the C and N aquifers or the N aquifer. As described in Chapter 3, these aquifers are regional in extent, underlying much of the northwestern corner of Arizona. The N aquifer underlies Black Mesa and is the current source of water to the Black Mesa Complex and many of the communities on the Hopi and Navajo Reservations. While the C aquifer exists under Black Mesa, it is deep (greater than 5,000 feet under the Black Mesa Complex) and of poor quality. In areas where the C aquifer is at or near the ground surface, including in the area of the proposed C aquifer well field, the water quality is suitable for most uses.

The N and C aquifers are separated by approximately 1,000 feet of low permeability semi-consolidated silts and clays of the Chinle and Moenkopi Formations. There is essentially no hydraulic connection between the N and C aquifers. Impacts due to pumping of these aquifers to supply the Black Mesa Complex are, therefore, discussed separately.

The impact of groundwater pumping is commonly assessed by a measured or projected lowering of the water level in the pumping wells and in wells located within the cone of depression created by the pumping well(s). The lowering of the water level has the potential to result in five primary effects as follows:

- Increase in the cost of pumping due to increased lift to get the water to the land surface.
- Reduction in saturated thickness and consequently a decrease in the transmissivity (ability of the aquifer to transmit water to the well) in unconfined aquifers. In severe cases, a well can cease to produce water or “go dry.”
- Diminution of stream base flow and spring flow (groundwater discharge to the surface-water system) due to a lowering of aquifer water levels in the area of perennial streams and springs.
- Migration of man-caused or natural poor-quality groundwater toward the well field.
- Potential for subsidence in unconsolidated aquifer systems due to compression of fine-grained layers. Also, the removal of cavity filling material and dissolution of limestone in some limestone aquifers can foster sinkhole development. These effects are not a concern in this study; however, due to the fact that the primary water-bearing units of the N and C aquifers are not comprised of unconsolidated material or limestone (refer to Appendix H for more discussion).

In large, complicated aquifers and stream systems with multiple pumping centers, it is necessary to use numerical models to assess the relationship between groundwater pumping and streamflow diminution. Three separate models have been developed over the past several years that have assessed the potential stream diminution from C-aquifer pumping in the area of Clear and Chevelon Creeks. These models are briefly described below:

- ***Western Navajo and Hopi Water Supply Needs, Alternative and Impacts Study.*** In 2003, under Reclamation’s Western Navajo and Hopi Water Supply Needs, Alternative and Impacts Study, HDR developed a three-dimensional (3-D) numerical flow model of the Clear and Chevelon Creek area. The numerical model (MODFLOW) covered only a portion of the C aquifer and did not include all pumping centers. The area outside the numerical model was simulated with an analytical model (HDR 2003).
- ***USGS Superposition Model.*** The USGS developed a numerical model of the entire C aquifer for the Reclamation. Given the Black Mesa EIS schedule constraints, the USGS developed a simplified model of the C aquifer that addressed only pumpage from the proposed well field and its impact on Clear and Chevelon Creek streamflow. This “superposition model” is a two-dimensional (2-D) MODFLOW numerical model designed to be conservative in that the efficiency of the connection between the groundwater and surface water in the creeks was assumed to be high. In addition, the model does not include any natural recharge or regional groundwater flow. It assumes all water pumped from the proposed well field comes from aquifer storage or Clear and Chevelon Creeks. This model was not calibrated to historic flow in Clear and Chevelon Creeks (Leake et al. 2005).
- ***S.S. Papadopoulos and Associates (SSPA) Model.*** SSPA developed a three-dimensional (3-D) MODFLOW model of the entire C aquifer that includes considerations of recharge, regional flow, and all known pumping centers. The model was calibrated to measure flow in lower Clear and lower Chevelon Creeks and water level changes in wells (SSPA 2005).

The three C-aquifer groundwater models were developed independently. However, the USGS and SSPA models predict essentially the same streamflow depletion in lower Clear and Chevelon Creeks. These models predict greater depletion than the HDR model, due in part to the lower project pumpage assumed in the HDR model. However, all three models predict small streamflow depletion values resulting from project pumping over the planning period (refer to Appendix H for more details).

The N aquifer has been modeled by the USGS and two consultants retained by Peabody. These models are described below:

- **USGS Black Mesa Model.** The USGS developed a finite-difference model of the N aquifer in 1983 that was upgraded in 1988 and 2000. The model was designed to evaluate the impacts of current and future groundwater withdrawals for the Peabody coal mine, as well as municipal withdrawals from surrounding Indian communities. The model is 2-D and comprised of one layer that represents the N aquifer. A general head boundary was used to simulate vertical flow between the D aquifer and N aquifer (Brown and Eychaner 1988; Eychaner 1983).
- **HSI GeoTrans and Waterstone D and N Aquifer Model.** HSI GeoTrans and Waterstone (GeoTrans) developed a finite-difference model of the D and N aquifers using the MODFLOW numerical code. This is a regional 3-D groundwater flow model developed to estimate the effects of pumping by Peabody and several Indian communities on the aquifers and on surface-water flows. The GeoTrans model covers a slightly larger area than the USGS model. Additional hydrogeologic field data were collected and compiled as a part of the studies to develop the model. The model has undergone extensive sensitivity testing and validation. Evaluation of the model indicates that it successfully simulates historic water level response to pumping in the N aquifer. It also produces N-aquifer drawdowns that are essentially the same as the USGS model (Peabody 1999, GeoTrans 2005, 2006). This model has been accepted by OSM for use in evaluating impacts due to mine-related pumpage.

In this Draft EIS, the USGS superposition, SSPA and GeoTrans numerical models are used to assess the impacts of pumping from the C and N aquifers, respectively, as these models are the most representative of the complexities of these aquifer systems (refer to Appendix H).

4.4.1.4 C Aquifer Water-Supply System

As described in Chapter 2, there are two possible C-aquifer pumping subalternatives. These are summarized in Table 4-5.

Table 4-5 Pumping Rate Subalternatives

Subalternative Pumping Rate (af/yr)	Comment
6,000	Project only (including coal-slurry and coal-washing)
11,600	Project (6,000) plus 5,600 for tribal domestic, municipal, industrial, and commercial use (2010-2060)

Impacts of these pumping subalternatives on surface-water and groundwater resources in the study area are described below.

4.4.1.4.1 Well Field

Increased Cost of Pumping. Since the siting of individual wells in the C-aquifer well field has not yet been determined, location of the nearest existing stock well is unknown. However, drawdown in any nearby well would not be more than the drawdown in the center of the well field. Static water level in the well field area is approximately 240 feet bgs. The estimated annual energy cost of pumping for a stock watering well from this depth is \$130 (refer to Appendix H). Under the maximum well-field pumping (up to 11,600 af/yr), drawdown of the water level in the center of the C-aquifer well field is projected to be 58 feet (SSPA 2005). Thus, the maximum pumping lift would be 298 feet (240 feet + 58 feet) after

50 years of well-field operation. This would result in an annual pumping cost of \$150, an increase of 15 percent, or a negligible impact. The impact on pumping cost for 6,000 af/yr would result in less than half the pumping cost increase, or about 7 percent, also a negligible impact (refer to Appendix H).

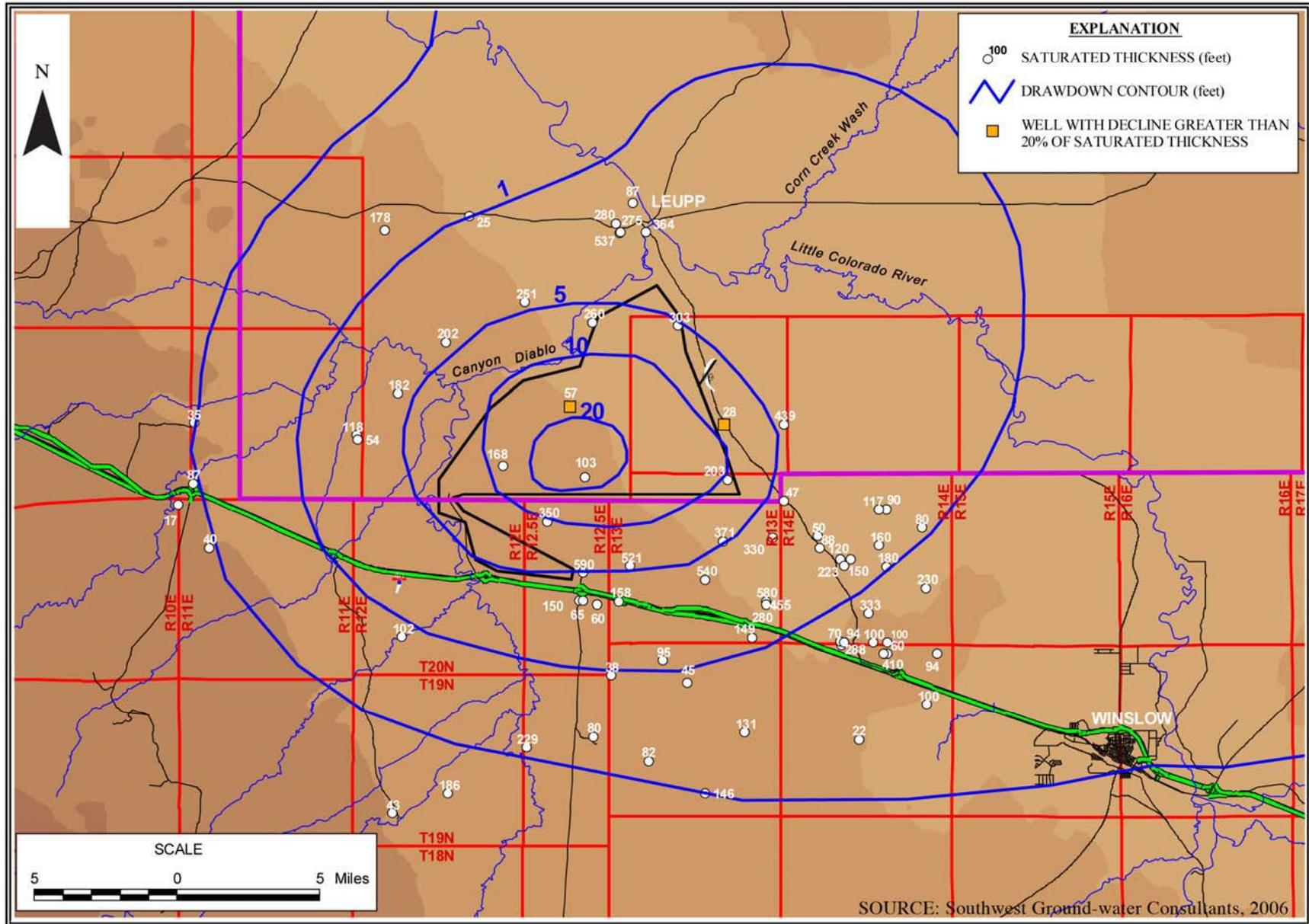
As noted in Appendix H, many C aquifer stock-watering wells have windmills and not electric pumps. For these wells, costs do not increase when the water level declines, as long as the decline does not require the pump to be set deeper. The pump setting depth in wells in the area is generally unknown. Assessing the impact of project pumping on these wells relies on available data concerning the height of the water column in the well (depth of the well minus the static water level) and is evaluated in the same manner as the potential reduction in aquifer saturated thickness, as described in the subsequent subsection

Reduction in Aquifer Saturated Thickness. The C aquifer in the area of the well field is unconfined; average saturated thickness of the C aquifer in the well field area is 716 feet (Reclamation 2005). As noted above, under maximum well-field pumping (up to 11,600 af/yr), maximum drawdown of the water level in the center of the C aquifer well field is projected to be 58 feet in 2060 (SSPA 2005), or 8 percent of the aquifer thickness after 50 years of pumping. This level of drawdown would have a negligible impact on the aquifer (refer to Appendix H). The impact on the pumping cost for 6,000 af/yr, which would pump less than one-half the groundwater, would be an increase of less than 4 percent.

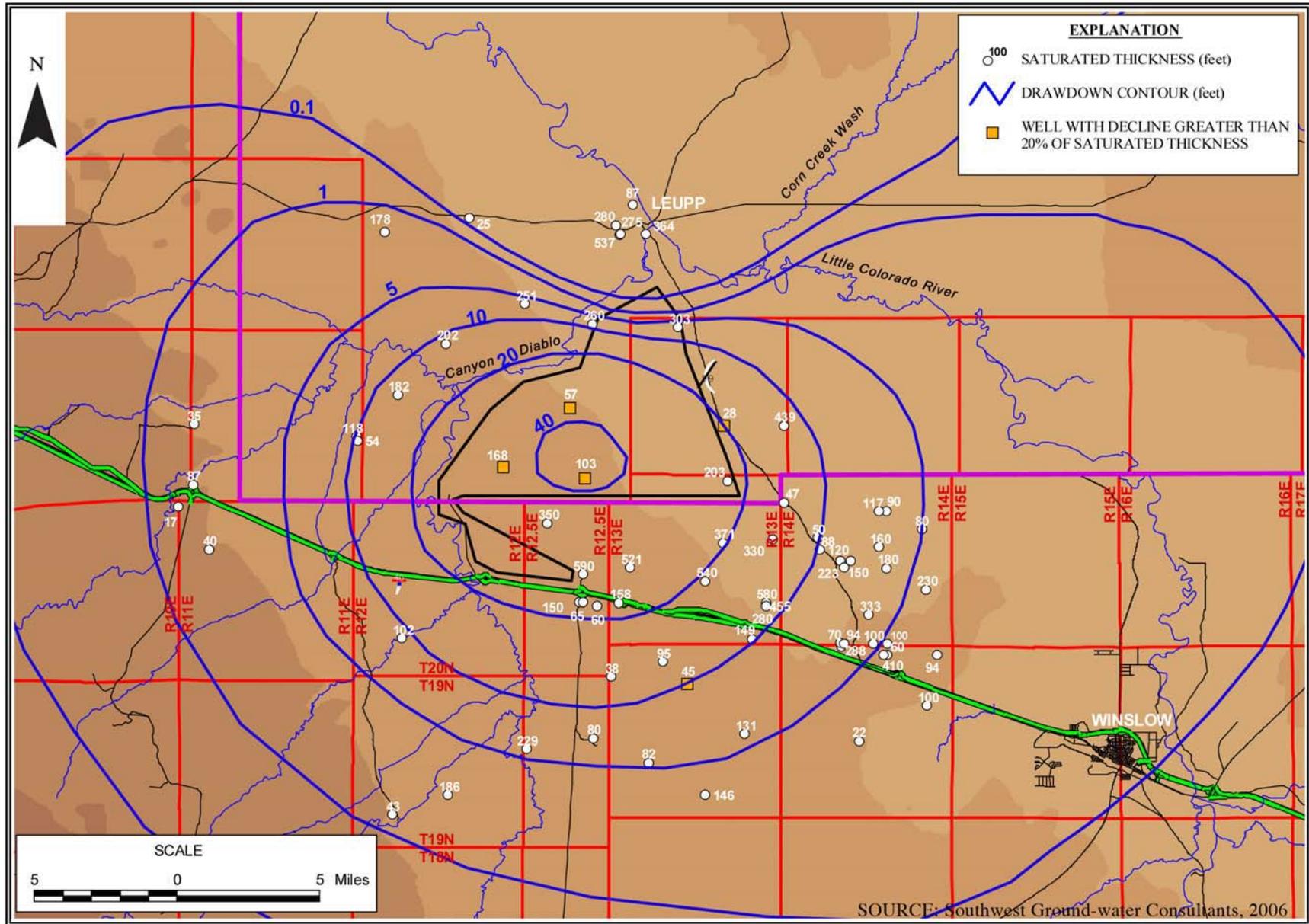
While the overall reduction in aquifer saturated thickness is small, some local wells would be impacted. Maps 4-1 and 4-2 show the anticipated 2060 drawdown due to pumping for the 6,000 and 11,600 af/yr subalternatives, respectively. The saturated thickness in wells with known depths and water levels also is shown. The number shown is the height of the water table above the bottom of the well, in feet. Under the 6,000 af/yr subalternative, two wells would experience a reduction of saturated thickness of between 29 and 32 percent, resulting in a minor to moderate impact (refer to Appendix H). At the 11,600 af/yr withdrawal rate, five wells would have a reduction in saturated thickness of between 21 and 70 percent, with corresponding impacts of minor to major. While the impact on individual wells is significant, the number of wells affected is relatively small, two and five out of a total of 71 known wells for each subalternative. There may be some additional wells that have not been identified or for which saturated thickness data are not available. Depending on the specific design of the C-aquifer well field and distribution facilities, some affected well owners could receive replacement water from the proposed well field. Other impacted owners could require that wells be deepened or new wells drilled. Specific actions would be taken to address impacts on existing water users in coordination with the tribes.

Under the 11,600 af/yr subalternative, local water levels in the Leupp area are projected to rise, since some of existing current demand would be supplied from the C aquifer well field with concurrent reductions in local well use. This water-level rise creates the difference in the pattern of drawdown south of Leupp between the 6,000 af/yr (Map 4-1) and 11,600 af/yr (Map 4-2) scenarios.

Diminution of Stream and Spring Flow. Stream base flow diminution in lower Clear Creek and lower Chevelon Creek was estimated using the USGS and SSPA groundwater models (Leake et al. 2005; SSPA 2005). At the end of the planning period (2060), the maximum diminution would occur at the confluence of the creeks with the Little Colorado River (Table 4-6).



**Map 4-1 Drawdown vs. Saturated Thickness, C Aquifer
6,000 af/yr Subalternative**



**Map 4-2 Drawdown vs. Saturated Thickness, C Aquifer
11,600 af/yr (Applicant's Preferred Alternative)**

Table 4-6 Projected Base Flow Diminution in Upper East Clear Creek, Lower Clear Creek, and Lower Chevelon Creek

Subalternative	Upper East Clear Creek (cfs) ¹	Lower Clear Creek (cfs) ²	Lower Chevelon Creek (cfs) ²
6,000 af/yr	less than 0.001	0.05	0.03
11,600 af/yr	less than 0.001	0.06	0.04

SOURCES: ¹Leake et al. 2005; ²S.S. Papadopoulos and Associates 2005

Model-predicted diminution of stream baseflow in upper East Clear Creek is essentially zero. Maximum predicted base flow reduction in lower Clear Creek is 0.06 cfs for the 11,600 af/yr subalternative or 1.1 percent of the average base flow and 0.05 cfs or 1.0 percent for the 6,000 af/yr subalternative, a negligible impact in both cases. For lower Chevelon Creek, the diminutions for the 11,600 and 6,000 af/yr subalternative are respectively 1.5 and 1.1 percent of the 2005 base flow (2.7 cfs), also a negligible impact for both scenarios (refer to Appendix H).

As discussed in Chapter 3, while base flow constitutes essentially all of the streamflow in some days during the summer months, the base flow is a relatively small percentage of the average annual stream flow of 83 cfs in lower Clear Creek and 54 cfs in lower Chevelon Creek. Maximum diminution of average annual flow by maximum project groundwater pumping (11,600 af/yr) is 0.1 percent, resulting in a negligible impact on human uses.

Blue Springs is the major discharge point for the C aquifer, releasing more than 164,000 af/yr into the Little Colorado River, upstream from its confluence with the Colorado River. Water from the springs is not potable (salinity is 3,000 ppm), but is of cultural significance to the Hopi and Navajo people and supports critical habitat for the Little Colorado River humpback chub. Blue Springs is approximately 77 miles north-northwest of the C aquifer well field (refer to Map 3-4).

Diminution of Stream and Spring Flow. Stream baseflow diminution in lower Clear Creek and lower Chevelon Creek was estimated using the USGS and SSPA groundwater models (Leake et al. 2005; SSPA 2005). At the end of the planning period (2060), the maximum diminution at the confluence of the creeks with the Little Colorado River would occur, which is shown in Table 4-7.

Table 4-7 Projected Streamflow Diminution in Upper East Clear Creek, Lower Clear Creek, and Lower Chevelon Creek in 2060

Subalternative	Upper East Clear Creek (cfs)	Lower Clear Creek (cfs)	Lower Chevelon Creek (cfs)
6,000 af/yr	less than 0.001	0.07	0.03
11,600 af/yr	less than 0.001	0.10	0.08

Model-predicted changes in flow at Blue Springs due to project pumping are essentially zero (SSPA 2005). The only other known C aquifer springs within the project area are those that support base flow in Clear and Chevelon Creeks. Effects on these springs are identified in the discussion of impact on streamflow and Table 4-6 above.

Migration of Poor Quality Groundwater. As noted in Chapter 3, groundwater quality in the C-aquifer well field is suitable for most drinking water and industrial uses. However, the quality of the groundwater declines to the northeast, with TDS levels reaching 2,000 mg/L approximately 10 miles from the center of the proposed well field. The potential for this water to migrate into the well field was evaluated using

particle-tracking methods. The capture area of the well-field pumping at the maximum rate (11,600 af/yr) does not reach the 2,000 mg/L isopleth, although it does reach the 1,500 mg/L isopleth. Based on the modeling, it was concluded that water quality would remain suitable for drinking water purposes over the modeled period (SSPA 2005). Under the 6,000 af/yr subalternative, pumping is confined to a 16-year period (mid 2009 through 2025). It is highly unlikely that any change in water quality would occur over this period. Some change in water quality over the longer planning period (until 2060) and higher pumping rate of up to 11,600 af/yr cannot be ruled out, but is unlikely to make the water unsuitable for domestic use as any poor quality water migrating from the northeast would be blended with good quality water moving from the southwest into the well field. Any increase in salinity, if it occurs, would take place gradually over a period of years and would not likely be noticeable (such as a change in taste) by domestic users.

4.4.1.4.2 C Aquifer Water-Supply Pipeline

Because the pipeline would be constructed near land surface, construction and operation would not affect existing groundwater in the regional D, N, or C aquifers, which generally have water levels below the level of excavation for the pipeline trench. The pipeline would cross numerous washes where, locally, groundwater could be near the surface. On the Black Mesa Complex, the pipeline would cross the Wepo and shallow alluvial aquifers. In areas with shallow groundwater, some temporary discharge of groundwater to the excavation may occur during construction. The impact on other users, if any, is expected to be limited in both time and distance from the excavation.

Based on the conceptual design, engineering, and construction of the pipeline (Appendix A-3), it is unlikely that the water-supply pipeline would fail. However, if a failure were to occur, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of water would stop. In the event of a failure, some flooding would occur in topographic lows and drainage channels and some erosion and sediment transport may occur at the point of the failure. The area affected would be limited. Releases resulting from pipeline failure would not be expected to have an adverse impact on local water quality.

Overall, construction and operation of the C Aquifer water supply pipeline is expected to have a negligible impact on the existing surface and groundwater resources.

4.4.1.5 D and N Aquifer Water-Supply System

Two potential options for mining-related and coal-slurry pipeline water supply have been identified. As indicated in Section 2.2.1.2.2, there are two potential subalternatives for using the existing N-aquifer water supply. Under the agencies' preferred alternative, the N aquifer water-supply system would not be relied on for mining or industrial use, while the proposed new C aquifer water-supply system would provide the majority of the water needed for the mining operations. The N-aquifer wells would need to be pumped periodically to keep them in operating condition until being returned to the Navajo Nation, and also would be used as a temporary back-up supply in case the primary C-aquifer water supply fails for any reason. Under a second subalternative, the N aquifer water-supply system would continue to be used as the sole water supply.

As discussed in Appendix H, the analysis of impacts due to pumping from the D and N aquifers relies on the 3-D groundwater flow model developed for Peabody by GeoTrans. The effects of N-aquifer pumping associated with each option is discussed in the following subsections.

4.4.1.5.1 Alternative A, Supplemental Use of N-Aquifer Water (Agencies' Preferred Alternative)

Under the preferred alternative, recent past average annual use (2000 through 2004) of the N aquifer (4,400 af/yr) would be reduced to an average rate of about 480 af/yr over the life of the mining operations. Therefore, even though pumping of the N aquifer may continue, water levels in the area of the well field may rise due to a decrease in the pumping compared to previous years. Pumping would consist of up to 500 af/yr from mid 2009 through 2025 for mine-related and public use; up to 500 af/yr for mine reclamation and domestic use from 2026 through 2028; and up to 444 af/yr for post-reclamation, domestic, and maintenance uses from 2029 through 2038. These pumping rates assume that no N-aquifer water is needed as a backup supply and the C-aquifer water supply does not fail for any reason. Since water supply systems have historically been highly reliable, it is expected that the actual pumping that would occur during the LOM permit period would be similar to the projected amounts.

Cost of Pumping. Peabody modeled what the effects on nearby N-aquifer community wells would be under various mine-pumping scenarios (GeoTrans 2006). Predicted water-level change is given in Table 4-8.

Table 4-8 N-Aquifer Well Drawdown, Alternative A, Supplemental Use of N-Aquifer Water (Agencies' Preferred Alternative), 2005-2025

Community	Well	Water Level, 2005 (ft msl)		Water Level, 2025 (ft msl)		Drawdown (ft) ¹		
		All but Project	All	All but Project	All	All but Project	All	Project
Chilchinbeto	PM3	5533.4	5465.2	5516.0	5481.2	17.4	-16.1	-33.5
Forest Lake NTUA 1	4T-523	5667.6	5469.1	5653.2	5563.9	14.4	-94.8	-109.3
Kayenta West	8T-541	5488.5	5454.7	5438.3	5418.6	50.2	36.1	-14.1
Keams Canyon	PM2	5799.2	5790.6	5781.8	5770.3	17.4	20.3	3.0
Kykotsmovi	PM1	5461.6	5438.6	5413.3	5383.8	48.2	55.1	6.6
Pinon	PM6	5712.9	5640.7	5680.1	5620.4	32.8	20.3	-12.5
Rocky Ridge	PM2	5609.2	5516.0	5594.1	5523.2	15.1	-7.5	-22.3
Rough Rock	10R-111	5719.4	5717.8	5717.8	5715.8	1.6	2.0	0.3

SOURCE: GeoTrans 2006

NOTE: ¹ Negative sign (-) indicates rise in water level.

Five of the eight wells modeled show a rise in water level due to a reduction in N-aquifer pumping under this alternative. As would be expected, wells closest to the mine well field have the greatest predicted response. The well with the greatest total drawdown is at Kykotsmovi (55.1 feet); however, the drawdown due to the project (6.6 feet) is 3 percent of the 2004 depth to water (229 ft bgs), resulting in a negligible impact (refer to Appendix H).

Some of the Peabody production wells pump from both the D and N aquifers, with about 3 percent of the water coming from the D aquifer (Peabody 1986, revised 2005). The communities of Chilchinbeto, Kitsillie, Kykotsmovi, and Polacca also use D-aquifer water but are located far enough from the mine that drawdown due to maximum project pumping is limited to about 1 foot (OSM 2006). This level of drawdown would have no measurable impact on pumping cost.

D aquifer uses near the leasehold are primarily for stock watering and use windmill driven pumps. While these wells are not subject to increased pumping cost, they can be adversely impacted if water levels decline in the wells to a point where pumps must be lowered and/or the wells deepened to remain productive.

Two windmill wells in the D aquifer are within 15 miles of the Peabody pumping center, identified as 4T-402 and 4K-387. Windmill well 4K-387 is screened in both the Cow Springs and Dakota Formations, and is approximately 15 miles from the Peabody pumping center. Windmill well 4T-402 withdraws water from the Dakota Sandstone Formation and is approximately 1 mile from the Peabody pumping center. Due to the reduction in pumpage associated with this alternative, the water level in 4T-402 is projected to rise over the 2005-2025 period, resulting in no adverse impact (OSM 2006).

Reduction in Aquifer Saturated Thickness. All of the N-aquifer and D-aquifer wells that are predicted to experience water-level declines are located in the confined portion of the aquifer and are not predicted to have their water levels lowered below the top of the aquifer. In other words, no reduction in saturated thickness is predicted for N- and D-aquifer wells.

Diminution of Stream and Spring Flow. As discussed in Chapter 3, The USGS has been monitoring N-aquifer spring flow from four springs (Moenkopi School, Pasture Canyon Spring, Burro Spring, and an unnamed spring near Dinnehotso) for a minimum of 10 years (some springs have been monitored for much longer but not always at the same location). The closest USGS monitored spring (the unnamed spring near Dinnehotso) is more than 35 miles from the Black Mesa Complex. The USGS concludes that “for the consistent periods of record at all four springs, the discharges have fluctuated but long-term trends are not apparent” (USGS 2005a). It appears that pumping to-date has not measurably reduced the monitored N-aquifer spring flow. However, modeling of N-aquifer groundwater discharge suggests that as future nonmining-related groundwater pumping in proximity to some of these springs increases, flows from springs could be impacted (GeoTrans 2006).

There are other N-aquifer springs that are not monitored and past changes to these springs, if any, are unknown. As discussed in Appendix H, numerical models of the N aquifer are not designed to simulate discharge from individual springs (Brown and Eychaner 1988; GeoTrans 1999). However, the GeoTrans model does simulate groundwater discharge to Begashibito Wash approximately 25 miles west of the leasehold. Cow Springs, located at the southwestern extent of Begashibito Wash, is an area of groundwater discharge as expressed by seeps and small springs. Cow Springs is the closest modeled area of seeps and springs to the mine and would therefore experience the greatest impact due to project pumping. The model predicts changes in groundwater discharge into Begashibito Wash/Cow Springs combined.

Model-predicted groundwater discharge diminution due to Peabody pumping is given in Table 4-9. Under the minimum pumpage scenario, the 2025 diminution in Begashibito Wash/Cow Springs is predicted to be 13.6 af/yr. This is 0.63 percent of the estimated 2005 discharge of 2,169 af/yr, or a negligible impact.

Migration of Poor Quality Groundwater. Throughout the Black Mesa region, water levels in the D aquifer are typically higher than in the N aquifer. Therefore, there is a downward component of groundwater flow and the potential for poorer quality D-aquifer water to migrate into better quality N-aquifer water. Flow and water-quality conditions between the N and D aquifers are documented in recent USGS publications (Truini 2003, 2005). These studies conclude that leakage through the Carmel Formation from the overlying D aquifer to the underlying N aquifer has occurred for thousands of years, and that the historical and continued leakage is greatest in the southern half of the Black Mesa region due to lithologic conditions in confining Carmel Formation.

Table 4-9 Projected Groundwater Discharge Diminution to Black Mesa (N Aquifer) Streams, in af/yr, Alternative A, Supplemental N Aquifer Use (Agencies' Preferred Alternative), 2005-2025

Streams/Springs	2005		2025		Change due to Pumping			Percent Peabody
	All	Non-Project	All	Non-Project	All	Non-Project	Project	
Pumping								
Streams/Springs								
Chinle Wash	498.8	498.8	498.8	498.8	0.1	0.1	0.0	0.00
Laguna Creek	2,434.5	2,443.2	2,381.7	2,390.4	52.8	52.8	-0.1	0.00
Pasture Canyon	389.4	389.4	330.5	330.5	58.9	58.9	0.0	0.00
Moenkopi Wash	4,283.3	4,302.7	4,275.5	4,299.5	7.8	3.2	4.6	0.11
Dinnebito Wash	515.0	515.3	514.2	514.9	0.8	0.4	0.5	0.09
Oraibi Wash	455.5	455.9	452.3	453.6	3.1	2.3	0.8	0.17
Polacca Wash	431.1	432.1	422.3	424.2	8.8	7.9	0.9	0.22
Jaidito Wash	2,015.1	2,018.2	1,999.3	2,007.8	15.8	10.3	5.5	0.27
Begashibito Wash/ Cow Springs	2,169.1	2,177.3	2,153.5	2,175.3	15.6	2.0	13.6	0.63

SOURCE: GeoTrans 2006

The USGS indicated that an increase in downward leakage from the D aquifer to the N aquifer would first appear as increased TDS or electrical conductivity (Eychaner 1983). The USGS also identified increased chloride and sulfate concentrations as important indicators of downward leakage. The USGS monitors water quality in the confined N aquifer throughout the Black Mesa region as part of a 1991 Cooperators agreement among BIA, USGS, ADWR, and Peabody. The USGS monitoring program collects samples at some of the Peabody pumping wells in order to validate Peabody's N aquifer water-quality monitoring program, which began in 1980. To date, USGS and Peabody N aquifer water-quality data indicate that no increasing or decreasing trends are apparent in TDS, chloride, or sulfate concentrations are apparent, although small year-to-year variations in concentrations do occur (USGS 2005a).

Most of Peabody's production wells are partially screened in the water-bearing units comprising the D aquifer, as well as being screened in the N aquifer. Hydraulic heads in the D aquifer are about 250 feet higher than in the N aquifer in the area of the well field. When the production wells are not pumping, D-aquifer water has the hydraulic potential to flow downward from the D aquifer screened interval to the N aquifer. Reduction in pumping since December 2005 has resulted in some of the Peabody production wells being turned off for some extended periods of time (weeks) with the potential for D-aquifer water to mix with N-aquifer water in the immediate vicinity of those wells. However, Peabody's first quarter 2006 water-quality monitoring data indicate that degradation to the N aquifer in the vicinity of the Peabody production wells is not occurring. Water-quality samples collected in February and March 2006 from the production wells that had been idle since December 2005 show no increases in electrical conductivity, TDS, chloride, or sulfate concentrations compared to the historical data (OSM 2006) A shutdown of the mine well field also occurred in the fall of 1985. In the USGS 1987 report on the Black Mesa monitoring program, no degradation of water quality in the well field was noted (Hill and Sottolare 1987).

Peabody conducted an analysis of potential leakage from the D aquifer to the N aquifer using the GeoTrans model and standard mixing calculations. Pumping from the N aquifer was similar to that proposed under the preferred alternative with the exception that some additional pumpage was simulated for well field maintenance (Scenario K). Results of this analysis indicated a maximum increase in N aquifer sulfate concentration of 1 percent in 2039 (Peabody 1986, revised 2003, Table 23). The 1 percent increase in 2039, if it occurred, would be localized to the immediate areas of the individual

pumping wells, and would not change the drinking water use designation of the N aquifer. The impact, if any, is judged to be negligible.

Peabody is required to continue monitoring the water quality of the N-aquifer production wells and report the data to OSM each quarter. If any degradation in N-aquifer water quality that could affect existing water use occurs, Peabody would be required to take corrective action.

Although the applicants prefer that no additional N-aquifer water be used for mining or slurry operations, in order to span the range of impacts that might occur if one or more C-aquifer supply failures were to occur, a worst case scenario for N-aquifer water use was developed and modeled. If the C aquifer water-supply system were to fail, backup water use from the N aquifer could range from a few af/yr to 6,000 af/yr, depending on the severity and length of the system failure. Because it is not possible to predict the timing or severity of breakdowns that may occur, a flat water use over the LOM permit period was assumed. Since aquifer impacts are cumulative, this methodology was assumed to produce the same or greater impacts than a scenario in which a breakdown would occur in a particular year. Since the C-aquifer water supply would not be expected to fail over the entire LOM permit period, a conservative estimate of 2,000 af/yr was assumed (one-third of the total) to be pumped to evaluate impacts.

Under this worst-case failure scenario, recent average annual use (2000 through 2004) of the N aquifer (4,400 af/yr) would be reduced to an average rate of 2,000 af/yr over the life of the mining operation, through 2025. (It should be noted that modeling performed to evaluate this scenario used 2,500 af/yr; thus it is somewhat more conservative in its prediction of streamflow depletion and water-level drawdown.) In addition, 500 af/yr would be pumped from 2026 through 2028 for Black Mesa Complex reclamation and up to 444 af/yr for post-reclamation domestic and maintenance uses from 2029 through 2038.

Cost of Pumping. Drawdowns due to project pumping under this scenario are given in Table 4-10.

Table 4-10 N-Aquifer Well Drawdown, Alternative A, Use of N-Aquifer Water During Outages of C-Aquifer Well Field (2,000 af/yr), 2005-2025

Community	Well	Water Level, 2005 (feet msl)		Water Level, 2025 (feet msl)		Drawdown (feet) ¹		
		All but Project	All	All but Project	All	All but Project	All	Project
Chilchinbeto	PM3	5533.4	5465.2	5516.0	5459.3	17.4	5.9	-11.5
Forest Lake NTUA 1	4T-523	5667.6	5469.1	5653.2	5494.0	14.4	-24.9	-39.4
Kayenta West	8T-541	5488.5	5454.7	5438.3	5411.7	50.2	43.0	-7.2
Keams Canyon	PM2	5799.2	5790.6	5781.8	5769.3	17.4	21.3	3.9
Kykotsmovi	PM1	5461.6	5438.6	5413.3	5380.5	48.2	58.1	9.5
Pinon	PM6	5712.9	5640.7	5680.1	5603.3	32.8	37.7	4.6
Rocky Ridge	PM2	5609.2	5516.0	5594.1	5499.0	15.1	17.1	2.3
Rough Rock	10R-111	5719.4	5717.8	5717.8	5715.5	1.6	2.0	0.7

SOURCE: GeoTrans 2006

NOTE: ¹ Negative sign (-) indicates rise in water level.

As under the agencies' preferred alternative, this scenario results in rises in post-2025 water levels attributable to project pumping in wells closest to the Peabody well field (due to the fact that the proposed average annual pumpage is less than 2000-2004 average annual pumpage). The maximum increase in drawdown due to project pumping (9.5 feet) occurs at Kykotsmovi. The 2004 depth to water at

Kykotsmovi is approximately 229 feet bgs (Truini et al. 2005). The increase in lift and power cost would be about 4 percent, resulting in negligible impact on pumping cost (refer to Appendix H).

Local D-aquifer windmill wells are within the area of influence of well-field pumping (see Section 4.4.1.5.2). Estimated 2025 water level under this pumping scenario (2,000 af/yr) at the closest well (4T-402) shows a rise of about 11 feet, resulting in no adverse impact (GeoTrans 2006).

Reduction in Aquifer Saturated Thickness. As discussed under the agencies' preferred alternative, the N and D aquifers remain confined (fully saturated) under all potential alternatives and thus would experience no reductions in saturated thickness (GeoTrans 2006).

Diminution of Stream and Spring Flow. Modeled changes in groundwater discharge to streams and springs are given in Table 4-11.

Table 4-11 Projected Groundwater Discharge Diminution to Black Mesa (N Aquifer) Streams, in af/yr, Alternative A, 2,000 af/yr N-Aquifer Use, 2005-2025

Pumping ¹	2005		2025		Change due to Pumping			Percent Project
	All	Non-Project	All	Non-Project	All	Non-Project	Project	
Streams/Springs								
Chinle Wash	498.8	498.8	498.8	498.8	0.1	0.1	0.0	0.00
Laguna Creek	2,434.5	2,443.2	2,380.4	2,390.4	54.1	52.8	1.2	0.05
Pasture Canyon	389.4	389.4	330.5	330.5	58.9	58.9	0.0	0.000
Moenkopi Wash	4,283.3	4,302.7	4,272.2	4,299.5	11.1	3.2	7.9	0.18
Dinnebito Wash	515.0	515.3	514.1	514.9	0.9	0.4	0.5	0.09
Oraibi Wash	455.5	455.9	452.3	453.6	3.1	2.3	0.8	0.18
Polacca Wash	431.1	432.1	422.2	424.2	8.9	7.9	1.0	0.23
Jaidito Wash	2,015.1	2,018.2	1,999.2	2,007.8	15.9	10.3	5.6	0.28
Begashibito Wash/ Cow Springs	2,169.1	2,177.3	2,153.0	2,175.3	16.1	2.0	14.1	0.65

SOURCE: GeoTrans 2006

NOTE: ¹ Modeled pumpage for mine operations is 2,500 af/yr, slightly higher than proposed. Streamflow change is therefore slightly conservative.

Predicted diminution in groundwater discharge is greatest at Begashibito Wash/Cow Springs where the decrease due to project pumpage is 14.1 af/yr. This would result in a decrease of 0.65 percent, or a negligible impact.

Migration of Poor Quality Groundwater. Like the preferred alternative pumping scenario, this option results in less pumpage in the future. Therefore, a negligible impact is anticipated.

4.4.1.5.2 Alternative A, N Aquifer as the Sole Water Supply

This alternative assumes that the C-aquifer well field would not be constructed. Average annual N-aquifer pumping under this option is estimated to be 6,000 af/yr from mid 2009 through 2025, an increase of about 33 percent over the recent past annual pumpage. The increase would result from the additional 0.6 million tons per year of coal that would be transported to the Mohave Generating Station. In addition, 500 af/yr would be pumped for Black Mesa reclamation (from 2026 through 2028) and up to 444 af/yr for post-reclamation domestic and maintenance uses from 2029 through 2038.

Cost of Pumping. Increasing project pumpage would increase the drawdown in nearby wells (Table 4-12).

Table 4-12 N-Aquifer Well Drawdown, Alternative A, Maximum Use of N-Aquifer Well Field (6,000 af/yr), 2005-2025

Community	Well	Water Level, 2005 (ft msl)		Water Level, 2025 (ft msl)		Drawdown (ft)		
		All but Project	All	All but Project	All	All but Project	All	Project
Chilchinbeto	PM3	5533.4	5465.2	5516.0	5421.2	17.4	44.0	26.6
Forest Lake NTUA 1	4T-523	5667.6	5469.1	5653.2	5379.2	14.4	90.2	75.8
Kayenta West	8T-541	5488.5	5454.7	5438.3	5399.9	50.2	54.8	4.6
Keams Canyon	PM2	5799.2	5790.6	5781.8	5768.0	17.4	22.6	5.6
Kykotsmovi	PM1	5461.6	5438.6	5413.3	5375.9	48.2	62.7	14.4
Pinon	PM6	5712.9	5640.7	5680.1	5575.1	32.8	65.6	32.8
Rocky Ridge	PM2	5609.2	5516.0	5594.1	5458.6	15.1	57.4	42.3
Rough Rock	10R-111	5719.4	5717.8	5717.8	5715.2	1.6	2.6	1.0

SOURCE: GeoTrans 2006

Drawdown due to project pumping at the Forest Lake NTUA #1 well of 75.8 feet is predicted at the end of 2025 (GeoTrans 2006). This would result in a 6.5 percent increase in pumping lift and cost, a negligible impact (refer to Appendix H).

As discussed in Section 4.4.1.5.1, some of the Peabody production wells pump from both the D and N aquifers. The communities of Chilchinbeto, Kitsillie, Kykotsmovi, and Polacca also use D-aquifer water but are located far enough from the mine that drawdown due to maximum project pumping is limited to about 1 foot (OSM 2006). This level of drawdown would have no measurable impact on pumping cost.

Two D-aquifer windmill wells are within the area of influence of well-field pumping. Estimated 2025 drawdown for the Peabody N aquifer well-field pumping scenario of 6,000 af/yr at the closest well (4T-402) is approximately 2.2 feet (GeoTrans 2006). The water column (height of the water level above the bottom of the well) is approximately 340 feet. The estimated drawdown is 0.6 percent of the water column, which would have a negligible impact on the yield of the well.

Reduction in Aquifer Saturated Thickness. The N and D aquifers remain confined (fully saturated) under this maximum pumping alternative and thus would experience no reduction in saturated thickness.

Diminution of Stream and Spring Flow. Model-predicted streamflow reduction under 6,000 af/yr pumpage is given in Table 4-13.

Model-predicted diminution in groundwater discharge is greatest at Begashibito Wash/Cow Springs, where flow reduction in 2025 due to project pumping is 14.9 af/yr, or 0.69 percent of the total 2005 discharge. Even at the maximum potential project pumpage, the reduction in groundwater discharge is considered to be negligible (refer to Appendix H).

Table 4-13 Projected Groundwater Discharge Diminution to Black Mesa (N Aquifer) Streams, in af/yr, Alternative A, 6,000 af/yr N-Aquifer Use, 2005-2025

Pumping	2005		2025		Change due to Pumping			Percent Project
	All	Non-Project	All	Non-Project	All	Non-Project	Project	
Streams/Springs								
Chinle Wash	498.8	498.8	498.8	498.8	0.1	0.1	0.0	0.00
Laguna Creek	2,434.5	2,443.2	2,378.1	2,390.4	56.4	52.8	3.6	0.15
Pasture Canyon	389.4	389.4	330.5	330.5	58.9	58.9	0.0	0.000
Moenkopi Wash	4,283.3	4,302.7	4,266.8	4,299.5	16.5	3.2	13.3	0.31
Dinnebito Wash	515.0	515.3	514.1	514.9	0.9	0.4	0.5	0.10
Oraibi Wash	455.5	455.9	452.3	453.6	3.2	2.3	0.8	0.18
Polacca Wash	431.1	432.1	422.2	424.2	8.9	7.9	1.0	0.24
Jaidito Wash	2,015.1	2,018.2	1,999.0	2,007.8	16.1	10.3	5.7	0.28
Begashibito Wash/ Cow Springs	2,169.1	2,177.3	2,152.2	2,175.3	16.9	2.0	14.9	0.69

SOURCE: GeoTrans 2006

Migration of Poor Quality Groundwater. Over the more than 20 years that N-aquifer water quality has been monitored there has been no appreciable long-term trend or change in quality (Peabody 2005; USGS 2005a). The maximum pumping scenario would result in 33 percent increase over recent past (2004-2005) pumping for the life of the mining operations. While there is no known reason to suspect that water quality would deteriorate over the life of the mining operations, there is a level of uncertainty not associated with the other options. Nevertheless, any impact likely would not be sufficient to cause a loss of the resource for industrial or domestic use. Due to the level of uncertainty, a minor impact is conservatively assigned.

4.4.2 Alternative B – Approval of the LOM Revision Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

4.4.2.1 Black Mesa Complex

Surface-water and groundwater impacts due to mining under this alternative would be similar, but reduced in area, from those described in Alternative A. Effects on the hydrologic regime are controlled by the regulatory requirements of SMCRA and oversight by OSM. Hydrologic impacts are limited in scope and are largely confined to the Black Mesa Complex.

4.4.2.2 Project Water Supply

4.4.2.2.1 C Aquifer Water-Supply System

The C aquifer water-supply system would not be constructed under this alternative. Thus no impacts would occur.

4.4.2.2.2 N Aquifer Water-Supply System

Under Alternative B, 1,236 af/yr would be pumped from the N aquifer for the Kayenta mining operation from 2006 through 2026, along with 500 af/yr for Black Mesa mining operation reclamation (from 2026 through 2028) and 444 af/yr from 2029 through 2038.

Cost of Pumping. Drawdown at selected wells due to Alternative B pumping is given in Table 4-14.

Table 4-14 N-Aquifer Well Drawdown, Alternative B, Use of N-Aquifer Water for Kayenta Mine and Reclamation of Black Mesa Mine, 2005-2025

Community	Well	Water Level, 2005 (ft msl)		Water Level, 2025 (ft msl)		Drawdown (ft) ¹		
		All but Project	All	All but Project	All	All but Project	All	Project
Chilchinbeto	PM3	5533.4	5465.2	5516.0	5473.0	17.4	-7.9	-25.6
Forest Lake NTUA 1	4T-523	5667.6	5469.1	5653.2	5546.2	14.4	-77.1	-91.5
Kayenta West	8T-541	5488.5	5454.7	5438.3	5415.3	50.2	39.4	-10.8
Keams Canyon	PM2	5799.2	5790.6	5781.8	5770.0	17.4	20.3	3.3
Kykotsmovi	PM1	5461.6	5438.6	5413.3	5382.8	48.2	55.8	7.2
Piñon	PM6	5712.9	5640.7	5680.1	5616.4	32.8	24.6	-8.5
Rocky Ridge	PM2	5609.2	5516.0	5594.1	5517.3	15.1	-1.3	-16.4
Rough Rock	10R-111	5719.4	5717.8	5717.8	5715.8	1.6	2.0	0.3

SOURCE: GeoTrans 2006

NOTE: ¹ Negative sign (-) indicates rise in water level.

N-aquifer pumpage under this alternative is somewhat greater than the preferred alternative but significantly less than past pumpage, resulting in a water level rise in wells closest to the Peabody well field. Greatest increased drawdown due to project pumpage occurs at Kykotsmovi and is 7.2 feet. Depth to water at Kykotsmovi in 2004 was approximately 229 feet (Truini et al. 2005). Increased cost of pumping in 2025 due to project drawdown is approximately 3 percent. The impact is considered negligible (refer to Appendix H).

As with the other N-aquifer pumping alternatives, impacts on D-aquifer wells would be negligible.

Reduction Saturated Thickness. As discussed under the preferred alternative, the N and D aquifers remain confined (fully saturated) under all potential alternatives and thus will experience no reduction in saturated thickness.

Diminution of Stream and Spring Flow. Projected groundwater discharge diminution is given in Table 4-15.

Under proposed Alternative B project pumpage, the greatest change in discharge, 13.7 af/yr, occurs at Begashibito Wash/Cow Springs. This change is 0.63 percent of the 2005 discharge and is considered negligible.

Migration of Poor Quality Groundwater. Over the more than 20 years that N-aquifer water quality has been monitored there has been no appreciable long-term trend or change in quality (Peabody 2005c; USGS 2005a). Since the Alternative B pumping scenario would result in less N-aquifer pumpage in the future, there is no reason to suspect that water quality would change for the worse.

Table 4-15 Projected Groundwater Discharge Diminution to Black Mesa (N Aquifer) Streams, in af/yr, Alternative B, Approval of LOM without Black Mesa, Coal Slurry or C-Aquifer Water Supply, 2005-2025

Pumping	2005		2025		Change due to Pumping			% Project
	All	Non-Project	All	Non-Project	All	Non-Project	Project	
Streams/Springs								
Chinle Wash	498.8	498.8	498.8	498.8	0.1	0.1	0.0	0.00
Laguna Creek	2,434.5	2,443.2	2,381.1	2,390.4	53.4	52.8	0.6	0.02
Pasture Canyon	389.4	389.4	330.5	330.5	58.9	58.9	0.0	0.000
Moenkopi Wash	4,283.3	4,302.7	4,274.7	4,299.5	8.6	3.2	5.4	0.13
Dinnebito Wash	515.0	515.3	514.1	514.9	0.9	0.4	0.5	0.09
Oraibi Wash	455.5	455.9	452.3	453.6	3.1	2.3	0.8	0.17
Polacca Wash	431.1	432.1	422.3	424.2	8.8	7.9	0.9	0.22
Jaidito Wash	2,015.1	2,018.2	1,999.2	2,007.8	15.8	10.3	5.5	0.27
Begashibito Wash/ Cow Springs	2,169.1	2,177.3	2,153.4	2,175.3	15.7	2.0	13.7	0.63

SOURCE: GeoTrans 2006

4.4.3 Alternative C – Disapproval of the LOM Revision (No Action)

4.4.3.1 Black Mesa Complex

Surface-water and groundwater impacts due to mining under this alternative would be the same as under Alternative B. Effects on the hydrologic regime are controlled by the regulatory requirements of SMCRA and oversight by OSM. Hydrologic impacts are limited in scope and are largely confined to the Black Mesa Complex.

4.4.3.2 Project Water Supply

4.4.3.2.1 C Aquifer Water-Supply System

The C aquifer water-supply system would not be constructed under this alternative.

4.4.3.2.2 N Aquifer Water-Supply System

N-aquifer water use under this alternative is the same as under Alternative B and would have identical impacts.

4.5 CLIMATE

The following statements, from the 1990 Final EIS for the Black Mesa – Kayenta Mine Project, would apply to the construction of the coal-slurry and water-supply pipelines and to continued operation of the mines:

“Proposed mining activities at the Black Mesa – Kayenta mine would affect the life zone near the ground (microclimate), which would be modified on a local basis until revegetation is successful. The climate of the Western United States (macroclimate) would not be affected by the proposed operations at the Black Mesa – Kayenta mine, inasmuch as the particles needed to generate cloud condensation nuclei would be restricted to areas generally within a few hundred feet of their source and would probably be emitted at ground level. The particles would have very little buoyancy and would settle quickly near their source. Furthermore, no constant source of moisture is available to transform any cloud condensation nuclei into potential precipitation-producing clouds.

Soil temperatures and near ground [air] temperatures would be higher in areas of bare soil than in areas of vegetated land, and moisture availability in the soil would be reduced. Wind speed directly adjacent to the surface would be slightly higher, causing an increase in erosion and mechanical abrasion of exposed soil by moving particles. Local mine site wind patterns may be changed by post-mining topography.

OSM concludes that that the impacts of Alternative 1 on the microclimate and macroclimate would be negligible over the short and long term.”

Similarly, the geographic scope and predicted air pollutant emissions of the proposed actions are too small to allow calculation of any measurable impacts of the project on global climate. The assessment of the impacts of global climate change is in its formative phase, and it is not yet possible to know with confidence the net impact of such change. The potential effects of global climate change could alter water supplies, agriculture, sea levels, ultraviolet radiation levels, and natural variances in the ecosystem. Because climate change must be viewed from a global perspective, the magnitude of the emissions potentially contributed by the Black Mesa Project needs to be viewed in that context. Activities associated with mining of coal resources, reconstruction and operation of the coal slurry pipeline, and construction and operation of the C aquifer water-supply system would produce some of the listed greenhouse gases, primarily as a result of power requirements and fuel consumption, activities that produce greenhouse gases. The incremental contribution of greenhouse gases from the proposed Black Mesa Project and alternatives would be negligible when compared to total greenhouse gases produced in the United States. The indirect effects associated with resuming operation of the Mohave Generating Station are discussed in Section 4.24.

4.6 AIR QUALITY

The assessment of air quality impacts is based on compilation of regulated pollutant emissions for the Black Mesa Complex and background sources, and calculation of predicted emissions and gaseous pollutant emissions associated with the proposed replacement of the existing coal-slurry pipeline and construction of the proposed new water-supply system.

4.6.1 LOM Revision Air Pollutant Emissions

Particulate Matter Emissions from Mining Activity. Fugitive PM₁₀ emissions data for the Black Mesa Complex operations for the life of mine were obtained from Peabody (Peabody 2005a). These data include annual PM₁₀ emission rates for overburden and coal removal; operation of vehicles, heavy equipment, the draglines, and overland conveyor systems; the coal preparation facilities; and wind erosion of disturbed surfaces resulting from mining activity. Vehicle exhaust emissions are excluded from these data; see the following paragraph for vehicle and equipment exhaust emissions. This information was developed by Peabody, using USEPA-approved emissions estimation models, based on a variety of input information pertaining to current and planned mining operations. Annual PM₁₀ emissions for most of the background sources within the study area (and within Arizona) were obtained from ADEQ (2005). Annual PM₁₀ emissions information for the Navajo Generating Station was obtained from SRP (2005). Annual PM₁₀ emissions information for the Mohave Generating Station was obtained from SCE (2005).

Particulate Matter and Gaseous Air Pollutant Emissions from Vehicle and Equipment Exhaust. Predicted emissions of PM₁₀, carbon monoxide (CO), unburned hydrocarbons (HC), nitrogen oxides (NO_x) and sulfur dioxide (SO₂) resulting from the combustion of fuels (predominantly diesel) in various vehicles and equipment at the Black Mesa Complex were estimated based on a vehicle and equipment inventory supplied by Peabody. For purposes of this EIS, HC are assumed to be VOC. Emission factors for diesel-fueled heavy-duty vehicles and off-highway equipment were calculated following the method outlined in

the USEPA report “Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-Compression-Ignition,” (USEPA 420-P-04-009, April 2004). Emission factors for gasoline-fueled light-duty trucks were obtained from a MOBILE5 model run based on national averaged fleet conditions, at a speed of 10 miles per hour and an ambient temperature of 60°F. Vehicle and equipment exhaust will contain PM_{2.5}. As a very conservative estimate, it can be assumed that all of the PM₁₀ emissions from internal-combustion engines are composed of PM_{2.5} material.

4.6.2 Pipeline Construction Emissions

Particulate Emissions from Earth-Moving Activity. Predicted PM₁₀ emissions associated with construction of the coal-slurry and water-supply pipelines were calculated using published USEPA emissions factors for heavy construction operations. Specifically, Section 13.2.3, “Heavy Construction Operations,” of the USEPA document, “Compilation of Air Pollutant Emissions Factors” (AP-42), provides a total uncontrolled PM emission factor of 1.2 tons/acre/month for heavy earth-moving operations similar to the anticipated pipeline construction activities (e.g., clearing, grading, digging trenches, temporary storage piles, backfilling trenches, compaction, etc.) (USEPA, AP-42, January 1995). This emission factor includes generation of fugitive dust due to vehicular traffic associated with the construction activity. Therefore, estimation of vehicle-caused fugitive dust during construction of the pipelines was not determined separately.

According to the USEPA document *Particulate Emissions From Controlled Construction Activities* (EPA-600/R-01-031), uncontrolled PM₁₀ emissions from major cut and fill operations in desert soils are 33 percent of total PM. According to the Midwest Research Institute document *Estimating Particulate Matter Emissions from Construction Operations*, the application of water or dust suppressants on exposed areas would reduce emissions by another 61 percent (Midwest Research Institute 1999). Therefore, a controlled PM₁₀ emission factor of 0.154 tons/acre/month was used to calculate PM₁₀ emissions from earth-moving activity.

Table 4-3 provides a breakdown of total acreage affected by reconstruction of the coal slurry pipeline. The total right-of-way area corresponding to the realignment alternatives is 2,319 acres, which provides the highest number of affected acres, and which is used here to estimate worst-case particulate emissions. Table 4-4 provides a breakdown of total acreage affected by construction of the well field, water-supply pipeline and associated facilities (electric transmission and distribution lines, substation and access roads). The total right-of-way area for the western route of the 11,600 af/yr alternative is 1,766 acres, which represents the highest number of acres affected, and which is used here to estimate worst-case particulate emissions.

According to the pipeline construction plan in Appendix A-2, it is unlikely that a particular location along the pipeline route would undergo active earth-moving activity for more than a week. For purposes of this impact analysis, it was conservatively assumed that, on average, the entire area affected by pipeline construction would be affected by heavy construction operations for approximately 0.5 month. In actuality, since the total duration of the coal-slurry pipeline construction is anticipated to be 18 months, and the total area that may be disturbed is 2,319 acres, the average amount of time a single acre would be impacted would likely be substantially less than 0.5 month. This same assumption applies to the water-supply pipeline alternatives, as well. An emission factor of 1.2 tons per acre was multiplied against the total project acreage, and then the result was halved, to derive total project uncontrolled PM emissions for each proposed segment of the coal-slurry and water-supply pipeline projects.

Particulate and Gaseous Pollutant Emissions from Construction Equipment. Construction vehicles and equipment usually are powered by gasoline or diesel-fired internal combustion engines. Operation of such

equipment results in emissions of PM₁₀, NO_x, SO₂, CO, and VOC. Vehicle and equipment exhaust would contain PM_{2.5}. As a very conservative estimate, it can be assumed that all of the PM₁₀ emissions from internal-combustion engines are composed of PM_{2.5} material.

The type and number of on-road and off-road vehicles and equipment to be used during construction of the coal-slurry pipeline have not been specified by the project applicants. Therefore, gaseous air pollutant emissions from the pipeline construction were estimated based on a typical array of equipment and vehicles for similar projects. A roster of on-road and off-road vehicles and equipment to be used during construction of the well field and water-supply pipeline were provided by SCE. Table 4-16 shows the roster of equipment and vehicles anticipated for construction of the coal-slurry pipeline, well field, pump stations, and water-supply pipeline.

Table 4-16 Equipment List for Typical Construction of Coal-Slurry Pipeline and Water-Supply Pipeline

Equipment	Coal-Slurry Pipeline	Water-Supply Pipeline		Average Engine Horsepower (hp)
		Well Field	Water Pipeline and Pump Stations	
Quantity				
Pickup and crew cab trucks	30	30	30	200
Truck (2-5 tons)	1	12	21	250
Truck (5-15 tons)	17	1	2	250
Bulldozer (rubber tire)	15	5	7	300
Backhoe/Loader/Trencher	17	5	13	150
Crane (10-20 tons)	-	3	10	300
Crane (75 ton)	-	-	1	400
Drill rig	-	1	5	300
Generator/Welder	10	1	2	200
Grader	1	2	2	125
Roller/Compactor	-	1	-	150
Semi-tractor/Trailer	-	5	9	350
Portable rock crushing plant	-	4	13	-
Rock crushing generator	-	-	1	200
Portable concrete batch plant	-	-	1	-
Concrete batch plant generator	-	-	1	200
Office Trailer	1	-	1	-

SOURCE: Black Mesa Pipeline, Inc. 2005; Appendix A-2 Typical Well Field and Pipeline Construction, Operation, and Maintenance 2005; Southern California Edison Company Roster of Equipment and Vehicles for the Water-Supply System 2006

Emissions from Pipeline Operations. Air pollutant emissions from operation of the coal-slurry and water-supply pipelines, if any, would be negligible. All pumping equipment on both pipelines would be electric. Therefore, air pollutant emission estimates were not calculated.

4.6.3 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.6.3.1 Black Mesa Complex

Table 4-17 is a summary of the PM₁₀ emissions associated with the Kayenta and Black Mesa mining operations. This information represents projected worst case emission levels for the life of mine. For both mines, the emissions shown are from projected mining activities for the three worst case years for the life of mine (2006, 2022, and 2023). The basis for selecting the worst case years were high mine production levels and proximity to property boundaries. At Black Mesa, projected production for 2006 according to life of mine plans was 4.6 million tons. During the previous three years (baseline years), prior to temporary suspension of activities at the mine at the end of 2005, Black Mesa produced an average of 4.49 million tons of coal. Emission calculations for 2006 are, therefore, considered a “worst case” representation of baseline emissions.

Table 4-17 Annual Fugitive PM₁₀ Emissions from Black Mesa Complex Operations

Operation	PM ₁₀ Emissions (tons per year)		
	Baseline ¹	2022	2023
Kayenta mining operation (fugitives)			
Overburden removal	56.47	67.33	59.34
Coal removal	6.43	6.43	6.43
Draglines/heavy equipment	411.58	423.25	429.48
Coal truck travel	13.68	19.55	19.94
Coal preparation facilities	157.81	158.26	158.26
Wind erosion	379.26	379.26	379.26
Black Mesa mining operation (fugitives)			
Overburden removal	12.92	13.78	14.56
Coal removal	3.01	4.15	4.15
Draglines/heavy equipment	252.82	311.91	323.78
Coal truck travel	18.65	20.89	22.10
Coal preparation facilities	68.04	42.43	42.43
Wind erosion	171.63	236.88	236.88
Overland conveyor system	0.01	0.01	0.01
Vehicle and equipment exhaust²	147.00	147.00	147.00
Total	1,699.31	1,831.13	1,843.62

SOURCE: Peabody Western Coal Company 2005a, 2005b

NOTES: ¹ Baseline emissions are the life-of-mine projections for 2006 for the Black Mesa Complex including the Kayenta and Black Mesa mining operations

² Usage levels of vehicles and equipment are assumed to remain the same through 2026.

Table 4-18 is a summary of the estimated annual PM₁₀ and gaseous air pollutant emissions associated with the exhausts from vehicles and equipment used within the Black Mesa Complex. The PM₁₀ emissions from vehicles are included in the total PM₁₀ emissions for the Black Mesa Complex in Table 4-17. The gaseous air pollutants associated with vehicle and equipment exhaust emissions currently have minor, localized impacts within the immediate vicinity of the complex, but have negligible impacts on air quality in the region.

Table 4-18 Air Pollutant Emissions from Vehicle and Equipment Exhaust at Black Mesa Complex ¹

Vehicle/Equipment	Quantity	Fuel	Average Engine Power (hp)	Unit of Emission Factors	Emission Factors ^{1,2}					Maximum Annual Emissions (tons/year) ^{3,4}				
					VOC	CO	NO _x	PM ₁₀	SO ₂	VOC	CO	NO _x	PM ₁₀	SO ₂
Diesel mining equipment														
Tractor/backhoe/trencher	36	Diesel	100	g/hp-hr	0.5572	3.8020	5.3827	0.6371	0.1822	3	18	26	3	1
Crane/large forklift	23	Diesel	400	g/hp-hr	0.2165	2.0991	5.7831	0.2313	0.1641	1	6	18	1	0
Welder/compressor	24	Diesel	300	g/hp-hr	0.2165	2.0991	5.7831	0.2313	0.1641	3	30	83	3	2
Dozer /loader	54	Diesel	850	g/hp-hr	0.3058	1.2283	5.9150	0.2201	0.1641	93	373	1,796	67	50
Large coal haul trucks (150-250 tons)	25	Diesel	1500	g/hp-hr	0.3058	1.2283	5.9150	0.2201	0.1641	53	213	1,027	38	28
Semi-tractor/trailer	22	Diesel	350	g/hp-hr	0.2165	2.0991	5.7831	0.2313	0.1641	1	5	15	1	0
Drill	11	Diesel	300	g/hp-hr	0.3298	1.2014	5.3619	0.3094	0.1640	4	16	70	4	2
Grader /scraper	19	Diesel	600	g/hp-hr	0.2165	2.0991	5.7831	0.2313	0.1641	5	47	131	5	4
Vehicles														
Pickup truck	2	Diesel	200	g/hp-hr	0.3298	1.2014	5.3619	0.3094	0.1640	1	2	9	0	0
2-ton trucks	32	Diesel	250	g/hp-hr	0.3298	1.2014	5.3619	0.3094	0.1640	5	19	85	5	3
2-5 ton trucks	22	Diesel	300	g/hp-hr	0.3298	1.2014	5.3619	0.3094	0.1640	14	52	234	14	7
5-15 ton trucks	27	Diesel	400	g/hp-hr	0.2165	2.0991	5.7831	0.2313	0.1641	5	52	145	6	4
Pickup/crewcab/suburban	70	Gasoline	200	gpm	4.72	46.06	2.41	0.093	0.113	13	128	7	0.3	0.3
Total Emissions										201	963	3,643	147	103

SOURCE: Peabody Western Coal Company 2005a, 2005b; U.S. Environmental Protection Agency 2004

NOTES: VOC = volatile organic compounds

CO = carbon monoxide

NO_x = nitrogen oxides

PM₁₀ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers

SO₂ = sulfur dioxide

¹ Emission rates are estimated for both Kayenta and Black Mesa mining operations for all years.

² Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-Compression-Ignition," USEPA 420-P-04-009, April 2004. For all vehicles and equipment, Tier 1 emission factors were used.

³ Emission factors for gasoline-driven pickup trucks and crew cab were obtained from a MOBILE5 run based on national averaged fleet conditions, at a speed of 10 miles per hour and an ambient temperature of 60°F.

⁴ Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment and their operating schedule.

⁵ Annual emissions for pickup trucks and crew cab were calculated based on a traveling distance of 120 miles/day and an operating schedule of 300 days/year.

g/hp-hr = grams per horse-power hour

gpm = gallons per mile

4.6.3.2 Coal-Slurry and Water-Supply Pipelines

Table 4-19 is a summary of the PM₁₀ emissions associated with earth-moving operations during construction of the coal-slurry and water-supply pipelines. Included are the maximum annual and total project PM₁₀ emissions (controlled and uncontrolled).

Table 4-19 Particulate Matter Emissions Associated with Earth-moving Activity During Construction of Coal-Slurry and Water-Supply Pipelines (Alternative A only)

Pipeline	Work Area (acre)	Maximum Annual¹ Uncontrolled PM₁₀ Emissions (tons)³	Maximum Annual¹ Controlled PM₁₀ Emissions (tons)⁴	Project² Total Uncontrolled PM₁₀ Emissions (tons)³	Project² Total Controlled PM₁₀ Emissions (tons)⁴
Coal-slurry pipeline, existing route with realignments	2,319 ⁵	335	131	503	196
Water-supply pipeline: western alternative, 11,600 af/yr	1,766 ⁶	192	75	352	138
Total work area/emissions	4,085	527	206	855	334

SOURCE: Calculations using Alternative A description and U.S. Environmental Protection Agency emissions factors (USEPA Document AP-42)

NOTES: ¹ Maximum emissions in a 12-month period.

² Total duration of coal-slurry pipeline construction is 18 months; total duration of water-supply pipeline construction is 22 months.

³ Total PM (1.2 tons/acre/month) * 33 percent PM₁₀ factor.

⁴ Reduction of uncontrolled PM₁₀ by 61 percent due to watering.

⁵ From Table 4-4; alternative with highest amount of affected acreage.

⁶ From Table 4-3; alternative with highest amount of affected acreage.

Table 4-20 is a summary of the PM₁₀ and gaseous pollutant emissions associated with the use of construction vehicles and equipment during construction of the coal-slurry pipeline. Included are both total project (24 months) emissions and maximum annual emissions. Table 4-21 is a summary of the PM₁₀ and gaseous pollutant emissions associated with the use of construction vehicles and equipment during construction of the C aquifer water-supply pipeline. Included are both total project (22 months) emissions and maximum annual emissions.

The equipment and vehicles used during construction are substantially fewer in number than levels typically associated with measurable air pollutant impacts, such as congested urban areas. In addition, vehicles would be mobile, rarely in one location for more than a few minutes, and the equipment would be transient, moving to new locations along the pipeline routes every few days. Therefore, the gaseous air pollutants associated with vehicle and equipment exhaust emissions would have minor, localized impacts within the immediate vicinity of ongoing construction activity, but negligible impacts on air quality in the region.

Table 4-22 summarizes how PM₁₀ emissions were calculated for the rock crushing plant used to make the gravel that would underlie the pipeline. Table 4-23 summarizes how PM₁₀ emissions were calculated for the portable concrete batch plant used to produce concrete for a variety of uses at the well field, pipeline crossings under roads and streams, and pump stations. Table 4-24 summarizes the maximum particulate and gaseous pollutant emissions, from earth-moving activity and operation of equipment and vehicles, resulting from the construction of the well field and water supply pipeline.

Table 4-22 PM₁₀ Emissions from Portable Rock Crushing Plant ¹

Source ²	Quantity	Amount Processed ³ (TPH)	Hours Operated (hr/yr)	Emission Factor (lb/ton/unit)	Maximum Annual Emissions (TPY)	Total Construction Emissions (tons)
Batch drop operations	1	20	3,000	0.00017	0.005	0.009
Loading feed hopper	1	20	3,000	0.00017	0.005	0.009
Pneumatic loading of lime silo	0	20	3,000	0.0049	0.0	0.0
Lime transfer onto conveyor belts	0	20	3,000	0.000046	0.0	0.0
Primary crushing	1	20	3,000	0.00054	0.016	0.030
Secondary crushing	1	20	3,000	0.00054	0.016	0.030
Tertiary crushing	0	20	3,000	0.00054	0.0	0.0
Fine crushing	0	20	3,000	0.0022	0.0	0.0
Screening	1	20	3,000	0.00074	0.022	0.041
Fine screening	0	20	3,000	0.0022	0.0	0.0
Stackers	1	20	3,000	0.00017	0.005	0.009
Conveyor transfer points	1	20	3,000	0.000046	0.001	0.003
TOTAL					0.07	0.13

SOURCE: Appendix A-2 Typical Well Field and Pipeline Construction, Operation, and Maintenance; URS Corporation 2006

NOTES: PM₁₀ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers.

hr/yr = hours per year

lb/ton/unit = pound per ton per unit

TPH = ton per hour

TPY = ton per year

¹PM₁₀ Emissions from Portable Rock Crushing Plant are based on ADEQ Annual Air Emissions Inventory Questionnaire For Facilities Permitted to Operate a Crushing and Screening Plant

²Fugitive Emissions from Haul Roads and Storage Piles as well as Truck Unloading Emissions have already been accounted for in Table 4-10: Particulate Matter Emissions Associated with Construction of Coal-Slurry and Water-Supply Pipelines (Alternative A only).

³ Amount Processed was estimated based on a calculated volume of 2,136,673 ft³ of crushed rock (density 100 lb/ft³) needed to complete the project over the span of 22 months.

Table 4-20 Air Pollutant Emissions from Construction Vehicles and Equipment - Coal-Slurry Pipeline (Alternative A)

Vehicle/Equipment	Quantity	Fuel	Average Engine Power (hp)	Load Factor ¹	Unit of Emission Factors	Emission Factors ^{2,3}					Maximum Annual Emissions (tons/year) ^{4,5}					Total Construction Emissions (tons/year) ⁶				
						VOC	CO	NO _x	PM ₁₀	SO ₂	VOC	CO	NO _x	PM ₁₀	SO ₂	VOC	CO	NO _x	PM ₁₀	SO ₂
Trucks (2-ton)	1	Diesel	250	0.59	g/hp-hr	0.33	1.20	5.36	0.35	0.66	0.16	0.59	2.61	0.17	0.32	0.24	0.88	3.92	0.26	0.48
Trucks (5-15 tons)	17	Diesel	250	0.59	g/hp-hr	0.33	1.20	5.36	0.35	0.66	2.73	9.96	44.45	2.89	5.44	4.10	14.94	66.67	4.34	8.16
Sideboom	10	Diesel	500	0.43	g/hp-hr	0.21	1.37	6.09	0.21	0.65	1.47	9.75	43.27	1.52	4.62	2.20	14.63	64.90	2.28	6.93
Dozer	15	Diesel	300	0.59	g/hp-hr	0.22	2.10	5.78	0.27	0.66	1.90	18.42	50.76	2.38	5.76	2.85	27.64	76.14	3.57	8.64
Grader	1	Diesel	125	0.59	g/hp-hr	0.36	1.39	5.43	0.39	0.66	0.09	0.34	1.32	0.10	0.16	0.13	0.51	1.99	0.14	0.24
Tractor/backhoe/loader	17	Diesel	150	0.21	g/hp-hr	0.79	2.34	6.29	0.64	0.76	1.40	4.14	11.14	1.14	1.35	2.09	6.21	16.71	1.70	2.03
Air compressor/generator	5	Diesel	200	0.43	g/hp-hr	0.28	0.79	5.64	0.28	0.65	0.40	1.12	8.02	0.39	0.92	0.61	1.67	12.04	0.59	1.39
Welder	5	Diesel	200	0.21	g/hp-hr	0.65	2.02	6.21	0.57	0.77	0.45	1.40	4.31	0.40	0.53	0.68	2.10	6.47	0.60	0.80
Pickup trucks and crew cab	30	Gasoline	200	-	g/mile	3.150	30.210	2.200	0.098	0.113	4.88	46.75	3.40	0.15	0.17	7.31	70.13	5.11	0.23	0.26
Total Emissions											13	92	169	9	19	20	139	254	14	29

SOURCE: URS 2006

NOTES: VOC = volatile organic compounds

CO = carbon monoxide

NO_x = nitrogen oxides

PM₁₀ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers

SO₂ = sulfur dioxide

g/hp-hr = grain per horsepower-hour

¹ Load Factor values were obtained from USEPA's Newest Draft Nonroad Emission Inventory Model, which can be found at www.epa.gov/otaq/models/nonrmdl/nr-eiip4.wpd

² Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-Compression-Ignition," USEPA 420-P-04-009, April 2004. For all vehicles and equipment, Tier 1 emission factors were used.

³ Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 °F.

⁴ Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment, and an operating schedule of 3,000 hours/year.

⁵ Annual emissions for pickup trucks and crew cab were calculated based on a traveling distance of 150 miles/day and an operating schedule of 6 days/week and 52 weeks/year.

⁶ Total emissions from pipeline construction are based on 18-months of construction.

Table 4-23 PM₁₀ Emissions from Portable Concrete Batch Plant ¹

Source ²	Throughput Rate ³ (TPH)	Hours Operated (hr/yr)	Emission Factor (lb/ton/unit)	Maximum Annual Emissions (TPY)	Total Construction Emissions (tons)
Batch drop operations – aggregate	1,499	3,000	0.00016	0.360	0.660
Batch drop operations – sand	1,499	3,000	0.00004	0.090	0.165
Aggregate transfer to feed hopper	1,499	3,000	0.00016	0.360	0.660
Sand transfer to feed hopper	1,499	3,000	0.00004	0.090	0.165
Aggregate transfer to elevated bins	1,499	3,000	0.00016	0.0360	0.660
Sand transfer to elevated bins	1,499	3,000	0.00004	0.090	0.165
Aggregate transfer to weigh hoppers	1,499	3,000	0.00016	0.360	0.660
Sand transfer to weigh hoppers	1,499	3,000	0.00004	0.090	0.165
Cement transfer to silo	1,499	3,000	0.00005	0.112	0.206
Cement transfer to weigh hopper	1,499	3,000	0.001	2.248	4.122
Mixer loading – truck mix	1,499	3,000	0.0073	16.413	30.091
Mixer loading – central mix	1,499	3,000	0.00061	1.372	2.514
Conveyor transfer points (aggregate)	1,499	3,000	0.000022	0.049	0.091
Conveyor transfer points (sand)	1,499	3,000	0.000017	0.038	0.070
Screening	1,499	3,000	0.00035	0.787	1.443
Fine screening	1,499	3,000	0.001	2.248	4.122
TOTAL				25.07	45.96

SOURCE: Appendix A-2 Typical Well Field and Pipeline Construction, Operation, and Maintenance 2006; URS Corporation 2006

NOTES: PM₁₀ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers.

hr/yr = hours per year

lb/ton/unit = pound per ton per unit

TPH = ton per hour

TPY = ton per year

¹PM₁₀ Emissions from Portable Concrete Batch Plant are based on ADEQ Annual Air Emissions Inventory Questionnaire For Facilities Permitted to Operate a Concrete Batch Plant

²Fugitive Emissions from Haul Roads and Storage Piles as well as Truck Unloading Emissions have already been accounted for in Table 4-19: Particulate Matter Emissions Associated with Construction of Coal-Slurry and Water-Supply Pipelines (Alternative A only).

³Concrete throughput rate was estimated based on 1,278 yds³ of concrete (density 150 lb/ft³) of needed to complete the project over the span of 14 months.

Table 4-24 Annual Emissions From Construction of Water-Supply Pipeline (Alternative A)

Emissions	PM ₁₀ (tons)	VOC (tons)	CO (tons)	NO _x (tons)	SO ₂ (tons)
Equipment/Vehicle combustion ¹	11	15	98	186	21
Portable rock crushing plant ²	0.07	-	-	-	-
Portable concrete batch plant ³	25	-	-	-	-
Earth-moving ⁴	75	-	-	-	-
TOTAL	111	15	98	186	21

SOURCE: URS Corporation 2006

NOTES: VOC = volatile organic compounds

CO = carbon monoxide

NO_x = nitrogen oxides

PM₁₀ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers

SO₂ = sulfur dioxide

¹ Equipment/Vehicle combustion emissions includes water-supply pipeline total construction emissions from Tables 4-12.

² Portable rock crushing plant emissions are from Table 4-22.

³ Portable concrete batch plant emissions are from Table 4-23.

⁴ Earth-moving emissions are project total controlled PM₁₀ emissions from Table 4-19.

4.6.3.3 Total Air Quality Impacts of Alternative A

Table 4-25 provides a summary for Alternative A of the maximum annual PM₁₀ emissions for the mining operations and construction of the coal-slurry and water-supply system. Estimates for several years that reflect annual project emissions before, during, and after construction of the pipelines are included in this table. The timelines in Table 4-25 show that the Kayenta mining operation would continue through 2026; water-supply pipeline construction would occur from January 2008 through late 2009 (22 months); coal-slurry pipeline construction would occur from January 2008 through July 2009 (19 months); and Black Mesa with the coal-washing plant would operate 2010 through 2026.

Table 4-25 Maximum Annual Controlled PM₁₀ Emissions During and After Pipeline Construction (Alternative A)

Source	Maximum Annual Emissions (tons/year)				
	2006 ¹	2007 ¹	2008 ¹	2009 ¹	2010-2026 ²
Black Mesa and Kayenta mining operations ³	1,699	1,699	1,699	1,699	1,843
Coal-slurry pipeline	0	0	140	70	0
C aquifer water-supply system ⁴	0	0	111	63	0
Increase over existing conditions	0	0	251	133	144

SOURCE: Calculated from Tables 4-17 and 4-18 data, and Peabody Western Coal Company 2005

NOTES: PM₁₀ = particulate matter with aerodynamic diameters less than or equal to 10 micrometers.

¹ Assumes baseline emissions for Black Mesa Mine.

² Assumes Black Mesa mining operation production is 6.35 million tons per year with wash plant after 2009.

³ The projected worst case emissions for 2006 were used for years 2006 through 2009; the 2010 to 2026 emissions are the worst case year during that period, which was 2023.

⁴ The water-supply pipeline western route alternative has the highest predicted emissions.

The worst-case increase in PM₁₀ emission rates from the project is 251 tons per year and occurs during 2008, when both the water-supply and coal-slurry pipelines are under construction. This increase represents approximately 4.4 percent of total regional point source PM₁₀ emissions (projected Black Mesa Complex baseline emissions and other background sources). As described in Chapter 3, the highest annual average ambient concentration of PM₁₀ recorded between 2003 and 2005 by the monitors at the Black Mesa Complex was 37.7 µg/m³ (refer to Table 3-11), which is 75.4 percent of the NAAQS value of 50 µg/m³. Therefore, a temporary 4.4 percent increase in regional emissions would not be anticipated to cause an exceedance of the NAAQS. Consequently, the air quality impacts associated with Alternative A are considered minor.

New Source Review of new and modified facilities in areas with acceptable air quality evaluates the facilities' ability to comply with the NAAQS and the PSD increments. As described in Section 3.6, an "attainment" area is a geographic area in which existing levels of air quality have been designated by USEPA as meeting the NAAQS. An area is designated as "unclassified" if the Agency lacks sufficient air monitoring data to assign either an 'attainment' or 'non-attainment' designation to that area. The areas surrounding the Black Mesa Complex and the pipeline routes are designated as either attainment or unclassified.

4.6.3.3.1 Assessment of NAAQS Conformance

Excavation activities during pipeline construction have the potential to create transient concentrations that may exceed the NAAQS in a limited area. However, the ambient impacts of such transient emissions are difficult to model with accuracy. Mitigation measures for Alternative A would include application of water to vehicle traffic routes and excavation zones, avoidance of excavation during adverse wind conditions, use of gravel on heavier-use roadways, and limitations on vehicle speed on unpaved areas. Combinations of these measures would be used to fit local conditions. Even with such measures, it is possible that the PM₁₀ standard for 24-hour averaging periods may be exceeded close to excavation areas during periods of construction activity. These localized exceedances would not continue once the activity in a specific area is completed for that day.

The estimated emissions of PM₁₀ and other pollutants for the entire scope of pipeline construction activities are tabulated in Section 4.6.3.2. Only a small fraction of these emissions would affect any given location along the pipeline route during a single day. It is the daily emissions that more realistically reflect the PM₁₀ emission level that could affect NAAQS compliance on a localized basis.

A refined dispersion modeling analysis was performed to characterize the effects of operation of the Black Mesa Complex with the proposed coal-washing plant (McVehil-Monnett Associates, Inc. 2006). This analysis used the Industrial Source Complex (ISC3) refined model, and one complete year of representative, on-site meteorological data. Emissions inventories for PM₁₀ and NO_x were developed using emission factors endorsed by the Wyoming Department of Environmental Quality (WDEQ). Three worst case years were identified based on total Black Mesa Complex emissions and proximity to mine boundaries. Receptor points were positioned along the permit boundary of the Black Mesa Complex, at key cultural resource locations, and at residences that are assumed to remain occupied during the life-of-mine operations. Details on the emissions inventory development and modeling methodology are provided in the Air Quality Technical Support Document for the Black Mesa Project Draft EIS (McVehil-Monnett Associates, Inc. 2006).

Background concentrations, that were combined with predicted mining activity contributions, were based on several years of ambient PM₁₀ data from two monitors at locations that are relatively unaffected by man-made emissions (monitors 3R and 12, from Tables 3-11 and 3-12). Based on the ambient monitoring data described in Section 3.6.1, a background PM₁₀ concentration of 13.0 µg/m³ was determined for both

24-hour and annual averaging times. Based on accepted guidance from ADEQ for rural areas of the State, a background NO₂ concentration of 2.1 µg/m³ was used for the annual NO₂ assessment.

The ISC3 model uses a conservative methodology to estimate particulate depositions. The model is not sophisticated enough to accurately deposit particulate emissions or to determine the true wind direction. Therefore, results are expected to overestimate the impacts that would be calculated by more sophisticated methods.

The results of the refined model assessment of NAAQS conformance for Black Mesa Complex activities are summarized in Table 4-26. The maximum predicted ambient concentrations at any location along the Black Mesa Complex boundary are equal to the sum of the predicted contribution from mine sources, plus the conservative background concentrations for the area. The highest predicted boundary receptor concentrations for any modeled day at all receptors are below the NAAQS. Mining activities are ground-level emission sources, and the particulate emissions are not transported far from the source. Consequently, the predicted particulate concentrations have been shown to decrease substantially at relatively short distances outside the Black Mesa Complex boundary. Since the maximum predicted boundary concentrations are below the NAAQS, the concentrations at locations outside the boundary also would be less than the NAAQS.

Table 4-26 Assessment of NAAQS Conformance for Black Mesa Complex

Pollutant and Averaging Time	Predicted Maximum Black Mesa Complex Contribution for Analyzed Years (µg/m ³)			Predicted Total Concentration for Analyzed Years Including Estimated Background (µg/m ³)			NAAQS (µg/m ³)
	2006 ¹	2022	2023	2006 ¹	2022	2023	
PM ₁₀ ; 24-hour	85.7	84.0	101.9	98.7	97.0	114.9	150
PM ₁₀ ; Annual	28.2	33.7	35.9	41.2	46.7	48.9	50
NO ₂ ; Annual	10.6	18.2	18.9	12.7	20.3	21.0	100

SOURCE: McVehil-Monnett Associates, Inc. 2006

NOTE: ¹ Based on worst-case projection for the Black Mesa Complex

Table 4-27 shows that predicted concentrations of PM₁₀ and NO₂ from the NAAQS modeling assessment are below significant impact levels at Navajo National Monument (10 miles northwest of the Black Mesa Complex) and the Monument Valley Visitor Center (31 miles north-northeast of the Black Mesa Complex), which are the nearest sensitive Class II areas. Moreover, this dispersion analysis showed that ambient concentration contributions at or above significance levels from mining activities would not occur at any sensitive receptors or existing, major stationary sources.

Table 4-27 Assessment of Impacts From Black Mesa Complex on Local Sensitive Receptors

Receptor	PM ₁₀ Annual Impact (µg/m ³) Significance Level = 1 µg/m ³			NO ₂ Annual Impact (µg/m ³) Significance Level = 1 µg/m ³		
	2006 ¹	2022	2023	2006 ¹	2022	2023
Navajo National Monument	0.41	0.40	0.39	0.13	0.13	0.15
Monument Valley Visitor Center	0.29	0.29	0.29	0.08	0.12	0.12

SOURCE: McVehil-Monnett Associates, Inc. 2006

NOTE: ¹ Based on worst-case projection for the Black Mesa Complex

The results in Table 4-26 and Table 4-27 should be interpreted while recognizing the tendency of the ISC3 model to predict significantly greater PM₁₀ concentrations than normally observed. To better represent certain ground level sources, USEPA revised and re-evaluated the ISC3 Model only to find that “[i]n spite of the improved performance of the ISC3 model, the model significantly over predicts (as defined by the protocol) for PM₁₀ but not for TSP” (see USEPA, December, 1995. Modeling Fugitive Dust Impacts from Surface Mining Operations – Phase III, “Evaluating Model Performance”, EPA-454/R-96-002,33). Conclusions based on the predicted PM₁₀ concentrations shown in Tables 4-17 and 4-18 should account for this documented tendency of the ISC3 model to significantly over predict PM₁₀ impacts from surface coal mines.

4.6.3.3.2 Assessment of PSD Increment Consumption

The PSD increments are maximum allowable increases in ambient pollutant concentrations above a baseline level (set as the minor source baseline date) for specified averaging times. As each new source is permitted within a defined region, the amount of available increment is reduced, or “consumed,” because of the predicted changes in ambient concentrations due to the new source(s). Consumption of increment for a given pollutant and averaging time, at a given locale, is equal to the predicted ambient concentrations from operation of currently permitted sources, less the concentrations that would have occurred due to operation of the roster of emission sources present at the minor source baseline date. The PSD increments for Class I and Class II areas are provided in Table 4-28.

**Table 4-28 Class I and Class II Increments and Significance Thresholds
Applicable to PSD Permitting Projects**

Pollutant	PSD Significance Thresholds ($\mu\text{g}/\text{m}^3$)		PSD Increment ($\mu\text{g}/\text{m}^3$)	
	24-Hour Average	Annual Average	24-Hour Average	Annual Average
PM ₁₀ Class II	5	1	30	17
PM ₁₀ Class I	5	1	8	4
NO ₂ Class II	NA	1	NA	25
NO ₂ Class I	NA	1	NA	2.5

SOURCE: McVehil-Monnett Associates, Inc. 2006

The proposed physical and operational changes at the Black Mesa Complex would not result in net increases of air pollutant emissions of sufficient magnitude to trigger a PSD permitting requirement. Furthermore, with respect to permitted point source emissions only (excluding area and mobile sources) at the Black Mesa mining operations, the changes would result in a net decrease in emissions. Nevertheless, an assessment of PSD Increment consumption in Class I areas resulting from these changes was carried out, based on the refined dispersion modeling performed for the life of the mine (McVehil-Monnett Associates, Inc. 2006; Peabody 2005a, 2005b). For purposes of this EIS, comparison of the PSD significance thresholds with the predicted off-property concentrations of NO₂ and PM₁₀ resulting from the continued operation of the Black Mesa Complex was employed as an indicator of the consumption of increment in regional Class I areas.

The predicted distances to annual concentrations (due to mining activities) less than or equal to the PSD significance levels were quantified. This simulation was used to identify the maximum distance from the Black Mesa Complex boundary that increases in PM₁₀ and NO₂ concentration were predicted to be above the PSD significance levels. The assessment was based on estimated emissions of PM₁₀ and NO_x at a level corresponding to the three worst-case years used in the dispersion modeling conducted by McVehil-

Monnett Associates. Receptor points in the model were positioned in an array extending outward from the Black Mesa Complex.

The footprint, or “isopleth,” of the area where concentrations were predicted above the PSD significance levels for annual averaging times are illustrated in Map 4-3 and Map 4-4, which are extracted from the Air Quality Technical Support Document for the Black Mesa Project Draft EIS (McVehil-Monnett Associates, Inc. 2006). The predicted extent of significant concentrations appears to extend farther to the south of the Black Mesa Complex, compared to other directions due to modeled wind patterns. In the case of PM₁₀, concentrations above 1 µg/m³ can be predicted to occur as far as approximately 60 miles to the south. For NO₂, Map 4-4 shows that the maximum distance for the predicted occurrence of concentrations above 1 µg/m³ is approximately 24 miles to the south. In other directions, the significance thresholds barely are exceeded outside the Black Mesa Complex boundaries.

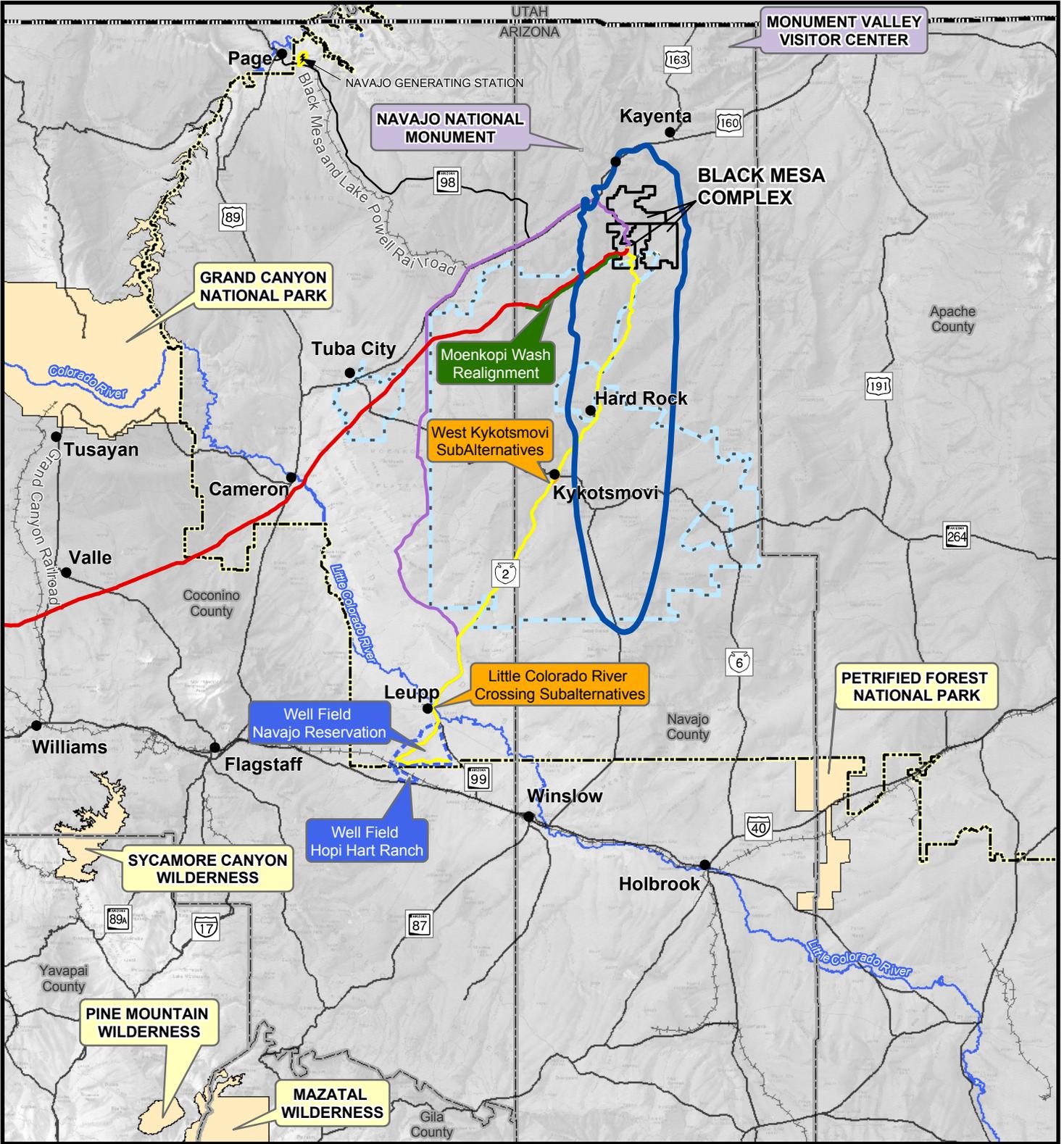
The modeling results predict that air quality impacts would not extend toward the closest sensitive areas. The Navajo National Monument and the Monument Valley areas are sensitive Class II areas located to the northwest and north-northeast, respectively, from the Black Mesa Complex. In these directions, even the very low significance threshold concentrations are predicted to not be exceeded beyond the boundary of the Black Mesa Complex.

Even in the southern direction, the maximum distances to significant concentration levels under the worst-case conditions are small in comparison to the distances from the Black Mesa Complex to other sources in the region and to Class I areas. The closest Class I area in a southerly direction from the Black Mesa Complex is the Petrified Forest National Park, which is 87 miles distant. This analysis predicts that the concentrations of PM₁₀ and NO₂ emissions from operations at the Black Mesa Complex would be insignificant within the boundaries of any Class I Areas or Class II sensitive areas, and the annual PM₁₀ and NO₂ increments would be protected within the boundaries of those Class I Areas and sensitive Class II Areas.

With respect to Class II increment consumption around the Black Mesa Complex, a different method of analysis was employed. Emissions of PM₁₀ and NO₂ from mining operations were separated into reasonable estimates of baseline emissions (those that were occurring just prior to the minor source baseline dates), and those that consume increment by virtue of occurring after the minor source baseline dates. The PM minor source baseline date was established in this area on October 31, 1977, while the NO₂ minor source baseline date was established on August 15, 1990.

Production levels and mine plans at the Black Mesa Complex have changed very little over the life of the mine to date. It is reasonable to assume that current emissions are a good estimate of the emissions that were occurring just prior to the minor source baseline date. However, a conservative evaluation would be based on the assumption that only 75 percent of current emissions existed on the minor source baseline dates. It follows that 75 percent of the predicted concentrations from the dispersion model are representative of the concentrations that would have existed at the property boundary just prior to the minor source baseline dates. These baseline emissions do not consume the increment.

From Table 4-26, the highest predicted annual PM₁₀ concentration at the Black Mesa Complex property boundary, without background concentrations, would be 35.9 µg/m³ in 2023. This concentration represents emissions from both the Black Mesa and Kayenta operations. Based on the assumptions above, 75 percent of this concentration would be considered in the baseline and not increment-consuming. Therefore, 25 percent, or 9 µg/m³ would count toward the increment. This value falls well below the annual PM₁₀ increment for Class II areas (17 µg/m³).



Prepared By:
URS

N

0 10 20
Miles

LEGEND

Coal-Slurry Pipeline

- Existing Route
- Realignments

(Existing route with realignment/reroute is the preferred alternative)

Water-Supply Pipeline

- Eastern Route (preferred alternative)
- Subalternatives (preferred alternative)
- Western Route

Air Quality Features

- PM₁₀ 1 µg/m³ Impact Contour
- Federal Class I Area
- Sensitive Class II Area

Other Project Features

- Well Field

General Features

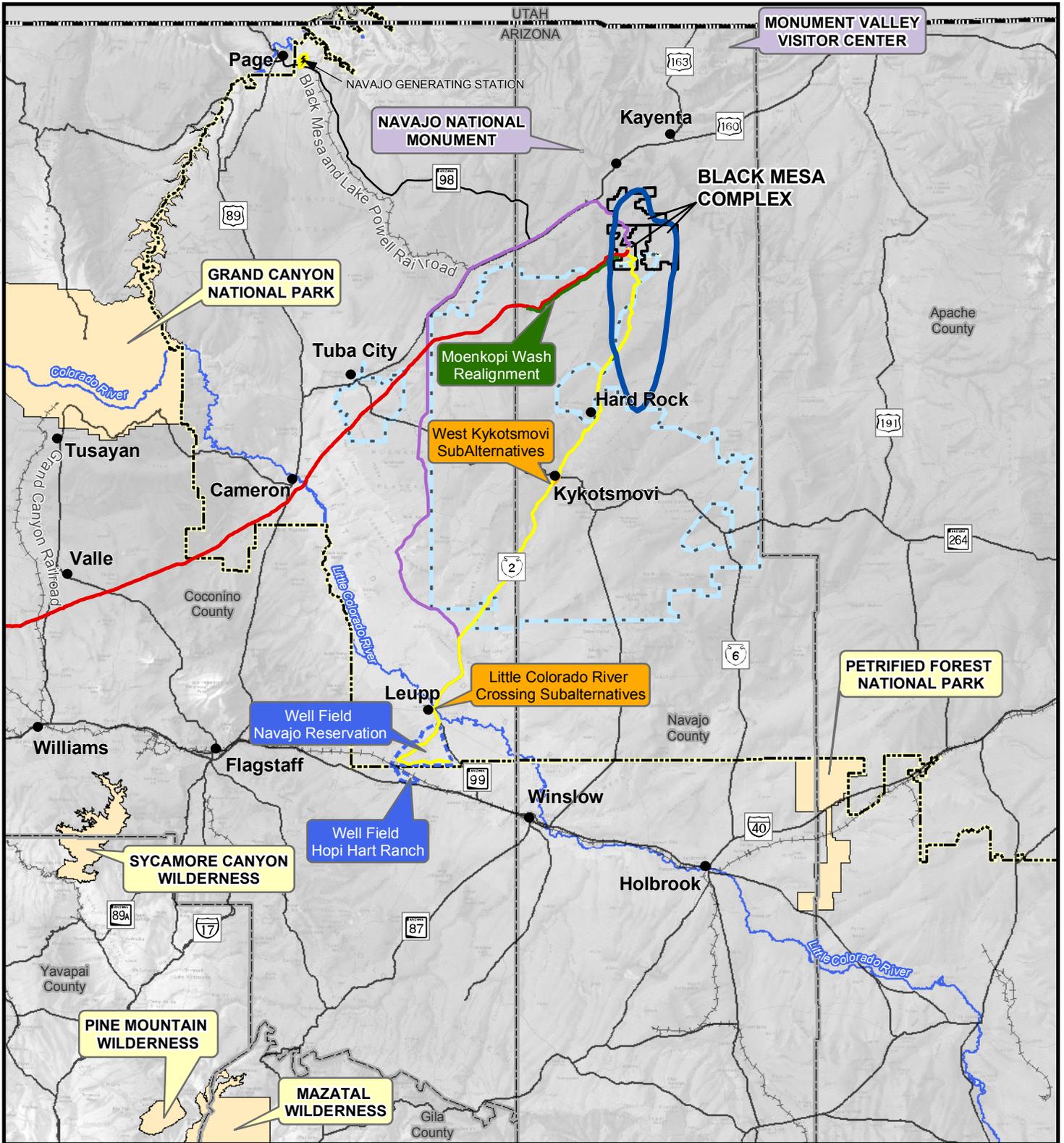
- Navajo Reservation Boundary
- Hopi Reservation Boundary
- River
- Interstate/U.S. Highway/State Route

Particulate Matter (PM₁₀) Significant Impact Area

Black Mesa Project EIS

September 2006

Map 4-3



Prepared By:
URS

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0 10 20
Miles

SOURCES:
URS Corporation 2005
McVehil-Monnett Associates, Inc. 2006
Arizona State Land Department 2005
Navajo Nation Parks and Recreation 2005

LEGEND

Coal-Slurry Pipeline

- Existing Route
- Realignments

(Existing route with realignment/reroute is the preferred alternative)

Water-Supply Pipeline

- Eastern Route (preferred alternative)
- Subalternatives (preferred alternative)
- Western Route

Air Quality Features

- NO₂ 1 µg/m³ Impact Contour
- Federal Class I Area
- Sensitive Class II Area

Other Project Features

- Well Field

General Features

- Navajo Reservation Boundary
- Hopi Reservation Boundary
- River
- Interstate/U.S. Highway/State Route

Nitrogen Dioxide (NO₂) Significant Impact Area

Black Mesa Project EIS

September 2006

Map 4-4

Using this conservative approach, it also can be seen that the 24-hour Class II PM₁₀ increment and the Class II annual NO₂ increment would be protected. Therefore, it can be concluded that Class II PSD increments will be protected in the vicinity of the Black Mesa Complex.

4.6.3.3.3 Assessment of Visibility Impacts in Class I and Sensitive Class II Areas

Class I areas are defined as those areas of the Nation that are of special natural, scenic, recreational, or historic interest to the public. The quality of scenic vistas is protected by PSD regulations that require applicants to assess the potential for visibility impairment in “mandatory” Class I areas identified within the regulations. Section 3.6.5 provides a summary of the existing visibility conditions, quantified as the standard visual range, from monitoring data at mandatory Class I areas near the study area. There are no mandatory Class I areas closer than 60 miles from the Black Mesa Complex; the closest being the eastern boundary of Grand Canyon National Park, which is approximately 74 miles distant to the west-southwest. Two nearby tribal areas, Navajo National Monument, which is generally northwest and about 10 miles distant, and the Monument Valley Visitor Center, which is approximately 31 miles to the north-northeast, were determined to be areas in which visibility also would be considered an important AQRV. Therefore, visibility impacts on these two areas also were assessed.

Assessment of visibility impacts is required for PSD permitting when mandatory Class I areas are within 60 miles of the project area. In addition, similar assessments usually are required by land managers for sensitive tribal lands and Class II wilderness areas. The project alternatives do not trigger PSD permitting. However, for purposes of this EIS, this section provides a qualitative evaluation of the potential for visible plume impacts provided for four mandatory Class I areas (Grand Canyon, Mesa Verde, Bryce Canyon, and Petrified Forest National Parks)¹ and the two sensitive tribal Class II areas closest to the Black Mesa Complex.

Pipeline construction activities have the potential to create transient, relatively high concentrations of some pollutants within a limited area in the immediate vicinity of the construction site. The distances from the pipeline routes to mandatory Class I areas and sensitive tribal lands suggest that transport of these short-term construction emissions and the ability for a viewer to see a visible plume would be negligible. Mitigation measures for the Black Mesa Complex and the two pipelines are discussed in Section 4.19; these would reduce further the potential for visible plumes at mandatory Class I or sensitive areas from either pipeline construction or continuing mine activities. The estimated emissions of PM and PM₁₀ and other pollutants for pipeline construction activities are tabulated in Section 4.6.3.2.

For purposes of this EIS, the potential for air quality effects in the form of visible plumes at mandatory Class I areas was assessed for the continued operation of the Black Mesa Complex and proposed coal-washing facility. Emissions considered as potential sources of visible plumes from the Black Mesa

¹ These four Class I areas do not represent the four closest to the Black Mesa Complex or to the air quality study area for this EIS; rather, they are the closest mandatory Class I areas for which visibility data from IMPROVE monitoring stations are available. Peabody Energy’s consultant, McVehil-Monnett & Associates, chose these four areas for analysis, pursuant to their work on the Air Quality Technical Support Document (McVehil-Monnett 2006). The Capitol Reef National Park is located approximately 38 miles north-northwest of the study area (where the study area boundary crosses the Arizona-Utah state line near the boundaries between Coconino and Navajo Counties in Arizona), and approximately 75 miles north-northwest of the Black Mesa Complex. Canyonlands National Park is approximately 68 miles north-northeast of the study area (where the study area boundary crosses U.S. 163 crosses at Arizona-Utah state line) and approximately 100 miles north-northeast of the Black Mesa Complex. IMPROVE visibility data were unavailable for the Capitol Reef and Canyonlands National Parks.

Complex are low-level releases of fugitive dust and gaseous (e.g., NO_x) emissions from vehicle tailpipes and blasting. These emissions do not emanate from a single location, rather, emissions from the Black Mesa Complex are distributed nonhomogeneously throughout eight mine areas and four preparation areas covering approximately 2 to 5 square miles (depending on the year) across a mine site encompassing nearly 100 square miles.

The assessment of visible plumes from ground-level area emission sources, such as mining activities, is not suitably addressed by conventional dispersion modeling tools. The USEPA has developed a simplified and conservative screening tool (VISCREEN) for plume visibility assessments. However, this tool was designed to evaluate impacts from single, elevated point sources. As a result, no appropriate screening level assessment approach exists for the type and distribution of sources found at the Black Mesa Complex. Mining activities tend to release larger-sized particles that are deposited to the ground a short distance from the source.

Consequently, it is more meaningful to review the meteorological and topographic influences that could affect the visibility of plumes from the Black Mesa Complex. These considerations are evaluated as follows for each of the areas of interest.

Grand Canyon, Mesa Verde and Bryce Canyon National Parks. For these distant mandatory Class I areas the prevailing local wind pattern near the Black Mesa Complex and elevation differences indicate that plumes would not be visible. As described in Peabody's Technical Support Document, the winds near the Black Mesa Complex are predominantly from the north, which would tend to prevent transport of a visible plume toward the east, north, or west. The elevations of intervening plateaus to the west and southwest of the Black Mesa Complex generally 6,000 feet above MSL, but the terrain slopes down to 4,000 feet above MSL or less closely to the eastern boundary of the Grand Canyon National Park (46 miles west of the Black Mesa Complex). The more-distant Bryce Canyon National Park, (150 miles northwest of the Black Mesa Complex), is on the gradual plateau upslope on the opposite side of the Colorado River valley, at an elevation of nearly 7,500 feet above MSL. Near Mesa Verde, (120 miles northeast of the Black Mesa Complex), the elevation increases dramatically just to the west of the park, creating a topographic barrier.

Petrified Forest National Park. This mandatory Class I area is 87 miles south-southeast of the Black Mesa Complex. Although the local winds would tend to transport a plume in this direction, the distance to the park and the elevations of intervening plateaus indicate that a visible plume would be unlikely. Several plateaus to the south of the Black Mesa Complex are above 6,000 feet above MSL, compared to the prevailing park elevations at about 5,500 feet above MSL or below.

Navajo National Monument and Monument Valley. These two sensitive Class II areas are 10 miles northwest and 31 miles north-northeast of the Black Mesa Complex. The prevailing local winds would tend to prevent transport of a visible plume in the direction of these sensitive areas.

4.6.4 Alternatives B and C

There are no emission increases associated with Alternative B or Alternative C.

4.6.5 Fugitive Dust and Health-Related Issues

During scoping, a concern was raised about asthma and black lung.

Asthma is a disease that affects the breathing passages (bronchi) of the lungs. Asthma is caused by chronic inflammation of these passages. Consequently, bronchioles of persons with asthma are highly sensitive to various internal and external "triggers." An asthma attack is a reaction to a trigger, much like

an allergic reaction. When an asthma attack is triggered, the bronchioles swell and fill with mucus, narrowing the airway. Sometimes, muscles within the breathing passages contract, further narrowing the airway. This narrowing makes it difficult for air to be breathed out (exhaled) from the lungs.

The exact causes of asthma are not known. What all people with asthma have in common is chronic airway inflammation and excessive airway sensitivity to various triggers. Some people are born with the tendency to have asthma, others are not. Scientists are trying to identify the genes that cause this tendency. Each person with asthma has his or her own unique set of triggers. Common triggers among sensitive persons include exposure to tobacco and wood smoke, inhaling airway irritants such as perfumes and cleaning products, exposure to allergens such as molds and animal dander, exposure to cold, dry weather, an upper respiratory infection such as a cold, emotional stress, stomach acid reflux disease, and sulfites (an additive to some foods and wine) (Merck Research Laboratories 2005a).

Based on the foregoing, it is difficult to establish, scientifically, a direct link between air pollution sources and elevated incidence of asthma in a local population. The best indicator available to assess air pollutant concentrations is the NAAQS established by the USEPA to protect human health and welfare. The ambient PM₁₀ concentrations monitored in the area surrounding the Black Mesa Complex (refer to Section 3.6.1) comply with the long-term (chronic exposure) NAAQS.

Black lung is the disease caused by prolonged inhaling of coal-mine dust in proximity to the source. Only the smallest dust particles make it past the nose, mouth, and throat to the aveoli, or air sacs, deep in the lungs. The aveoli, located at the ends of the bronchioli, are responsible for exchanging gases with the blood. Macrophages, a type of blood cell, collect foreign particles and carry them to where they can be expelled (coughed out or swallowed). If too much fine dust is inhaled over an extended period of time, some particles and dust-laden macrophages collect permanently in the lungs. The aveoli walls become weakened and less elastic after years of cleaning out dust deposits, which leads to emphysema. Lung tissue and blood vessels on the lungs may become scarred by the dust particles, which reduces the amount of oxygen that the lungs can transfer into the blood stream, obstructing airflow, and causing chronic bronchitis (Merck Research Laboratories 2005b; U.S. Department of Labor, Mine Safety and Health Administration [MSHA] 2005b; The Courier-Journal 2005).

Black lung is prevented by adequately suppressing coal dust at the work site. Enforcement of maximum permitted dust levels in occupational settings is a preventive measure used to minimize exposure to coal dust. In 1969, standards for coal dust and other safety measures were first set when Congress passed the Federal Coal Mine Safety and Health Act, which set dust levels per meter of air and established the MSHA within the Department of Labor to monitor safety and health levels of mines. MSHA mandates a program to ensure worker safety. This includes proper safety gear, use of respirators where warranted, maintaining a dust-suppression system, and conducting ongoing worker training including a mandatory 8-hour annual refresher course. MSHA also conducts a periodic dust-sampling program where workers are provided with a monitor to wear during their shifts. The samples are analyzed to ensure that workers are being protected. The ambient PM₁₀ concentrations monitored in the area of the Black Mesa Complex indicate that the public is not exposed to short-term (24 hours) or chronic (annual) concentrations at levels that present a risk of black lung.

The Black Mesa Complex has an extensive fugitive dust suppression program. Respirators are mandatory for workers in certain areas, which include drillers, mobile equipment operators, welders, and workers at the coal-preparation facilities. Protective mechanisms include pressurized cabs on vehicles and heavy equipment that have air-conditioning systems that filter the air and keep dust from coming into the cab. Cabs are sealed around the doors and windows. Drills have dust skirts and dust-controlling devices (Dunfee 2006).

4.6.6 Acid-Deposition Effects Due to Mining Activities

A potential issue that was identified during the scoping comment phase of this EIS was the possibility that emissions from diesel-engine driven vehicles and mining equipment at the Black Mesa Complex, or along the pipeline route during construction, could cause acid-deposition impacts. Engine tailpipe emissions do contain relatively small concentrations, (on the order of 10 to 100 ppm) of NO_x and SO₂, which are precursors of acid deposition. However, consideration of the physical and chemical processes for acid deposition support the conclusion that this phenomenon would not result from engine emissions.

Two processes must occur to form “acid rain.” First, concentrations of NO_x and SO₂ from an emission source are converted in the atmosphere to soluble chemical forms. Second, the acidic reaction products must be transported at a sufficiently high elevation to be absorbed in rain droplets. The dispersion of engine exhaust plumes, in contrast, do not create the conditions that can result in acid deposition. Tailpipe exhaust streams are expelled at high velocity, which promotes rapid dispersion close to the ground. Both the effects of surface wind currents, and the movement of the vehicles, promote rapid dispersal of the exhaust within relatively few meters of the exhaust point. Consequently, the conversion of NO_x and SO₂ to a soluble form is impaired. Even if the reactions could occur, vehicle exhausts cannot be transported to sufficiently high elevation to be absorbed in rain droplets.

A quantitative, screening-level assessment of acid deposition due to Black Mesa mining operations at the closest mandatory Class I areas resulting from the Black Mesa Complex was performed for purposes of the EIS. The nitrogen deposition rate was estimated from annual average concentrations based on a technique presented in IWAQM (Interagency Working Group on Air Quality Models, USEPA, December 1998).

Table 4-29 presents the calculated dry deposition of HNO₃, which serves as an indicator of the potential for deposition effects at each of the closest Class I areas. Significance criteria recommended by the Forest Service for terrestrial sulfur and nitrogen atmospheric deposition consist of an acceptable range of 3 to 5 kilogram per hectare per year (kg/ha-yr) for total nitrogen. Since the Black Mesa Complex is located in semi-arid region, the dry deposition estimates shown in Table 4-29 are appropriately compared to the 3 to 5 kg/ha-yr range for total nitrogen. The maximum estimated dry deposition of nitrogen for three modeled years (2006, 2022, and 2023) ranges from 0.10 (2022 and 2023) kg/ha-yr at Bryce Canyon National Park to 3.74 kg/ha-yr (2022 and 2023) at the Petrified Forest National Park. Therefore, maximum nitrogen deposition at each of the four Class I areas are within or below the range of acceptable deposition rates.

Table 4-29 Acid (HNO₃) Deposition Contributions From Black Mesa Complex

Class I Areas	Approx. Distance to Class I Areas (km)	2006		2022		2023	
		Maximum NO ₂ Annual Concentration (µg/m ³)	Calculated Dry Deposition of HNO ₃ (kg/ha-year) ¹	Maximum NO ₂ Annual Concentration (µg/m ³)	Calculated Dry Deposition of HNO ₃ (kg/ha-year) ¹	Maximum NO ₂ Annual Concentration (µg/m ³)	Calculated Dry Deposition of HNO ₃ (kg/ha-year) ¹
Petrified Forest National Park	145	0.052	1.13	0.173	3.74	0.173	3.74
Mesa Verde National Park	155	0.014	0.30	0.072	1.55	0.072	1.56
Grand Canyon National Park	120	0.050	1.08	0.013	0.28	0.013	0.28
Bryce Canyon National Park	190	0.032	0.70	0.010	0.21	0.010	0.21

SOURCE: McVehil-Monnett Associates, Inc. 2006

4.6.7 Federal Implementation Plan Conformity (Navajo Nation)

A typical consideration for projects that would have total emissions above major source thresholds is conformity with applicable implementation plans for the locale. In general, the conformity assessment consists of determining whether the proposed project would cause or contribute to nonattainment of NAAQS, and verifying that emissions from the project have been considered in establishing the emission inventory in the implementation plan.

In general, a conformity analysis is usually only performed if the proposed project occurs within a designated non-attainment area. Furthermore, a conformity determination is usually not required unless the proposed project will emit more than a *de minimis* (negligible) threshold amount per year established for each of the criteria pollutant for which the area has been designated non-attainment. All portions of the project location and the air quality study area located within Arizona, including the Navajo Nation, are classified as attainment, with respect to the NAAQS (see discussion in Section 4.6.8, below).

A portion of the study area is encompassed within the Navajo Nation, for which a Federal implementation plan exists for certain criteria pollutants. The emissions of the project alternatives have been considered in the development of the Federal implementation plan. The operation of the Black Mesa Complex predates the development of the Federal implementation plan, and emissions related to this operation would not increase by a significant amount for the continued operation of the mines and proposed coal-washing facility. Consequently, a complete Federal implementation plan conformity analysis is not warranted for the project alternatives.

4.6.8 State Implementation Plan Conformity (Arizona, California and Nevada)

A small portion of the proposed project (terminus of the coal slurry pipeline at Mohave Generating Station) is located within Clark County, Nevada, which is classified as a nonattainment area for the 8-hour ozone NAAQS. Emissions of ozone precursor compounds (NO_x and VOC) would only occur as a result of temporary vehicle and equipment operations in a relatively small area and are not anticipated to exceed the *de minimis* threshold of 100 tons per year. Therefore, there is no requirement to conduct a conformity analysis for the Clark County ozone nonattainment area.

Although the proposed project activity does not extend into California, a small portion of the 31-mile study area extends into the San Bernardino PM₁₀ nonattainment area. As discussed previously, fugitive dust emissions from earth-moving activity are emitted at ground level, tend to consist of coarser particles and do not migrate a significant distance from the source. Therefore, no particulate emissions would be expected to occur within this nonattainment area and no conformity analysis is required.

As stated previously, none of the portions of the study area in Arizona are classified as nonattainment for any NAAQS pollutant. Therefore, there is no requirement to conduct a conformity analysis for the portion of the study area within Arizona.

4.7 VEGETATION

The analysis includes a description of effects on plant community structure and composition in order to provide a context for discussing the impacts on vegetation, and also addresses potential impacts on riparian and wetland vegetation. The study area for upland vegetation includes areas that would be affected directly by ground disturbance, plus a 0.5-mile buffer to address noxious weeds. The region of influence for riparian, wetland, and aquatic vegetation includes drainages that may be affected by changes in flow or release of sediment, and vegetation that may be affected by localized groundwater withdrawal.

Impacts Common to All Alternatives. The primary impact on vegetation would be physical removal of plants in construction and mining areas. All areas where vegetation is removed by mining or construction would be revegetated. The Black Mesa Complex has a detailed revegetation plan, summarized in Appendix A-1. Monitoring of revegetation success is conducted twice a year, and an annual monitoring report is produced, such as ESCO Associates and Peabody (2005) for 2004 vegetation monitoring. Revegetation plans for the pipelines and well-field facilities have not been developed at this time but would be developed in coordination with the appropriate land-managing agencies at the time that the construction, operation, and maintenance plans are prepared prior to construction. Revegetation generally would consist of establishing grasses and shrubs in impacted areas. In the Black Mesa Complex, most of the revegetation species are native, but several non-native grass and forb species are used. Small portions of the mine would be planted with piñon, juniper, and other trees. Since one of the goals of mine revegetation is improved grazing, much of the Black Mesa Complex revegetation area is likely to be maintained in grassland and shrubland over the long-term, while smaller areas would develop by natural succession into woodland and shrubland to support wildlife and to provide culturally important plant species.

Natural succession is likely to be quicker along the pipeline rights-of-way because it is narrow and has a relatively large edge-to-area ratio. The revegetated surface initially would be dominated by the seeded species, other species that become established from seed banks, and weedy opportunistic species, but in time generally would have a composition similar to native communities through the process of natural succession and dispersal of plants from undisturbed areas. Plants that are adapted to shallow bedrock and steep topography are unlikely to re-establish because the construction and ground-surface preparation process generally would result in more uniform soils and gentler topography than native conditions. Differences between pre-disturbance and post-reclamation plant community composition may persist indefinitely where the substrate is substantially different than the predisturbance conditions.

The consequences of vegetation removal and subsequent revegetation may be short or long term, depending on the extent of impact, nature of the affected plant community, and relative success of revegetation. Plant communities that are dominated by trees would take longer to reach predisturbance conditions than other communities; piñon and juniper trees would take 50 or more years to reach mature size, even where they re-establish early in the revegetation period. Loss of mature trees would affect the ecological functions and uses of native plant communities. For example, removal of dense woodland would be beneficial for livestock forage production and open country birds but detrimental to wildlife species adapted to woodland or that use trees for cover, foraging, or nesting. Shrublands typically would take less time to re-establish, 10 to 20 years, and grasslands would take the least time, 3 to 5 years under good conditions.

Revegetation and natural succession would likely take longer and to be less successful in areas that have limitations such as extreme aridity, soil salinity, poorly developed soils, and highly erosive soils. While all of the affected areas have relatively low precipitation, re-establishment of vegetation is expected to be most successful at higher elevation areas now covered by plains and Great Basin grassland or piñon/juniper woodland. The most difficult areas to reclaim would be the Mohave desertscrub west of the Black Mountains on the coal-slurry pipeline, and Great Basin desertscrub at lower elevations on the Hopi and Navajo Reservations on the coal-slurry and water-supply pipelines. Special reclamation techniques (e.g., soil manipulation, hand seeding) may be needed in these areas.

Various construction activities have the potential to increase the abundance of existing noxious weeds or to introduce new noxious weeds into the project area. These activities include mobilizing and movement of construction vehicles, excavation and movement of topsoil, land clearing, and reclamation. Removing existing vegetation and disturbing soils would encourage germination of seed already present and allow

spread of weeds from airborne seeds. Weeds that are currently established may spread through disturbed areas, or new weeds may be introduced and become problematic. After construction, noxious weeds can persist or spread. Noxious weeds that establish in construction areas and along rights-of-way may spread into adjacent lands, resulting in degradation of habitat quality, and decreased productivity and increased management costs for agricultural activities including grazing.

Additional indirect construction-related impacts could include soil compaction, disruption of microphytic crusts, and an increased potential for wind and water erosion of disturbed surfaces. Soil erosion and compaction can impede the establishment of new vegetation, reduce vegetative cover and productivity, and have long-term effects on vegetation structure and composition in affected areas. The Black Mesa Complex has an extensive program of sediment ponds and other practices to control erosion. Erosion- and sediment-control practices are described in the soils section.

There are no known wetlands in the footprint of any of the facilities, and impacts on this resource are not discussed further.

4.7.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.7.1.1 Black Mesa Complex

Upland Vegetation. Mining operations, from January 1, 2006 into 2026, would result in disturbance of 13,529 acres of vegetation. The acres of vegetation types that potentially would be affected by mining are presented in Table 4-30.

Table 4-30 Approximate Acres of Vegetation Types Potentially Affected by 2006-2026 Mining Operations

Vegetation Type	Total Acres	Percent of Total Acres
Piñon/juniper woodland	8,564	63.3
Sagebrush	4,221	31.2
Saltbush	67	0.5
Greasewood	5	0.2
Revegetated land	271	2.0
Previously disturbed land	379	2.8
Tamarisk (riparian shrub)	2	0.0
Total	13,529	100.0

The short-term effects of mining would be major, due to the amount of native vegetation that would be affected. Large areas of piñon/juniper woodlands would be removed and, during reclamation, these areas would be converted to a mixture of grasses and shrubs. The vegetation plan includes establishment of general purpose rangeland for grazing, key shrubland and woodland habitat areas for wildlife, and cultural plant sites (Table F-2 in Appendix F). The standard rangeland seed mix includes some 21 species, consisting of cool-season and warm season grasses, forbs, and shrubs. Fifteen of the species are native and six are introduced, including two cool-season grass species, one shrub, and three forb species. Shrubland and woodland planting areas would be established on selected sites including ponds, ridgelines, drainage bottoms, hill slopes, and as islands within reclaimed areas. Vegetation would be established in these areas using both planting and seeding and would be designed to favor the establishment of trees and shrubs by including grasses and forbs that are compatible with shrubs. Development of cultural plant sites would be similar to establishment of key habitat areas, and is intended

to develop sites on more mesic aspects and coarse-textured soils similar to native areas supporting piñon/juniper and many cultural species.

With the inclusion of the key habitat areas and cultural plant sites, effects on plant species diversity are expected to be minor. The postmining uses of the reclaimed areas would be similar to premining uses, including production of forage for grazing, wildlife habitat, and collection of culturally important plants.

Culturally Important Species. Peabody, in consultation with the Hopi Tribe and Navajo Nation, has developed a list of more than 120 culturally important plants at Black Mesa, based on published ethnobotanical studies and contacts with medicine men, herbalists, and residents of Black Mesa (refer to Table F-2 in Appendix F). Establishment of culturally important plants would focus on about 60 of these species that are more common in use, have broad application for a variety of uses, or which were identified as particularly important. Peabody has developed an intensive nursery program to produce seedlings of these species for planting. Ten of the species in the standard rangeland mix are culturally important, and all of the tree and shrub species in the planting program are culturally important. A specific cultural plant mix of 10 to 15 species would be seeded in the cultural plant sites, and seedlings from the nursery project would be planted in selected sites.

With the implementation of the proposed mitigation program, impacts on culturally important plant species would be moderate in the short term and minor to moderate in the long term. Long-term impacts on common species would be considered minor for species that are successfully re-established and moderate for those that are difficult to re-establish. No impacts on uncommon or rare culturally important species have been identified. It should be noted that the availability of many perennial forbs is limited in premining native plant communities due to intensive grazing. Perennial forb cover is no more than 0.8 percent in the premining sagebrush type and 0.1 percent in piñon/juniper woodland (ESCO Associates 2003).

Riparian Vegetation. Riparian vegetation occurs on major drainages within the permit area and downstream, and consists mostly of tamarisk (saltcedar). Although tamarisk is an invasive species and has a lower habitat value than native species, it can be important for migrating birds (Yong and Finch 2002). Riparian vegetation is supported primarily by water stored in alluvial aquifers and intermittent stream flows that recharge the aquifers. A number of past and present activities have the potential to affect riparian habitats within and downstream of the mine permit area, including the construction of roads, dams, and sediment ponds. Dams and sediment ponds may affect downstream habitat by reductions in surface flow, interception of recharge to alluvial aquifers, and truncation of alluvial aquifers (for dams built to bedrock). These in turn may affect stream baseflow, channel characteristics, and spring discharge downstream.

Direct impacts from mining could affect about 2 acres of riparian shrub (tamarisk). Planting of willow and cottonwoods at some ponds could replace and improve the lost habitat. Short-term impacts would be minor and long-term impacts would be negligible.

As of January 2002, the total watershed draining to dams and impoundments in the permitted area was 4.2 square miles in the Dinnebito Watershed and 62.8 square miles in the Moenkopi Watershed (Peabody 2004). These represent 0.5 and 2.4 percent, respectively, of the total watershed area. The areas affected would be increased during the LOM mining to 0.7 and 2.8 percent, respectively, and reduced back to 0.47 and 2.2 percent after final reclamation. Because the mine area is high in the watershed and receives more precipitation than lower elevation areas, the amount of runoff intercepted is estimated to be about 1.7 percent of the average annual runoff of Dinnebito Wash basin and 6.1 percent of Moenkopi Wash basin, for the LOM, and 1.0 and 4.8 percent after final reclamation. For the portions of the watersheds

within the mine permit area, a higher proportion of runoff would be intercepted at the mine permit boundary—12 percent of Dinnebito Wash and 29 percent of Moenkopi Wash. These reductions in water availability could affect several miles of stream channel from the boundary until the next major downstream tributary, and could result in local reductions in riparian vegetation. However, monitoring of alluvial aquifer levels at the mine has shown negligible effects of impoundments on alluvial water levels. Overall effects on riparian vegetation would be negligible.

Noxious Weeds and Invasive Species. Peabody does not have a written noxious weed management plan, but does undertake weed control in revegetation areas and around other facilities. Maintenance and management of revegetated areas includes weed management when needed (Peabody 2004a). Weed infestations have not been a significant problem to date, and no weed infestations have developed that interfered with rangeland revegetation. Weedy plants (that are not listed as noxious weeds) are common in the early stages of revegetation, but typically decrease to become a minor component of a revegetated area after about 5 years. Proper timing of tillage during seedbed preparation and use of native grass hay for mulch have a significant role in reducing establishment of weeds. If nonlisted weeds comprise more than 40 percent of vegetation cover in a rangeland revegetation area for two consecutive years, weeds would be controlled by mowing. If problems persist, the area would be tilled and reseeded, and herbicides may be used prior to reseeding. Listed noxious weeds are controlled in compliance with Federal and tribal noxious weed requirements. Peabody controls weeds around shops and other facilities, and sprays roadsides to control diffuse knapweed and prevent its spread into revegetation areas (Pfannenstiel 2005). Based on use of these preventative and control measures, impacts from noxious weeds are assessed as minor.

Threatened, Endangered, and Special-Status Species. Mining would have no effect on any other threatened, endangered, or special-status plant species, because there are no other species that are known to occur on the Black Mesa Complex.

Coal-Washing Facility. The facility would occupy about 2 acres of sagebrush or reclaimed land. It would be dismantled and the land would be reclaimed and revegetated upon cessation of mining, using the same methods as previously described for the mining operations. Only a small area would be affected, with minor impacts on vegetation. Weeds would be controlled around the facility, and impacts of noxious weeds would be minor. Construction and operation of the facility would have no effect on any threatened, endangered, or special-status plant species.

Coal-Slurry Preparation Plant. This facility already exists and there would be no construction impacts. The plant would be dismantled and the land would be reclaimed and revegetated upon cessation of mining, using the same methods and success criteria as described for the Kayenta mining operation in the revegetation plan (Peabody 2004). Weeds would be controlled around the facility, and impacts of noxious weeds would be minor. Operation of the plant is not likely to have an effect on any threatened, endangered, or special-status plant species.

Coal-Haul Road. Construction of the coal-haul road would disturb about 127 acres of piñon/juniper woodland. Impacts would be the same as described for other areas of piñon/juniper woodland, and the haul road would be revegetated when the road is no longer needed using procedures described for the mining operations above. Disturbances from construction of the coal-haul road would increase the potential for the limited invasion and establishment of noxious weed species. Preventative and control measures are the same as described for the mining operations, and impacts are expected to be minor. Construction and use of the coal-haul road would have no effect on any threatened, endangered, or special-status plant species.

4.7.1.2 Coal-Slurry Pipeline

4.7.1.2.1 Coal-Slurry Pipeline: Existing Route

Upland Vegetation. Most of the 65-foot-wide construction right-of-way would include the right-of-way previously disturbed for construction of the original coal-slurry pipeline, which was typically 50 feet wide, but ranged up to 100 feet or more in difficult terrain. Most of the new disturbance would occur within previously disturbed areas. Since 35 years have elapsed since the original construction, the vegetation in much of the operational right-of-way is similar to that of adjacent undisturbed areas, except for a mostly two-track access road within the right-of-way. The exception is in areas occupied by piñon/juniper woodland, where most of the operational right-of-way is dominated by grassland species. Piñons, junipers, and some shrub species are common in portions of the right-of-way, but typically have lower density and much lower canopy cover than in adjacent undisturbed areas.

During construction, woody vegetation would be cut to ground level in all of the right-of-way, and portions of the right-of-way would be graded to create a suitable work surface for construction. Most of the existing above-ground vegetation would likely be destroyed or damaged by construction. Plant root systems and soil seed banks would mostly remain intact except in the trench, where soil seed banks would be replaced by topsoil salvage.

The acres of vegetation types that potentially would be impacted from construction are presented below in Table 4-31.

Table 4-31 Acres of Vegetation Types Potentially Affected – Coal-Slurry Pipeline: Existing Route

Vegetation Type	Area Affected (acres)		
	Existing 50-Foot-Wide Operational Right-of-Way	New 15-Foot-Wide Construction Right-of-way Adjacent to Existing Right-of-Way	Total
Piñon/juniper woodland		190	190
Grassland vegetation in existing right-of-way within mapped piñon/juniper	634		634
Plains/Great Basin grassland	448	134	582
Great Basin desertscrub	234	70	304
Desert grassland	92	28	120
Mohave desertscrub	192	58	250
Urban/industrial	52	16	68
Tamarisk	2	1	3
Total	1,654	497	2,151

Construction would affect more than 2,100 acres, including about 500 acres of land not disturbed previously by some ground-disturbing activity. This would be a major short-term impact. The proposed pipeline is adjacent to an existing Questar pipeline for about 27 miles west of the Navajo Reservation, and the “new” disturbance would likely be in the previously disturbed Questar pipeline right-of-way. Therefore, the area of disturbance to piñon/juniper woodland could be about 50 acres less than indicated, and would be considered a moderate long-term impact from construction. There would be no impacts on vegetation associated with work at the four existing pump stations.

BMPI would revegetate the construction area as part of construction activities, and specific information on proposed revegetation would be incorporated into the construction, operations, and maintenance plan once design and engineering for the pipeline have been completed. Impacts on vegetation from construction would be major, but long-term impacts would be minor, except for long-term loss of piñon/juniper woodlands, which is considered moderate. Impacts on vegetation diversity would be negligible to minor in all areas, over both the short and long term. Most of the noxious weed species currently present in undisturbed habitats could be expected to reoccupy the right-of-way, either through regrowth, revegetation seeding, or dispersal of seeds from adjacent areas along the relatively narrow right-of-way. The integrated noxious-weed management plan that would be prepared prior to construction, would include measures to prevent the spread of noxious weeds during construction and reclamation, and as part of right-of-way maintenance.

In the unlikely event of a pipeline failure, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would automatically close, and the flow of coal slurry would stop (Appendix A-2). The volume of coal slurry released to the surface would depend on the location of the leak on the pipeline (top of the pipe versus bottom of the pipe), and the terrain where the leak occurs (a flat location versus on a slope). Using historical data on Black Mesa coal-slurry pipeline releases, BMPI estimates that the amount of slurry released may range from an average of 100 cubic yards (or less) to a maximum of about 565 cubic yards. The maximum coal slurry would cover approximately 0.7 acre with 6 inches of nontoxic fines, while the fresh water in which the coal is entrained would soak into the ground. Typically, the slurry would leak to the surface and flow in a narrow meandering path, the direction and length of which would depend on the terrain. The release could result in some erosion, but generally would be confined to a local area. The impact would be short term and negligible to minor. If the volume of the release was sufficient to warrant mechanical removal of the coal, the potential damage to vegetation and soil caused by the removal of the deposit may outweigh the benefit of removing the coal. This would have to be determined by the appropriate agency and/or landowner and BMPI on a site-specific basis.

Culturally Important Species. Impacts on culturally important species are likely to be minor. The pipeline alignment is relatively narrow and crosses through typical habitats of the Colorado Plateau. It is unlikely that construction would adversely affect culturally important species that are rare and/or not common. More common species would be affected, but reductions in population size and availability generally would be minor.

Riparian Vegetation. About 3.2 acres of tamarisk would be variously affected along portions of Moenkopi Wash, Begashibito Wash, and the Little Colorado River. These areas are expected to recover relatively quickly after construction, and impacts would be negligible.

Noxious Weeds and Invasive Species. Construction of the coal-slurry pipeline has the potential to introduce or spread noxious weeds across a wide area of northern Arizona. BMPI currently has no weed management plan, and observations of the right-of-way suggest that recent construction may have introduced or spread noxious weeds in one portion of the pipeline route. BMPI would be required to prevent and control impacts from noxious weeds on Federal lands, and is required under State law to prevent the spread of state-listed restricted pests. An integrated noxious-weed management plan would be developed and implemented, and impacts would be minor.

Threatened, Endangered, and Special-Status Species. Several special-status species may occur along the coal-slurry pipeline route and realignments, based on known distributions and presence of suitable habitat. Individuals of these species could be present within or adjacent to the construction area, and could be destroyed or damaged during construction. There have been no recent field surveys for these species

along the pipeline route or realignments. However, surveys would be conducted prior to construction to identify specific areas and site-specific mitigation.

Four Navajo-listed species (Peeble's blue star, Parish's alkali grass, round dunebroom, and Beath milkvetch), one federally listed species (Welsh's milkweed), and one Federal candidate species (Fickeisen plains cactus) have the potential to occur along the route on the Navajo Reservation. These plants could be destroyed or damaged by construction activities. Impacts could vary from minor to major, depending on the number of plants affected and the status of the species. Although most of the area that would be disturbed by construction would be within the existing pipeline right-of-way, it is possible that at least some of these plants could have become re-established in the 35 years since the previous disturbance. The Navajo Nation requires clearance surveys prior to construction for Navajo Endangered Species List Group 2 and 3 species, including Welsh's milkweed and Fickeisen plains cactus. If Welsh's milkweed is found, formal Section 7 consultation would be required under the Federal Endangered Species Act. If other Navajo endangered species are found, appropriate mitigation would be developed in consultation with the Navajo Nation. Mitigation may include avoidance of individuals on the edges of the right-of-way, use of temporary fencing to protect plants adjacent to the construction area, transplanting, and salvage of soil seed banks. With application of these mitigation measures, impacts would likely be negligible to minor.

One Forest Service sensitive species is known to occur along the alignment within Kaibab National Forest. Tusayan rabbitbrush was observed to occur both within and adjacent to the right-of-way during a field reconnaissance in October 2005, and may occur at additional locations along the alignment. This species is adapted to light-to-moderate disturbance (Johnson 2006). Construction of the new pipeline could destroy plants within the construction area if present, but lightly to moderately damaged plants may resprout. In addition, new plants are likely to become re-established in the disturbed area. Thus, construction and operation of the pipeline is not expected to have adverse long-term impacts on this species. Impacts on local populations would be moderate in the short-term, and minor to negligible in the long term. The Forest Service would require an evaluation of areas of occurrence in the right-of-way, but not detailed surveys (Johnson 2006).

One BLM sensitive species—two-color beardtongue—may occur along the alignment in the Black Mountains and Sacramento Valley. The BLM would require preconstruction clearance surveys for sensitive species. If sensitive species are found, appropriate mitigation would be developed, such as those listed above for Navajo endangered species. Impacts would be negligible to minor.

Only two special-status species have the potential to occur on private and State Trust Lands because of the elevation and suitability of habitats where these lands occur: Tusayan rabbitbrush (in areas adjacent to Kaibab National Forest) and chalk live forever (in desert areas along the Nevada portion of the route). Impacts on these species would be minor, if present.

Under the Arizona Native Plant Law, BMPI would be required to notify the Arizona Department of Agriculture prior to construction activities that would affect protected native plants on non-Indian lands. Protected native plants are uncommon to rare along much of the pipeline alignment, except in the Mohave desertscrub and desert grassland vegetation types. The BLM, Kingman Field Office, would require the salvage of such plants—for example, cacti, yuccas, and agaves—prior to construction, and subsequent transplantation back into the right-of-way during revegetation. This mitigation would occur on about 17 miles of BLM land crossed by the alignment, including areas south and east of Kingman in desert grassland, as well as Mohave desertscrub in the Black Mountains and west to the Colorado River.

4.7.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignment (Agencies' Preferred Alternative)

Impacts on vegetation would be similar to those described for the existing alignment, but there are some differences in the acreage of affected plant communities (Table 4-32). The preferred alignment would affect about 50 acres more piñon/juniper woodland and desert grassland, about 45 acres less grassland in the existing right-of-way, and 50 acres less urban/industrial land. The amount of impact on riparian vegetation in Moenkopi Wash is not known, but probably would be similar to the existing route. The existing route with realignments is slightly longer and would affect about 2,159 acres, 8 more than the existing route. Most of the affected area was disturbed during the construction of the original pipeline, but about 790 acres would be new disturbance adjacent to the existing route or realignments, about 300 acres more than with the existing route. The BLM requirement for salvage of protected native plants would be applied on lands administered by the BLM along the Kingman reroute.

Table 4-32 Acres of Vegetation Types Potentially Affected – Coal-Slurry Pipeline: Existing Route with Realignments

Vegetation Type	Area Affected (acres)			Total
	Existing 50-Foot-Wide Permanent Operational Right-of-Way	New Temporary 15-Foot-Wide Construction Right-of-Way	New 50-Foot-Wide Permanent Right-of-Way on Realignments	
Piñon/juniper woodland	0	190	3	193
Grassland vegetation in existing right-of-way within mapped areas of piñon/juniper	632	0	0	632
Plains/Great Basin grassland	446	135	3	583
Great Basin desertscrub	235	70	0	305
Desert grassland	65	40	67	172
Mohave desertscrub	93	59	103	255
Urban/industrial	12	4	0	16
Tamarisk	2	1	0	3
Total	1,485	499	176	2,159

4.7.1.3 Project Water Supply

4.7.1.3.1 C Aquifer Water-Supply System

4.7.1.3.1.1 Water Withdrawal

Under the 6,000-af/yr and 11,600-af/yr pumping alternatives, the area of groundwater drawdown of 0.1 foot or more would include the Little Colorado River from about Winslow downstream to below Leupp. Riparian vegetation (mostly tamarisk) is present along the Little Colorado River in this area. However, except for a relatively small area around Winslow, the Little Colorado River is separated from the C aquifer by the relatively impermeable Moenkopi Formation. Pumping would have negligible impact on riparian vegetation along the Little Colorado River in this area.

The C aquifer is at or near the ground surface and riparian vegetation is present in lower Clear Creek, lower Chevelon Creek, and portions of the Little Colorado River from Woodruff to Joseph City. Groundwater drawdowns in these areas are projected to range from 0.1 to 1 foot by 2060, under the 11,600 af/yr alternative. Depth to groundwater is a prime determinant of the composition and abundance of riparian vegetation. The types of vegetation most at risk from groundwater decreases are obligate phreatophytes such as cottonwoods and willows, which use relatively shallow groundwater (typically within 10 feet of the ground surface), while tamarisk is more tolerant and can occur in dense stands where

the water table is as deep as 30 feet below the surface. The affected areas are dominated by tamarisk with relatively little cottonwood and willow. Gradual decreases in the elevation of the water table of 0.1 to 1 foot over an extended period of time would likely have minimal effects on riparian vegetation. Impacts may include thinning or loss of riparian vegetation in areas of deeper water table, and possible increases of tamarisk at the expense of cottonwoods and willows.

One special-status species, Parish's alkali grass, could potentially be affected by groundwater drawdown associated with operation of the well field, but has not been recorded in the area of potential impact.

4.7.1.3.1.2 Infrastructure

4.7.1.3.1.2.1 Well Field

The 6,000 af/yr volume alternative would have 12 wells, and the 11,600 af/yr volume alternative would have 21 wells. Other facilities would include access roads, power lines, a water-storage tank, two electrical substations, and piping. All impacts would occur in the Plains and Great Basin grassland or Great Basin desertscrub vegetation communities. The estimated areas of impact are shown in Table 4-33.

Table 4-33 Estimated Acres of Potential Impact on Plains and Great Basin Grassland or Great Basin Desertscrub from C-Aquifer Pumping

	6,000 af/yr Well Field	11,600 af/yr Well Field
Permanent Impacts		
Great Basin desertscrub	32.5	42.5
Plains and Great Basin grassland	30.5	40.5
Subtotal	63	83
Temporary Impacts		
Great Basin desertscrub	51	71
Plains and Great Basin grassland	47	67
Subtotal	98	138
Total	161	221

Impacts of vegetation removal would be minor to moderate for the short term, and minor for the long term, assuming that adequate revegetation is completed. Impacts on culturally important plants are expected to be minor. No impacts on riparian vegetation in the well field have been identified. Construction of the well field and associated facilities has the potential to introduce or spread noxious weeds, similar to other project facilities. The integrated noxious-weed management plan would prescribe measures to prevent spread of noxious weeds. No threatened, endangered, or special-status plant species would be affected by construction of the wells and related facilities, under either alternative.

4.7.1.3.1.2.2 C Aquifer Water-Supply Pipeline

C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

Upland Vegetation. Vegetation would be removed or disturbed during construction of the pipeline, power line and access road corridor, two pump stations, and 69kV transmission lines to the pump stations. The construction right-of-way for the pipeline would be 65 feet wide, all of it new disturbance but mostly located along existing roads. Woody vegetation would be cut to ground level across the entire right-of-way, and portions of the right-of-way would be graded. Most of the existing vegetation would be destroyed or damaged by construction, but plant root systems and soil seed banks would mostly remain intact or would likely be replaced through topsoil salvage. The only permanent above-ground facilities would be the pump stations, which would occupy about 1 acre.

The areas of impact from construction are presented below in Table 4-34 for the various vegetation types along the pipeline. Since the pipeline would be mostly in the road right-of-way, there would be few, if any, trees affected. In addition, much of the impact would occur along roads or in disturbed rights-of-way. The locations of the 69kV transmission line routes have not been determined and information on affected vegetation communities is not available. The rights-of-way would be revegetated as part of reclamation activities, and specific information would be incorporated into the construction, operations, and maintenance plan once design and engineering for the pipeline have been completed.

Table 4-34 Estimated Acres of Vegetation Types Potentially Affected – Water-Supply Pipeline: Eastern Route

Vegetation Type	Area Affected (acres)
Piñon/juniper woodland	89
Plains/Great Basin grassland	59
Great Basin desertscrub	522
Unidentified (transmission line)	370
Total	1,040

Impacts from construction on native vegetation would be major, and long-term impacts generally would be minor except for possible major impacts where the alignment crosses through large areas of Great Basin desertscrub that can be difficult to revegetate. Impacts on vegetation diversity would be negligible to minor in all areas, both short and long term, unless there is an invasion of noxious weeds or other invasive species. Most of the species currently present in undisturbed habitats can be expected to reoccupy the right-of-way, either through regrowth, revegetation seeding, or dispersal of seeds from adjacent areas along the relatively narrow right-of-way.

Based on the conceptual design, engineering, and construction of the pipeline (Appendix A-3), it is unlikely that the water-supply pipeline would fail. However, if a failure were to occur, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of water would stop. There would be some erosion may occur at the point of the failure and flooding would occur in topographic lows and drainage channels. The area affected would be limited. Impacts on vegetation would be short term and negligible to none.

Culturally Important Species. Impacts on culturally important species are likely to be minor. The pipeline route crosses through typical habitats of the Colorado Plateau, and construction is unlikely to adversely affect uncommon or rare culturally important species. More common species would be affected, but reductions in population size and availability generally would be minor.

Riparian Vegetation. Narrow strips of riparian shrub, dominated by tamarisk, are present along the banks at the Little Colorado River and other drainages. Impacts on riparian vegetation would be avoided at the crossing of the Little Colorado River because the pipeline would be installed either by using directional drilling under the river or on an abandoned, historic road bridge. Where affected by construction these areas are expected to recover relatively quickly after construction because of resprouting or reseeding, and impacts would be negligible.

Noxious Weeds and Invasive Species. Construction of the well field and associated facilities has the potential to introduce or spread noxious weeds across a large area of the Hopi and Navajo Reservations. Impacts would be minor considering that an integrated noxious-weed management plan would be developed and implemented during the construction and revegetation periods.

Threatened, Endangered, and Special-Status Species. Two special-status plant species—round dunebroom and Parish’s alkali grass—have the potential to occur along the eastern route, based on known distributions and general habitats. If present within the construction area, the plants would be destroyed or damaged by construction activities including trenching, right-of-way clearing, and vehicle traffic. These species are on Navajo Endangered Species List group 4, and the Navajo Nation would not require species-specific clearance surveys. If populations are identified, mitigation would include avoidance of individuals on the edges of the right-of-way, use of temporary fencing to protect plants adjacent to the construction area, transplanting, and/or salvage of soil seed banks. Impacts would be negligible to minor.

Little Colorado River Crossing and Kykotsmovi Area Subalternatives

Impacts on vegetation from construction at the crossing of the Little Colorado River mostly would be avoided, since either directional drilling or use of the historic bridge would avoid disturbing the active channel of the Little Colorado River and adjacent tamarisk riparian vegetation. Impacts on vegetation from construction of either of the subalternative routes in the Kykotsmovi area would be avoided because the pipeline would be buried under a road in either case and no sensitive resources would be affected.

C Aquifer Water-Supply Pipeline: Western Route

Impacts on vegetation would be the similar to those described for the eastern route, but the western route is about 30 miles longer and would impact a proportionally larger area of native vegetation as shown in Table 4-35. It also would affect a larger area of piñon/juniper woodland. Tamarisk and other riparian vegetation would be affected at the crossings of Dinnebito Wash, Moenkopi Wash, Coal Mine Canyon, and Begashibito Wash. The locations of the 69kV transmission line routes have not been determined and information on affected vegetation communities is not available. The only permanent above-ground facilities would be the pump stations, which would occupy about 2 acres.

Table 4-35 Acres of Vegetation Types Potentially Affected – Water-Supply Pipeline: Western Route

Vegetation Type	Area Affected (acres)
Piñon/juniper woodland	137
Plains/Great basin grassland	199
Great Basin desertscrub	553
Tamarisk	1
Unidentified (69kV transmission line)	655
Total	1,545

The same two special-status plant species that could occur along the eastern route (Parish’s alkali grass and round dunebroom) also could occur along the western route. Potential impacts on and mitigation for these species would be the same. The western route may affect Welsh’s milkweed, a federally listed threatened species. A field evaluation of habitats has not been conducted.

4.7.1.3.2 N Aquifer Water-Supply System

Under the proposed action, the existing N-aquifer wells would be pumped periodically to maintain the wells, to provide water when the C aquifer water-supply system is down, and for public water supply after the end of mining. The groundwater modeling conducted by GeoTrans (2006) assessed the potential depletions in groundwater discharges to streams. Reductions in baseflow were simulated in nine streams that receive discharge from the N aquifer. The largest of these is Moenkopi Wash, which had an estimated 1955 (prepumping) N-aquifer discharge of about 4,300 af/yr. Laguna Creek, Jeddito Wash, and Begashibito Wash had 1955 N-aquifer discharges of 2,000 to 2,500 af/yr, and the other five drainages

(Chinle Wash, Pasture Canyon, Dinnebito Wash, Oraibi Wash, and Polacca Wash), had N-aquifer discharges of around 400 to 500 af/yr. These numbers only represent baseflow, and most flow is intermittent and provided by surface runoff from snowmelt and storms. Simulated changes in baseflow due to Peabody pumping through 2038 were 1.3 percent compared to 1955, with the largest simulated reduction occurring in Begashibito Wash (1.48 percent). A large but unquantified portion of the N-aquifer discharge supports tamarisk and smaller amounts of other riparian vegetation. Although tamarisk is considered an invasive species and generally provides poor quality habitat compared to native riparian vegetation, this habitat is important for migrating birds and is used by the endangered southwestern willow flycatcher (refer to Section 4.8, Fish and Wildlife).

Tamarisk and other riparian vegetation that uses water from groundwater discharge may be affected by this reduction, through reductions in area of the stands, reduced growth rates, thinning of stands, or changes in composition in favor of upland species. Effects would be negligible and not measurable because of the small amount of simulated reduction, dispersed effects, and because intermittent runoff flows provide much of the water used by riparian vegetation.

If use of the C-aquifer facilities is not approved, the Black Mesa Complex would pump water from the N aquifer at a rate of 6,000 af/yr during mine operations, with reduced pumping afterwards for reclamation and public water supply. The simulated reductions in N-aquifer discharge to streams would be larger than for the proposed project. The largest reduction would be in Begashibito Wash in 2038, 1.66 percent (36.1 af/yr), and Moenkopi Wash would lose 0.89 percent of flow (38.2 acre-feet), compared to 1955. The combined simulated reduction in baseflow would be 106 af/yr, or about 0.74 percent of N-aquifer discharge to these streams. Similar to the proposed action, tamarisk and other riparian vegetation may be affected by this reduction but impacts would be minor.

Navajo sedge is a federally listed endangered plant species that occurs north of US 160 in seepage areas on cliffs (hanging gardens) receiving discharge from the N aquifer. Based on the groundwater modeling, this species has not been affected to date by pumping from the N aquifer and would not likely be affected in the future (GeoTrans 2005; Peabody 2004).

4.7.2 Alternative B—Approval of the LOM Revision Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

4.7.2.1 Black Mesa Complex

Impacts generally would be the same as described for Alternative A, except that the 2006 through 2026 mining disturbance area would be 8,062 acres. The acres of impact on the various vegetation types may differ depending on whether the Kayenta mining operation uses some of the areas currently included in the Black Mesa mining operation. However, the relative proportion of the vegetation types would be similar to Alternative A, approximately 65 percent piñon/juniper, 30 percent sagebrush, and a few percent in other vegetation types.

The mining operations would use 1,236 af/yr of N-aquifer water through 2026. Based on this scenario, the groundwater discharge to seven streams in 2038 would be reduced by an average of 0.6 percent (total of approximately 79 acre-feet) compared to simulated premining (1955) discharges. The maximum would be a decrease of 1.34 percent in Begashibito Wash (about 20 acre-feet), and the decrease in discharge to Moenkopi Wash would be 0.56 percent, or 23 acre-feet. These small decreases in discharge would have negligible effects on riparian vegetation similar to those described for Alternative A.

4.7.3 Alternative C – Disapproval of the LOM Revision (No Action)

Impacts would be similar to those described for Alternative A, except the Black Mesa mining operation would cease, and no additional vegetation in the Black Mesa mining operation area would be disturbed. The 2006 through 2026 mining disturbance area would be 8,062 acres, and would consist of approximately 65 percent piñon/juniper, 30 percent sagebrush, and a few percentage in other vegetation types. The mining operations would use 1,236 af/yr of N-aquifer water through 2026, the same as Alternative B, and impacts on riparian vegetation from drawdown of the N aquifer would be the same.

4.8 FISH AND WILDLIFE

The study area for terrestrial wildlife includes the mine permit areas and construction rights-of-way/footprints for the other facilities, plus an 0.5 mile buffer (1 mile for some threatened or endangered species). This study area provides the basis for analysis of both direct and indirect impacts on wildlife resulting from direct mortality, habitat loss, and disturbance and displacement effects during construction.

The region of influence for riparian, fisheries and aquatic habitats is larger in order to provide a basis for addressing indirect effects relating to construction, and the effects of operation of the C-aquifer well field. It includes areas directly affected by construction and mining, streams affected by changes in hydrology and the area of potential groundwater drawdown from project-related pumping of the C and N aquifers.

Impacts Common to All Alternatives. There would be a short-term loss of all habitat types from clearing of vegetation during mining, pipeline construction, and construction of other facilities. Impacts would be partially mitigated by revegetation. A detailed revegetation plan has been developed for the Black Mesa Complex (Peabody 2004), where revegetation of mining operations areas has been on-going since the 1960s. Revegetation plans have not been developed for other project facilities. There would be a long-term loss of woodland habitat. Woodlands would be replaced mostly by grassland in mining areas, and pipeline rights-of-way are typically managed to prevent re-establishment of trees. Even where they are planted or allowed to grow, establishment of trees may be difficult or episodic (during years of favorable conditions), and mature trees would take 50 or more years to replace. Species that occur primarily in woodlands would incur long-term reductions in habitat carrying capacity and populations. Species that use trees for thermal or hiding cover, or for nest sites or hunting, also may experience long-term effects. There would be displacement of wildlife and interference with movement patterns during periods of active mining and construction. The open pipeline trench could have effects on wildlife movement during pipeline construction. Injury or death of smaller and less mobile animals such as small rodents, reptiles, and amphibians could result from crushing on the ground or in burrows, burial in spoil areas, or from being trapped in the open trench and buried. Most of the small animals within the mined areas would likely be displaced, injured, or killed. There could be disruption of breeding or loss of nests or young where construction occurs during the nesting season of raptors and other migratory birds. Impacts are avoidable by restricting clearing of vegetation to the nonbreeding season, or by conducting nest surveys and protection of individual nests during the breeding period. Most native bird species are protected under the Migratory Bird Treaty Act, which prohibits direct take and destruction of occupied nests. Clearing of vegetation during the breeding season could result in loss of eggs or young in active nests, and would be a violation of the Act. Of the habitats in the project area, piñon/juniper woodlands have the highest diversity of breeding migratory birds. There could be degradation of wildlife habitat by invasion of noxious weeds or other invasive species.

4.8.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.8.1.1 Black Mesa Complex

Terrestrial Habitats and Wildlife. Mining operations, from January 1, 2006 into 2026, would result in the disturbance of approximately 13,529 acres of native and revegetated habitat, including 8,564 acres of piñon/juniper woodland, about 4,295 acres of sagebrush and other shrublands, and 650 acres of revegetated grassland. Black Mesa mining operation through 2026 would disturb approximately 5,681 acres of native or revegetated habitat, including 2,141 acres of piñon/juniper woodland, 3,450 acres of sagebrush and other shrubland, 3 acres of tamarisk, and 87 acres of revegetation grassland. Disturbed areas would be revegetated. Revegetation design features of particular relevance to wildlife and their habitats are described in the revegetation program prepared for the project (Peabody 2004a).

Short-term losses of habitat would be major, because more than 10,000 acres of native vegetation would be affected. With application of the revegetation program, long-term impacts would be reduced but would be variable for different groups of species. The most important change in habitat would be conversion of about 8,000 acres of piñon/juniper woodland habitat from woodland to mostly grassland. The revegetation program would replace some woodland and shrubland habitat, but there would be a large overall loss of woodlands. However, annual revegetation monitoring shows that herbaceous productivity is much greater in revegetated areas than in natural habitats at Black Mesa, and forage is more abundant for species able to use it.

The “key habitat areas” are shrubland and woodland revegetation areas (refer to Appendix F) designed to help mule deer and other species by providing thermal and hiding cover and shrub browse. The intent is to maximize the interspersed of various habitat components, including forage, protective cover, and thermal cover. Deer are known to use the revegetation areas for feeding, and usability would be improved by providing for escape and hiding cover. The piñon/juniper plantings, shrub plantings, and rock piles are intended to allow for travel across the reclaimed surfaces, to provide structural diversity for song birds and small mammals, to allow further development of wildlife habitat through natural succession, and to increase the usefulness of the rangeland revegetation areas for wildlife.

The usefulness of the woodland and shrub plantings initially would be low, but would increase as the trees and shrubs matured. However, substantial cover may take up to 50 years to achieve in woodland plantings and 10 or more years in shrub plantings. Once fully established, the plantings in the key habitat areas would increase the available edge habitat greatly and would help to break up the revegetation grasslands, making them more accessible to species able to use the edge habitat. The wildlife plantings as well as the plantings of culturally important plant species would encourage dispersal of these species and encourage natural succession.

Species adapted to open woodlands, edges, or grasslands would benefit from the proposed revegetation, including species such as black-tailed jackrabbit, Gunnison’s prairie dog, Navajo Mountain Mexican vole, silky pocket mouse, western harvest mouse (*Reithrodontomys megalotis*), Ord’s kangaroo rat, horned lark (*Ememophila alpestris*), meadow lark (*Sturnella neglecta*), and ash-throated flycatcher (*Myiarchus cinerascens*). Species that are generally restricted to thicker woodlands would have long-term losses of habitat and populations. These include species such as Colorado chipmunk, brush mouse, piñon mouse, Stephen’s woodrat, porcupine (*Erethizon dorsatum*), piñon jay (*Gymnorhinus cyanocephalus*), gray flycatcher (*Empidonax wrightii*), juniper titmouse (*Baeolophus ridgwayi*), mountain chickadee (*Poecile gambeli*), and black-throated gray warbler (*Dendroica nigrescens*).

Mining and revegetation also would eliminate rock outcrops, bluffs, and talus, and would reduce topographic diversity. The revegetated areas would be more uniform in substrate, topography, and drainage patterns. Losses of rocks and rough terrain would affect species such as the bobcat (*Felis rufus*), western spotted skunk (*Spilogale gracilis*), and rock squirrel (*Spermophilus variegatus*), which use these areas for foraging and denning. It also may remove nest sites for species such as red-tailed hawk, great-horned owl, and raven. Peabody's proposed plan to create rock piles every 100 acres would help to mitigate for loss of this habitat. Short-term impacts on wildlife would be major, because of the large area of habitat and the number of individuals that could be affected directly or indirectly. Long-term impacts would be reduced by the reclamation and revegetation program, and would be minor to moderate for some species, and beneficial for others. There would be a long-term loss of woodland habitat and species, but substantial blocks of undisturbed habitat would remain both within the Black Mesa Complex and in immediately adjacent areas. No species would be eliminated from the area. Piñon/juniper woodland is common on Black Mesa and the area affected by mining would be a small part of the total area. The presence of permanent ponds would contribute to diversity of habitats and wildlife species.

Raptors. Raptors would be affected both by mining activities and by long-term conversion of piñon/juniper woodland to grassland and shrubland habitat. Mining would displace raptor foraging and result in short-term moderate loss of foraging habitat. Direct impacts on active nesting activity would be minor because Peabody conducts annual ahead-of-mining raptor nests surveys. When active nests are found, Peabody is required to consult with OSM, FWS, BIA, and Navajo Nation to develop measures that would prevent effects on the active nest. Nests are removed when the season's breeding activity ends, resulting in either use of alternate nests site in future years, or long-term loss of the breeding territory. For the 1990 EIS (OSM 1990), Peabody estimated that loss of about 9,000 acres of piñon/juniper woodland and several thousand acres of other habitats would result in an estimated displacement of 4 to 6 Cooper's hawk nests, 1 northern goshawk nest (indirectly affected by noise and disturbance), 4 to 6 red-tailed hawk nests, and 3 great horned owl nests. A roughly similar level of impact may occur from this project.

Long-term loss of piñon/juniper woodland habitat would affect woodland foraging species such as Cooper's hawk, while favoring birds that use open country or that are adaptable, such as the red-tailed hawk and great horned owl. The increased herbaceous production in revegetation is likely to increase prey populations for raptors that forage in open areas, especially during initial periods of establishment when the revegetation areas are excluded from grazing, an average of about 5 years. Raptor perching would be reduced through reductions in the number of trees, but could be mitigated by installation of raptor hunting and resting perches throughout the reclaimed areas, at a minimum density of 1 per 400 acres. These perches are constructed of 1.5-inch steel pipe, with a welded steel cross bar, and are 10 feet high. These perches would not provide concealment or shelter from weather. Potential raptor nest sites would be reduced by destruction of mature trees, and replacement could take 50 or more years and would be limited to the small woodland planting sites.

Overall impacts on raptors would be minor for species that forage in open areas, because of the mitigations protecting active nests, the suitability of the revegetation areas for foraging, and the availability of alternate nesting habitat in proximity to mined areas. Impacts on Cooper's hawk and other species of dense woodlands would be moderate and long term.

Riparian Habitats and Species. Tamarisk riparian vegetation occurs along intermittent reaches of the major washes, with the most extensive area along Moenkopi Wash. This habitat is used by numerous migrating bird species in spring and fall (Yong and Finch 2002, Carpenter 1998). One of the concerns identified during scoping was effects on downstream riparian habitats and wildlife. There may be localized areas in Moenkopi Wash near the permit area boundary that show reductions in tamarisk habitat due to interception of runoff on the mining areas, but monitoring of alluvial groundwater on the Black

Mesa Complex has shown negligible effects from impoundments. Impacts on riparian vegetation from pumping of the N aquifer are addressed below under Section 4.8.1.3, Project Water Supply.

Aquatic Habitats and Species. A total of 267 impoundments would be constructed and used during mining, and more than 51 ponds would be left in place after mine closure. Planting of riparian vegetation would occur at some of them. These ponds would continue to provide habitat for amphibians, waterfowl, and shorebirds, and impacts of the project are considered to be beneficial.

Threatened, Endangered, and Special-Status Species. Mining operation would have minor to no effect on any listed endangered or threatened species. Species that occur in or near the Black Mesa Complex are as follows:

- Mexican spotted owls are known to occur on Black Mesa and have been studied and monitored for a number of years. The nearest nesting and activity area occurs about 2.2 miles from existing mine areas, and there are no records of nesting within the permit boundary. The owls occur in mixed conifer forest, typically nesting in sandstone cavities in the steep, shaded canyons. This habitat is distinctly different than the piñon/juniper woodlands present in the mine permit area. However, a protected activity center overlaps the permit area and two other protected activity centers are close enough and may overlap the mining operation. The closest records are in Yellow Water Canyon and in side canyons of Coal Mine Wash and Moenkopi Wash. The N-10 coal resource area is about 1 mile from mixed conifer forest. Monitoring would take place to determine if owls occur at the N-10 area and within 2 miles, starting 2 years before mining begins. Minor impacts could occur.
- Bald eagles have been observed occasionally in major washes and near ponds. The mine provides potential foraging opportunities for migrating eagles, including carrion, terrestrial mammals such as prairie dogs, and fish in some ponds. Mine operation would not affect use of the area by migrating bald eagles, and creation of permanent ponds may be opportunities for migrating eagles.
- Migrating willow flycatcher, of which some could be the southwestern subspecies, may use dense stands of tamarisk in the Black Mesa area during migration. Suitable stop-over habitat is present in a wash adjacent to areas J-02 and J-15, and portions of Yellow Water Wash bordering N-9. Mining activities would remove an estimated 3 acres of tamarisk. This is considered a minor impact because breeding would not be affected and there are relatively large areas of tamarisk habitat downstream from the mining areas. Planting of willows around some ponds may provide additional habitat for use during migration.
- Mountain plovers have suitable breeding habitat (large prairie dog colonies with low vegetation cover) in coal areas J-05, J-06, J-08, and J-14, but there is no record of occurrence of this species. Mining and revegetation are therefore expected to have no impacts on mountain plover.
- Kit foxes have the potential to occur in greasewood, sagebrush, and saltbush habitat within some of the southern coal areas, but the species has not been documented at Black Mesa; therefore, no impacts are expected.
- Northern goshawks are unlikely to be present because the habitat is unsuitable.

A number of other special-status species are known to occur, and impacts on those species would be negligible or minor.

- Several special-status raptor species are known to occur or may occur at the Black Mesa Complex, including the golden eagle, ferruginous hawk, northern goshawk, and peregrine falcon. Peabody conducts annual raptor monitoring surveys and is required to conduct raptor surveys prior to mining any area. With this mitigation, impacts on nesting would be negligible. Changes in habitat from mining and revegetation could increase the availability of prey in these areas and at ponds which may provide opportunities for the golden eagle, ferruginous hawk, and peregrine falcon, while loss of piñon/juniper habitat may adversely affect the northern goshawk. Impacts would be minor.
- Pale Townsend's big-eared bat is on the Navajo Endangered Species List. This species uses a wide range of habitats, and it is not clear whether conversion of piñon/juniper woodland would have adverse effects. Mining of cliffs and other rock formations that contain crevices or caves would remove actual or potential day and night roosting habitat. Similar and more suitable habitat occurs on northern Black Mesa outside the permit area, and impacts are expected to be minor.
- Navajo Mountain Mexican voles are known to occur at both the Kayenta and Black Mesa mining operations, in continuous stands of sagebrush, near permanent impoundments on mine reclamation areas, and along drainage bottoms (BIOME 2003). This species is on the Navajo endangered species list and is listed as a wildlife species of special concern by the State of Arizona. During 1999, live trapping was conducted in closed basins within mine reclamation areas and on reclamation grassland. A total of 28 Mexican voles were found in closed reclaimed basins, and none were found in revegetation grassland. Mexican voles represented 28 percent of the small rodents captured. Suitable habitat is present in the N-10, N-99 North and J-02/J-15 coal areas, and occupies about 70 acres. The species appears to be attracted to mesic areas near water impoundments that have taller and denser vegetation cover. Mining of suitable habitat would result in short-term loss of habitat and mortality of voles, but other areas of suitable habitat along drainages would not be affected. The reclaimed mine surface would provide suitable habitat in the long term. The overall impacts would be minor in the short and long terms.
- Impacts are expected to be negligible or minor for species that may occur but whose presence has not been documented. They include western burrowing owl, spotted bat, and milk snake.

The coal-washing facility would occupy a small site in proximity to the coal-slurry preparation plant. Impacts from construction and operation would be minor or negligible.

The coal-slurry preparation plant already exists and no additional ground-disturbing activities would take place.

The types of impacts from construction and operation of the coal-haul road would be similar to those described above for the mining operations areas. Construction of the road would remove about 127 acres of piñon/juniper habitat. Larger wildlife would be displaced during construction, and smaller or less mobile animals could be injured or killed. The loss of wildlife habitat would continue for the life of the facility. In addition, the road could be a barrier to wildlife movement because of its width and berms, particularly for less mobile animals. Impacts from construction and operation would last the life of the road and would be moderate. The coal-haul road would be reclaimed using the methods described above for the mining operations areas. Impacts on endangered and special-status species generally would be the same as described above for the mining operations areas.

4.8.1.2 Coal-Slurry Pipeline

4.8.1.2.1 Coal-Slurry Pipeline: Existing Route

Terrestrial Habitats and Wildlife. Reconstruction of the coal-slurry pipeline would affect more than 2,100 acres of wildlife habitat. Because construction would occur mostly within the previously disturbed right-of-way, only about 190 acres of piñon/juniper woodland would be removed, and the remainder would be grassland or shrubland habitats, much of it developed on previously disturbed right-of-way. Short-term impacts on wildlife habitat would be major, and long-term impacts would be moderate. Where the right-of-way crosses through piñon/juniper woodland, the strip of nonwoodland vegetation would be widened from 50 feet to 65 feet. Construction is not likely to affect cliffs or rock outcrops on the existing route since many were already altered or removed during construction of the original pipeline. Since the right-of-way is already present, the increased width may increase habitat fragmentation slightly. In addition, widening of the right-of-way for construction would have negligible effects on increasing cowbird access to dense piñon/juniper woodlands, since the right-of-way already is present.

The open pipeline trench may trap small animals and may cause injury to larger animals attempting to cross it. Animals are most at risk of being trapped or injured at night, and especially during the summer and wet weather.

Restoration of habitat would be difficult and may be unsuccessful in the more arid portions of the pipeline route, including the Great Basin desertscrub near the Little Colorado River, and the lower elevation areas of Mohave desertscrub. Unsuccessful reclamation would result in long-term loss of habitat.

Game Animals and Wild Burros. The coal-slurry pipeline would cross habitats used by pronghorn antelope, mule deer, elk, javelina, mountain lion, and bighorn sheep. No specific sensitive areas have been identified for these species, with the exception of the bighorn sheep. The others would be displaced from the construction area during periods of human activity, and would have short- or long-term losses of foraging habitat during the revegetation period. Impacts would be moderate short-term and negligible long-term.

Bighorn sheep habitat in the Black Mountains that is crossed by the pipeline includes about 3 miles of areas rated as high quality habitat and 3 miles of medium value habitat (BLM 1993). About 300 to 320 animals are located in the herd south of Highway 68, and this herd represents the largest surviving population in the Black Mountains after recent population declines north of Highway 68 (Pebworth 2006). The alignment would not affect watering sources used by bighorn sheep. The Black Mountains are a movement corridor, and construction of the pipeline across the mountains would disrupt movements during construction. Bighorn sheep are highly sensitive to human disturbance. AGFD recommends avoidance of construction during the lambing season (February 1 to May 31) and during the hunting season (December) (Pebworth 2006). The applicant would coordinate with AGFD and the land-managing agency to comply with this recommendation to the extent practicable and identify appropriate site-specific mitigation. Impacts from displacement and disruption of movement could be moderate to major, depending on the time of year and the length of the construction period.

The entire area from Kingman west to Bullhead City is part of the Black Mountain burro herd management unit. Any wild burros that occur in the area at the time of construction would disperse and be displaced temporarily, due to human activity, from the construction area and would have short- or long-term losses of foraging habitat during revegetation. Impacts would be minor.

Raptors. Nesting raptors could be affected by construction, when construction occurred near active nests. Impacts would be avoided by use of preconstruction nest surveys and avoidance of construction near

nests during their active period, similar to methods currently used by Peabody at Black Mesa. Loss of nesting and foraging habitat would be minor because of the narrow area of impact and the large amount of available and relatively undisturbed habitat adjacent to the right-of-way.

Aquatic Habitats and Wildlife. The only perennial aquatic habitat crossed by the pipeline is at the Colorado River. The crossing would be bored under the river, and impacts on the river or its banks are not anticipated. The crossing method for the Little Colorado River would be a horizontal bore under the river. This is a major intermittent stream. One of the potential risks associated with horizontal boring is the escape of drilling mud into the environment as a result of release, tunnel collapse, or rupture (from excessive drilling pressure) of mud to the surface. If the rupture occurs in the watercourse, the fine clay particles can settle on the bottom of the watercourse, covering benthic invertebrates, aquatic plants, and fish and their eggs; however, specific impacts on species cannot be predicted. Ruptures may be difficult to detect when they occur underwater, but the potential for a rupture would be minimized through proper geotechnical practices, adequate drill planning and execution, careful monitoring, and use of appropriate equipment and response plans in the unlikely event that one occurs. During operation, it is unlikely that the pipeline would fail and release slurry into the watercourse. Based on historical performance of the existing pipeline, no failures and consequent leaks in or near the river occurred during the 35 years of operation. Considering this and the proposed reinforced conceptual design of the pipeline, failures are not anticipated. In the unlikely event of a release, the extent of the impact is uncertain as such a determination would depend on the amount of slurry released and the aquatic ecology at the location and time of the release. Generally, the nontoxic coal fines released would suspend in the water, be carried by the current, and dispersed over the bottom of the watercourse. Some fish and benthic organisms may be impacted adversely by the coal fines being released into the river, but the effects would be very temporary and minor to negligible.

Threatened, Endangered, and Special-Status Species. Federally listed threatened or endangered species known or likely to occur in or near the project area include bald eagle, California condor, southwestern willow flycatcher, Mohave population of desert tortoise, bonytail chub, and razorback sucker. Impact is described below for each species and would be negligible or minor, with use of required mitigation for Mohave desert tortoise.

- Construction and operation is unlikely to affect bald eagle and California condor. These species may occur sporadically in the project area, but key habitat features are not present.
- Construction may result in disturbance or removal of an estimated 3.2 acres of tamarisk riparian vegetation along portions of Moenkopi Wash, Begashibito Wash, and the Little Colorado River. While tamarisk in these areas would not likely be suitable for nesting, it could provide foraging and resting habitat for migrating flycatchers. Migrating willow flycatchers have been observed at both Moenkopi Wash and the Little Colorado River, but the subspecies is not known (whether the listed southwestern willow flycatcher or other unlisted subspecies). Surveys, in which only one migrant willow flycatcher was detected during the initial survey effort, were conducted along the Little Colorado River approximately 0.5 mile upstream to 0.5 mile downstream of the proposed coal-slurry pipeline alignment during the 2005 breeding season. No nesting was observed in 2005, and there are no records of southwestern willow flycatcher nesting. Removal of tamarisk is therefore not likely to affect southwestern willow flycatchers, though there would be a temporary reduction of approximately 3.2 acres of available migratory stopover and foraging habitat.
- Construction and operation of the coal-slurry pipeline would have no effect on the Mohave desert tortoise in Nevada because the pipeline would be installed by horizontally boring under the Colorado River into the fenced yard of the Mohave Generating Station.

- Bonytail chub and razorback sucker both occur in the Colorado River at the proposed crossing. It is unlikely that construction and operation would affect these species. The new pipeline would be installed by boring under the river. The potential for a rupture of drilling mud would be minimized through proper geotechnical practices, adequate drill planning and execution, careful monitoring, and use of appropriate equipment and response plans in the unlikely event that one occurs. During operation, considering the historical performance of the existing coal-slurry pipeline and the proposed reinforced conceptual design of the pipeline, failures are not anticipated. In the unlikely event of a release, as described previously, fish may be impacted adversely by the coal fines being released into the river, but the effects would be very temporary and minor to negligible.
- Adverse effects from a potential rupture are likely to be negligible due to the implementation of an emergency rupture response plan and contingency crossing plan that outlines the protocol to monitor the construction, to stop work in the event of a rupture or spill, and to contain and clean-up drilling fluids and other deleterious substances. A large number of other special-status species also are known to occur along the route. Impacts on these species would be minor.
- There is suitable habitat for nesting by special-status raptor species including ferruginous hawks, golden eagle, and western burrowing owl. Construction could cause disruption of breeding activities and nest abandonment or loss of eggs or young if present. To comply with the Migratory Bird Treaty Act and Bald Eagle Protection Act, construction would be avoided during the breeding season in the vicinity of active nests. Locations of active nests would be identified based on preconstruction aerial and/or ground surveys. The project would have negligible effects on wintering, migrating, or foraging special-status raptors such as peregrine falcon.
- Several bat species are known or likely to occur along the pipeline route. The project would not involve destruction or modification of caves, mines, buildings, or cliff habitat where nocturnal or wintering roosts may be located. Construction could displace some bats from day roosts in piñon or juniper trees, and clearing of vegetation from the right-of-way would have a minor effect on availability of foraging habitat.
- Pronghorn antelope and kit fox are listed on the Navajo Nation Endangered Species list. Construction of the pipeline would have a negligible to minor effects on these species. Impacts could include temporary displacement from the construction area, and loss of pronghorn forage and kit fox prey from the right-of-way during construction and revegetation.
- Wupatki Arizona pocket mouse are on the Navajo Endangered Species List (Group 4). Impacts would be similar to those for other small mammals, and may include death from construction equipment and crushing, and loss of habitat. Impacts on populations are expected to be minor in the short term, and negligible long term.
- Gila monster and milk snake are likely to occur along portions of the route. As with other small animals, they may be killed by construction equipment or crushing in their burrow and by being trapped in the trench. The post-construction right-of-way may have reduced habitat suitability until revegetation is accomplished. Mitigation to reduce impacts would include preconstruction clearance surveys (within 48 hours of clearing habitat), fencing of the construction area to exclude Gila monster, and/or checking of the trench and other excavations prior to filling. Impacts would be minor.
- The Sonoran population desert tortoise is known to occur around Kingman and westward through the Black Mountains to the Colorado River. Impacts and mitigation would be similar to the Mohave population of desert tortoise.

- Northern leopard frog is not likely to be affected by construction of the pipeline because there is little or no suitable habitat. Although documented at the Little Colorado River, the river is normally dry, and the species is not likely to be encountered.
- Flannelmouth sucker is present at the proposed crossing of the Colorado River, but is not likely to be impacted because the crossing would be directionally drilled under the river. Adverse effects from a potential rupture are likely to be negligible due to implementation of an emergency rupture response plan and contingency crossing plan that outlines the protocol to monitor the construction, to stop work in the event of a rupture or spill, and to contain and clean up drilling fluids and other deleterious substances.
- Maricopa tiger beetle and Navajo Jerusalem cricket may occur along the route. Like other small animals, they could be killed by construction equipment or crushing in their burrows and by being trapped in the trench. The post-construction right-of-way may have reduced habitat suitability until revegetation is accomplished. Impacts on populations are expected to be minor because of the small size of the construction area relative to available habitat.

4.8.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignment (Agencies Preferred Alternative)

Impacts would be the same as described for the existing route, except for differences in the amount of affected habitat (refer to Section 4.7, Vegetation). The existing route with realignments would affect about 50 acres more piñon/juniper woodland and desert grassland, about 45 acres less grassland in the existing right-of-way, and 50 acres less urban/industrial land. The existing route with realignments also would affect about 300 acres more previously undisturbed habitats than the existing alignment.

Impacts on threatened, endangered, and special-status species generally would be the same. The amount of impact on tamarisk (southwestern willow flycatcher habitat) in Moenkopi Wash is not known, but would probably be similar to the existing route. There are several miles more Sonoran population desert tortoise and banded Gila monster habitat where preconstruction clearance surveys would be needed to identify habitat and means to prevent death or injury during construction.

4.8.1.3 Project Water Supply

4.8.1.3.1 C Aquifer Water-Supply System

4.8.1.3.1.1 Water Withdrawal

Under the 6,000-af/yr pumping alternative, the area of groundwater drawdown of 0.1 foot or more would include the Little Colorado River from near Winslow downstream to below Leupp (Appendix H). The 11,600-af/yr pumping alternative would involve both a higher rate of pumping and a longer time period. The area of groundwater withdrawal would be much larger and would extend from near Holbrook to Cameron along the Little Colorado River, and would include lower Clear Creek and lower Chevelon Creek (refer to Maps 4-1 and 4-2).

Several mathematical models were developed to assess the extent and magnitude of groundwater drawdown associated with the Black Mesa Project. The results provided below are summarized primarily from the SSPA study (SSPA 2005). It encompasses the entire C aquifer, accounts for all of the major hydrogeologic components of the flow system, and is calibrated to water levels in wells. More information about the groundwater models is provided in Sections 3.4 and 4.4.

According to the SSPA model, the area of simulated maximum withdrawal in 2060, with groundwater declines of 5 to 40 feet, would occur over a 293 square mile area extending southward from the proposed well field near Canyon Diablo to about 8 miles south of I-40 near Chilson. The groundwater drawdown in

this area would have no effects on riparian habitat, because C-aquifer water levels are generally greater than 200 feet below the land surface, and there is no direct hydrologic connection between the C aquifer and riparian vegetation on the land surface. Simulated groundwater drawdown of 0.1 to 1.0 feet by 2060 would occur over a larger area, including three perennial stream reaches that receive discharge from the C aquifer—lower Clear Creek, lower Chevelon Creek, and the Little Colorado River from Woodruff downstream to Holbrook. Lower Chevelon Creek is designated as critical habitat for the Little Colorado spinedace, a federally threatened species, and lower Clear Creek also may have this species although it has not been observed since 1960. It may be present because it is known to occur higher in the watershed, has suitable habitat in lower Clear Creek, recent sampling was not intensive, and the species exhibits wide fluctuations in populations. However, the presence of large numbers of non-native fish may preclude persistence of spinedace. Several other special-status species also occur, including bluehead sucker and Little Colorado sucker in all three streams, and roundtail chub in Clear Creek and Chevelon Creek. Roundtail chub has been petitioned for listing as a threatened or endangered species.

Only a portion of the total flow in the perennial stream reaches in lower Clear and Chevelon Creeks is from groundwater discharge. Most of the flow is from snowmelt and precipitation, which are seasonal. The month of June historically has the lowest streamflow, and during this summer dry period essentially all of the flow in perennial sections of these creeks is from groundwater discharge, which is referred to as the streams' base flow. Without base flow, the seasonal nature of precipitation and runoff would result in these streams being intermittent, with fish confined to permanent or semi-permanent pools during the dry season.

Based on results from the SSPA model (SSPA 2005), baseflow discharge would be reduced by 0.1 cfs in lower Clear Creek and 0.07 cfs in lower Chevelon Creek by 2060, from pumping of the C aquifer in the Canyon Diablo well field under the 11,600 af/yr alternative. Reductions in groundwater discharge would begin about 2020, and would increase to 0.1 cfs by the end of the simulation period in 2060. For lower Clear Creek, the modeled streamflow depletion of 0.1 cfs in 2060 represents about 2.5 percent of the estimated June base flow of 4.2 cfs, and the upper bound depletion of 0.25 cfs represents about 6 percent of base flow. The modeled streamflow depletion of 0.07 cfs for lower Chevelon Creek in 2060 represents about 2.5 percent of the estimated 3 cfs base flow in lower Chevelon Creek. Baseflow depletions in the Little Colorado River near Holbrook have not been simulated, and would be lower than in Clear and Chevelon Creeks because it is farther away from the pumping area.

Although this is only a minor portion of the current mean base flows for the month of June, there may be reductions in the availability of stream habitat during the dry season. The percentage reduction in flow during other portions of the year would be much smaller and would be unlikely to measurably affect availability of habitat. Effects from the project combined with other ongoing and expected pumping are addressed in Section 4.24.

These changes, while small, may affect availability of suitable stream habitat and reduce the ability of fish populations to survive the dry season. Little Colorado spinedace typically occupy mid-water portions of flowing pools and runs and avoid the deepest pools and relatively shallow areas. Changes may include reductions in flow and depth of water in pools, runs, and riffles and reductions in the wetted width of the stream. The frequency, duration, and volume of flow over riffles could be reduced in some areas or eliminated particularly in the upper, more intermittent, portion of lower Clear Creek, which could affect the young-of-the-year that use the riffles. Reductions in flow may isolate spinedace in nonflowing pools where they may be subject to more predation and competition for food and space. Streamflow depletions also may affect spinedace spawning and recruitment, which occur in shallow water areas, and could affect spinedace through changes in water temperatures and a reduction in food production. Effects on larval and juvenile spinedace are likely to be greater than on adults during this period, since they generally have

lower food reserves, higher metabolism, lower mobility, and are more vulnerable to predation. Young of the year are most abundant on uniformly turbulent riffles. Effects on the spinedace are likely to be major.

The other special-status fish species also may be affected by depletion of base flow. Adult roundtail chub typically prefer deeper pools, while young juveniles occupy backwater habitat and older juveniles tend to occupy shallow, swifter habitats. Bluehead sucker and Little Colorado sucker occupy a variety of habitats. Reductions in pool depth would slightly decrease the amount of habitat available for adult fish, and could reduce populations through competition. Younger fish would be more affected by loss of shallower habitats, including backwaters and runs, and may be forced into less suitable habitat where they would be subject to increased predation and competition. Effects on juvenile fish are likely to be greater than effects on adult fish. Section 4.18 provides a description of the conservation measures developed to offset the potential adverse effects of stream baseflow depletion. However, effects are still likely to be major due to the changes in stream habitat.

Groundwater drawdown also may affect availability of habitat for southwestern willow flycatcher. Riparian habitat (mostly tamarisk) occurs along the Little Colorado River and the lower portions of lower Clear and Chevelon Creek. It is limited in most of lower Clear and Chevelon Creeks because the creeks are in narrow canyons. Discharge from the C aquifer to the Little Colorado River occurs from Woodruff to Joseph City, where the water level in the aquifer is near the land surface. Groundwater drawdowns in these areas are projected to range from 0.1 to 1.0 foot by 2060, under the 11,600 af/yr alternative. Gradual decreases in the elevation of the water table of 0.1 to 1 foot over an extended period of time would likely have minimal or no effects on riparian vegetation. Impacts may include reduced foliage density and crown dieback or mortality of riparian plants in areas of deeper depth to water table. Tamarisk, the primary species in this area, would be less affected than obligate riparian species such as cottonwood and willow. Impacts on southwestern willow flycatcher habitat would not be measurable and would likely be negligible.

Bald eagle and peregrine falcon may occur occasionally in riparian habitats in the region, but are not likely to be affected by groundwater drawdown.

4.8.1.3.1.2 Infrastructure

4.8.1.3.1.2.1 Well Field

Construction of the wells and associated facilities would affect a small portion of the well field area during construction, resulting in temporary loss of habitat, displacement of some species of wildlife, and mortality of less mobile species. Operation of the well field would require a limited amount of human activity and therefore would have negligible to no impact on wildlife. There would be no loss of woodland habitat, all of the affected vegetation would be Plains and Great Basin grassland or Great Basin desertscrub.

Golden eagle nests are known to occur within 1 mile of the well field and may be affected by construction and operation activities. Impacts can be minimized or avoided by siting facilities away from nests and by seasonal restrictions on major activities near the nest when the nests are in use. Presence of burrowing owl should be determined through preconstruction surveys, and activities should be avoided during the nesting season where present. Construction and operation activities would result in minor temporary impacts from displacement and loss of some individuals that may occur in the vicinity, including wintering ferruginous hawks, occasional peregrine falcon, pronghorn antelope, pale Townsend's big-eared bat, and milk snake.

Kit fox may occur in the well field area, especially in Great Basin desertscrub habitat. Clearing and ground-disturbing activities associated with well field development could result in the loss of habitat for kit fox and could increase the potential for the direct mortality and/or displacement of some individuals (if present). These impacts are expected to be minor.

4.8.1.3.1.2.2 C Aquifer Water-Supply Pipeline

C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

Construction of the pipeline would affect about 860 acres of habitat, much of which would be within areas disturbed previously by road construction. Impacts on the 116 acres of piñon/juniper woodland would be long term because trees would not be replanted in the right-of-way, and the right-of-way would be converted from woodland to grassland. However, since the pipeline would be mostly in road rights-of-way, there would be few, if any, trees affected. Impacts on plains and Great Basin grassland and to Great Basin desertscrub generally would be temporary during the revegetation period. However, reclamation of the desertscrub areas could be difficult and there could be long-term losses of vegetation cover and productivity in the right-of-way.

Additional impacts would result from construction of two pump stations, new 69kV power lines along the pipeline, and access roads to the pump stations. The new power lines have the potential to cause raptor electrocutions and would be designed to prevent impacts.

The open pipeline trench may trap small animals and may cause injury to larger animals attempting to cross it. Animals are most at risk of being trapped or injured at night, and especially during the summer and wet weather.

There may be disturbance or loss of small areas of tamarisk at the Little Colorado River and some other drainages. No impacts would occur in aquatic habitats.

A number of other special-status species are known to occur. Impacts from construction would be minor with recommended mitigation, and impacts from operation and maintenance would be negligible.

- Both the golden eagle and western burrowing owl are known to nest in the vicinity of the existing pipeline route. Construction could cause disruption of breeding and loss of nests, eggs, or young. To comply with the Migratory Bird Treaty Act and Bald Eagle Protection Act, construction should be avoided during the breeding season near active nests. Preconstruction surveys would be used to identify locations of active nests and establish seasonal protective buffer zones. The project would have negligible effects on migrating or wintering peregrine falcons and ferruginous hawks.
- One special-status bat species, the pale Townsend's big-eared bat, is known to occur. Construction is unlikely to involve destruction of cliffs or bluffs in the right-of-way, where this species roosts in rock crevices. The project would have negligible effects on the species.
- Pronghorn antelope may be temporarily displaced during construction of the pipeline and associated facilities. Also, forage in the right-of-way would be lost temporarily.
- Kit fox may occur along the pipeline route, especially in Great Basin desertscrub habitat. Impacts may include direct disturbance to kit fox and disturbance or destruction of potentially suitable foraging and denning habitat.

- Impacts are expected to be negligible or minor for species that may occur but whose presence has not been documented, including mountain plover and milk snake, and may include temporary displacement of mountain plover and mortality of milk snake in the construction zone.

Little Colorado River Crossing and Kykotsmovi Subalternatives. Impacts on habitat and wildlife from construction at the crossing of Little Colorado River mostly would be avoided, since either directional drilling under the Little Colorado River and use of the historic bridge would avoid disturbing the active channel and adjacent tamarisk riparian vegetation. Impacts on habitat and wildlife from construction of either of the subalternative routes in the Kykotsmovi area would be avoided because the pipeline would be buried under a road in either case.

C Aquifer Water-Supply Pipeline: Western Route

Impacts on wildlife habitat would be similar to the eastern route, but a larger area of habitat would be affected, including approximately 136 acres of piñon/juniper woodland and 1,545 acres of all habitats. The new power lines have the potential to cause raptor electrocutions and would be designed to prevent such impacts.

There would be minor impacts on tamarisk riparian shrub at the Little Colorado River, Begashibito Wash, and possibly in other drainages.

Impacts on threatened, endangered, and special-status species would be the same as the eastern route, except for the following:

- The Mexican spotted owl may occur along several miles of route on the northern part of Black Mesa. It is not known whether suitable habitat would be directly affected. They also are known to occur within several miles of the route where it parallels portions of U.S. Highway 160, but the pipeline would not affect suitable habitat in this area. If the western route is selected, surveys would be conducted to identify suitable habitat and activity areas on or near the right-of-way, and seasonal limitations on construction would be coordinated with AGFD and the land-managing agency to identify means to protect activity areas near the construction zone.
- The western route would affect approximately 1 acre of tamarisk habitat that may be used by migrating southwestern willow flycatchers. Nesting has not been observed, and impacts on habitat would be short-term because tamarisk can recover quickly after disturbance.
- The northern goshawk is known to nest within 1 mile of the western route on Black Mesa. As with other raptors, construction could cause abandonment of an active nest and loss of eggs or young, depending on the season of construction, proximity of the nest, and visibility. Impacts would be prevented by avoidance of construction near active nests during the nesting season.
- Construction is likely to involve destruction of cliffs or bluffs that may be used as roost sites by Townsend's big-eared bats. Small numbers of bats could be displaced, but impacts on populations would be minor because of the relatively small area.

4.8.1.3.2 N Aquifer Water-Supply System

Groundwater modeling of N-aquifer pumping (GeoTrans 2006) identifies seven streams that would have reduced baseflow from aquifer discharge under both the 11,600-af/yr and the 6,000-af/yr pumping alternatives. Simulated reductions in N-aquifer discharge through 2038 would be about 0.57 percent (76.6 acre-feet) of total N-aquifer discharge for the 6,000-af/yr pumping alternative, and 0.79 percent

(106 acre-feet) for the 11,600-af/yr pumping alternative. Impacts would be largest at Begashibito Wash, more than 1 percent for both alternatives.

Drawdown would not affect perennial stream habitat, but may affect tamarisk and other riparian vegetation that use water from groundwater discharge, through reductions in area of the stands, reduced growth rates, thinning of stands, or changes in composition in favor of upland species. Although tamarisk is considered an invasive species and generally provides poor quality habitat compared to native riparian vegetation, this habitat is important for migrating birds and is used by the endangered southwestern willow flycatcher. Modeling indicates that there would be a small amount of effects from reductions of groundwater discharge would be minor or negligible and not measurable because of the small amount of simulated reduction, dispersed effects, and because intermittent runoff flows provide much of the water used by riparian vegetation. Impacts on southwestern willow flycatcher and their habitat would be negligible.

4.8.2 Alternative B – Approval of the LOM Revision Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

4.8.2.1 Black Mesa Complex

The Kayenta mining operation would continue through 2026. Impacts generally would be the same as described for Alternative A, except that the 2006 through 2026 mining disturbance area would be 8,062 acres. The acres of impact on the various types of wildlife habitat may differ depending on whether the Kayenta mining operation produces coal from some of the areas currently included in the Black Mesa mining operation. However, the relative proportion of habitats would be similar to Alternative A. The coal-slurry pipeline and C aquifer water-supply system would not be constructed and, therefore, would have no effects on wildlife. The mining operations would use 1,236 af/yr of N-aquifer water through 2026, up to 500 af/yr for mine reclamation and domestic use from 2026 through 2028, and up to 444 af/yr for post-reclamation maintenance and domestic uses from 2029 through 2038. The groundwater modeling of the N aquifer predicts that the groundwater discharge to seven drainages in 2038 would be reduced by an average of 0.6 percent (total of 79.9 acre-feet) compared to simulated premining discharges. The maximum would be a decrease of 1.39 percent in Begashibito Wash (about 30.3 acre-feet), and the decrease in discharge to Moenkopi Wash would be 0.25 percent, or 10.9 acre-feet. These small decreases in discharge would have minor effects on riparian habitat similar to those described for Alternative A.

4.8.3 Alternative C – Disapproval of the LOM Revision (No Action)

The Kayenta mining operation would continue through 2026, and impacts would be the same as described for Alternative B. The Black Mesa mining operation would cease and would not disturb any additional wildlife habitat. The 2006 through 2026 mining disturbance area would be 8,062 acres, and the proportion of habitat types affected would be similar to Alternatives A and B.

4.9 LAND USE

4.9.1 Alternative A (Applicants' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.9.1.1 Black Mesa Complex

As stated previously in the chapter, short-term impacts are those that would occur from the time when mining begins in a unit through reclamation when vegetation has been re-established. Reclamation efforts at the mine are directed toward restoring the land to be used for livestock grazing, wildlife habitat, and cultural plant use. When vegetation has been re-established, limited use of the land may be allowed. Long-term impacts are those that would persist beyond or occur after reclamation.

Residential. A total of 17 Navajo residences on the Navajo Partitioned Land and/or exclusive Navajo surface in the Black Mesa Complex would be displaced between 2005 and 2026 (Wendt 2005). Although relocation would be at Peabody's expense and new locations would most likely be within the residents' customary use areas (e.g., where ranching activities take place or where sociocultural ties exist), this would create hardships on the households and potentially could be a major impact.

Livestock Grazing. The maximum disturbance under Alternative A would exclude the use of 470.8 AUMs by 138 sheep, or 32 cattle or horses, from grazing within the disturbed and reclaimed areas for up to the life of the mining (OSM 1990). As under all alternatives, reclamation would focus on returning postmining surfaces to livestock grazing lands, the primary historical land use in the area. Reclamation takes place on lands immediately after mining activities in an area have been completed (refer to Appendix A-1). Premining grazing land would be restored, with changes in vegetation communities from piñon/juniper woodland and shrubland to grassland resulting in more forage available for livestock (OSM 1990). Based on the revegetation success standards that Peabody must achieve pursuant to the SMCRA permit, forage production would increase as much as 10 times over the premining productivity (OSM 1990). (Refer to Appendix A-1.)

The coal-haul road is located on Hopi land and would remove approximately 20 acres from grazing in Hopi Range Unit 263 until mining operations cease and reclamation is complete. After operations cease in 2026, the road would be revegetated and the area would be available for grazing.

Agriculture. Family garden plots would be relocated along with residences that are relocated to accommodate mining activity. Reclaimed land would support the re-establishment of family garden plots.

Relocations of residences, livestock grazing, and agriculture are disruptive to the households involved and therefore have the potential to become major impacts. Still, because the destination locations are nearby and many of the land uses could return to their former locations once mined land is reclaimed, the long-term impact of relocation would be moderate.

Commercial/Industrial. No commercial or industrial land uses—apart from those affiliated with Peabody—are located within the Black Mesa Complex. At the currently unpermitted area of the Black Mesa Complex, the coal-slurry preparation plant and proposed coal-washing facility site are within a previously disturbed fenced area dedicated to coal preparation. Therefore, construction of the coal-washing facility and operation of both facilities would have no impact on land uses.

4.9.1.2 Coal-Slurry Pipeline

In the unlikely event of a pipeline failure, the amount of slurry released would depend on the location of the leak on the pipeline (top of the pipeline versus bottom of the pipeline), and the terrain where the leak occurs (a flat location versus on a slope). Using historical data on slurry pipeline releases, BMPI estimates that the amount of slurry released may range from an average of 100 cubic yards (or less) to a maximum of 565 cubic yards. The maximum coal slurry release would cover approximately 0.7 acre with 6 inches of nontoxic coal fines, while the fresh water in which the coal is entrained would soak into the ground. The impact on land use would be short term and range from negligible to minor depending on the location and circumstances of failure. If the extent of the release warrants, BMPI would clean up the release immediately; therefore, the impact would be short term. An emergency response plan that addresses cleanup and management of impacts, including the length of time required for cleanup, would be in place for the coal-slurry pipeline.

4.9.1.2.1 Coal-Slurry Pipeline: Existing Route

Residential. Impacts would vary, depending on proximity and population density. Residences would be avoided whenever possible; however, during construction, access to property in both rural and suburban residential areas along the route would be disrupted. Approximately 70 residences could be affected along the existing route, either by restricted access or disturbance to residential property during construction.

Construction would restrict access temporarily to property in the Kingman and Laughlin areas, and would disturb residential properties (though not necessarily residential structures) in, or immediately adjacent to, the existing pipeline right-of-way in 12 low- to moderate-density residential areas.

Livestock Grazing. Construction activity would reduce available forage temporarily until reclamation is successful. Livestock grazing also could be impacted as a result of hazards to livestock from equipment and or construction activities (e.g., trenches). Such impacts would be reduced by notifying ranchers of upcoming construction activities in active grazing areas to move livestock to graze in other areas to avoid construction activities.

Agricultural. Family plots, generally in rural areas adjacent to or beyond the pipeline right-of-way, would not be directly impacted. Most farming occurs in rural areas where disturbance to related outstructures could be mitigated by moving or reconstructing them beyond the right-of-way.

Impacts on all of the above land uses would be short-term and in some cases very temporary. The impact levels would vary from minor to none. Minor impacts would usually result from access restrictions or property disturbance of longer duration, while negligible impacts would usually result from access restrictions that are slightly more disruptive than ordinary traffic disturbances.

Commercial/Industrial. The coal-slurry pipeline crosses under parking lots of Laughlin casinos and the Laughlin/Bullhead City Airport. However, in 1990, the original coal-slurry pipeline was replaced with two pipelines (one operating pipeline and one spare). These pipelines would be sufficient for the life of the reconstructed pipeline. There would be no construction in the parking lots or on airport property.

Rights-of-Way/Utility Corridors. The project would have no effect on rights-of-way and utility corridors.

4.9.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignments (Agencies' Preferred Alternative)

Along the Moenkopi Wash realignment, temporary disturbance to livestock grazing during construction would be the only impact in this area. Generally, land use impacts would be similar to those along the existing route. New right-of-way for this realignment would be required.

Along the Kingman reroute, construction activity (refer to Appendix A-2) would cause disturbance to three low- to moderate-density residential areas adjacent to the right-of-way. In addition, the reroute could disrupt access during construction; however, structures would not be affected. Construction and operation of the pipeline would not affect the existing high-voltage power line and gas pipeline that the Kingman reroute would partially parallel. Where other residential structures are located farther from the right-of-way and access road, impacts on landscaped property or outstructures would be fewer. Access to residential and industrial properties may be impeded temporarily during construction. This reroute would avoid highly dense residential areas crossed by the existing alignment. Impact levels would be minor to none for the reasons described for the existing route.

4.9.1.3 C Aquifer Water-Supply System

4.9.1.3.1 Well Field

Wells would be dispersed within the well field, spaced about 1.2 to 1.5 miles apart, and each well would require approximately 0.06 acre of permanent right-of-way for a well pad and associated equipment (e.g., wellhead, pump, communication, housing). A spur road to access each well would be needed and the pipeline from each well (that carries the water to the long-distance water-supply pipeline) would be buried in the access road. Also, an overhead power line would be constructed to each well to provide electricity to each pump. Approximately 55 residences exist within the area of the well field. Although residences would be avoided during the development of the well field, access to residences or associated use areas may be disrupted during construction activities. Much of the area of the well field is used for grazing. A total of approximately 63 acres would be used for right-of-way for the wells and associated facilities over the life of the water-supply system.

The impact from construction would vary from minor to none. Minor impacts would usually result from shifts in the areas used for grazing, or access restrictions or property disturbance of longer duration, while negligible impacts would usually result from access restrictions that are slightly more disruptive than ordinary traffic disturbances. Long-term impacts would be negligible.

4.9.1.3.2 C Aquifer Water-Supply Pipeline

In the unlikely event of a pipeline failure, some flooding would occur in topographic lows and drainage channels, there could be some amount of erosion, and much of the fresh water would soak into the ground. The amount of water released is not possible to predict. If the extent of the release warrants, the area affected (e.g., erosion) would be repaired as soon as practicable; therefore, the impact would be short term. The impact on land use would be short term and negligible.

4.9.1.3.2.1 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

Residential. The majority of the land crossed is rural. The eastern route generally parallels or is located within existing roadways or road rights-of-way; however, access to residences or commercial areas would be disrupted temporarily during construction at locations where the alignment crosses a sole access road. Survey of residential and commercial uses prior to construction would help avoid such areas and minimize impacts. Where the route is located away from a road, no residences would be affected.

Minor impacts would usually result from access restrictions or property disturbance of longer duration, while negligible impacts would usually result from access restrictions that are slightly more disruptive than ordinary traffic disturbances.

Livestock Grazing. The majority of the eastern route is located within a roadway. During construction, grazing would continue in areas adjacent to the right-of-way. In areas with no roads and trails, such as south of the Black Mesa Complex, grazing within the pipeline right-of-way would be displaced as a result of the forage removal from pipeline and access-road construction activities. Construction and operation of the pump stations would displace up to 4 acres (for construction) and 1.2 acres (permanently) of grazing land. Pump stations would be near highly traveled roads, where grazing is less likely to be concentrated. Short-term impacts would be minor; long-term impacts would be negligible to none.

Agricultural. Of approximately 74 acres of agricultural fields crossed by the eastern pipeline route, approximately 3 acres would be disturbed by construction, which would result in displacement of uses from about 4 percent of the agricultural areas along the route. Short-term impacts would be minor; long-term impacts would be negligible to none.

69 Kilovolt (kV) Power Line. Construction and operation of an overhead 69kV power line would temporarily impact residential, agricultural, commercial, and public/quasi-public land uses in or near the community of Kykotsmovi during construction by possibly limiting access. The line would be built adjacent and parallel to an existing road. Impacts would be moderate during construction, and negligible in the long term.

Kykotsmovi Area Subalternatives. Construction would temporarily disrupt access to residential, commercial, and public/quasi-public properties in the Kykotsmovi area. Both of the alternative routes are within roadways; thus, there would be no direct impact on structures. The western route would pass through areas of greater density than the eastern alternative, but location within the roadway would minimize direct impacts. Access to about seven residences along the western route would be affected during construction, which would be a minor impact. There would be no long-term impacts.

Little Colorado River Crossing Subalternatives. Both subalternative routes crossing the Little Colorado River would pass through an area largely devoid of development, and construction impacts would be negligible or none. The historic bridge over the Little Colorado River is abandoned and serves no transportation purpose.

4.9.1.3.2.2 *C Aquifer Water-Supply Pipeline: Western Route*

Land use impacts along the western pipeline route would be similar to those described for the eastern route, but because this alternative is longer, more ground would be disturbed.

Unlike the eastern route, this route parallels fewer existing roads or trails, and more forage would be removed for pipeline installation, displacing more grazing. Minor impacts would usually result from shifts in the areas used for grazing during construction, access restrictions or property disturbance of longer duration, while negligible impacts usually would result from access restrictions that are slightly more disruptive than ordinary traffic disturbances. Construction of an access road under this alternative would increase access to area residences and rangelands, or negligible beneficial effect.

4.9.2 **Alternative B – Conditional Approval of the LOM Revision Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System**

4.9.2.1 **Black Mesa Complex**

The Kayenta mining operation would continue to through 2026, and impacts would be similar to those discussed under Alternative A. The currently unpermitted parts of the Black Mesa Complex would be incorporated into the permit, and if mined (not planned at this time), impacts on those lands also would be similar to those in Alternative A. Existing disturbed areas of the mine would be reclaimed. The opportunity for improved livestock grazing would be foregone because the unmined land would be less productive for grazing. The unmined land is 10 times less productive over the long term than the land that is mined and reclaimed (OSM 1990). On reclaimed areas, final bond release could occur 10 years after the last augmented seeding, and livestock grazing could resume.

4.9.3 **Alternative C – Disapproval of the LOM Revision (No Action)**

4.9.3.1 **Black Mesa Complex**

The Kayenta mining operation would continue to operate through 2026, and impacts would be similar to those discussed under Alternative A. The Black Mesa mining operation would not resume, and the existing disturbed area of the mine would be reclaimed. On reclaimed areas, final bond release could occur 10 years after the last augmented seeding, and livestock grazing could resume. The opportunity for

improved livestock grazing would be forgone because the unmined land would be less productive for grazing, 10 times less productive than the land that is mined and reclaimed (OSM 1990).

4.10 CULTURAL ENVIRONMENT

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

- Physical destruction, damage, or alteration of 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 of the Interior's Standards for the Treatment of Historic Properties (36 CFR 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 in 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 the property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance [36 CFR 800.5(a)(2)].

The criteria of adverse effect were applied to each cultural resource identified within the area of potential effects and listed in or evaluated as eligible for the National Register or otherwise determined to have traditional cultural significance. For the NEPA analysis, the criterion for a significant impact on cultural resources was defined as an unavoidable adverse effect that appeared to have little potential for acceptable mitigation through consultation with parties participating in the review of the project in compliance with Section 106 of the NHPA.

Many of the resources that would be adversely affected are archaeological sites, and disturbance of those sites would be long-term permanent impacts. As final designs are prepared, project modifications would be considered to avoid or reduce impacts on those sites, and studies could be conducted to recover and preserve information to mitigate impacts on significant sites that cannot be avoided. A variety of measures might be implemented to mitigate short-term and long-term impacts on other types of cultural resources, particularly on various types of traditional cultural resources. For example, disturbed areas might be planted with native species that are collected for traditional uses to mitigate the short-term impacts of construction disturbance, and construction activities might be restricted to designated seasons to avoid short-term disturbance of eagles and raptors that are collected for ceremonial uses. Traditional ceremonies might be arranged to address what could be perceived as long-term impacts on ceremonial areas or named places related to traditional histories. Some of the most sensitive impacts relate to disturbance of human remains in historical graves or archaeological sites. Project modifications would be

considered to avoid disturbance of burials, but if all human remains cannot be avoided, they would be excavated and repatriated in consultation with related and affiliated groups pursuant to regulations and policies applicable to the ownership of the land on which they are located. Specific measures to reduce or mitigate adverse effects on each traditional cultural resource that cannot be avoided would be developed in consultation with the tribes who value those resources. Measures to avoid, reduce, or mitigate adverse effects on cultural resources would be implemented in consultation with the Navajo Nation THPO and Arizona and Nevada SHPOs and other interested parties pursuant to a Section 106 Programmatic Agreement.

4.10.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.10.1.1 Black Mesa Complex

Archaeological and Historical Resources. As discussed in Chapter 3.10, the 20-year Black Mesa Archaeological Project, conducted between 1967 and 1986, completed Section 106 mitigation requirements for coal mining operations within the Black Mesa Mine Complex (including the permitting of the coal-slurry preparation plant and construction of a coal-washing facility). Pursuant to terms and conditions of the current LOM Permit AZ-0001D, Peabody continues to report to OSM and address the discovery of any unrecorded archaeological and historical resources.

Alternative A would incorporate 18,984 acres of the currently unpermitted Black Mesa operations into the area currently permitted for mining through 2026. By definition, it is not possible to predict unexpected discoveries, but experience in fulfilling the LOM permit conditions since 1990 suggests that incorporation of the unpermitted area into the permit and mining coal through 2026 might result in approximately three to five additional unanticipated discoveries of archaeological or historical resources. Because of the extensive prior mitigation and relatively few sites that would be affected, this level of impact is rated as minor.

Traditional Cultural Resources. Traditional Hopis and Navajos consider all of Black Mesa to be a significant traditional cultural resource because of its role in traditional stories and ceremonial and clan traditions, and because it is an area where traditional resources are obtained. They feel that development of the Black Mesa Complex has adversely affected their traditional lifeways. Alternative A would authorize continued mining within the currently unpermitted area through 2026. Although Hopis and Navajos living anywhere might regard that continued mining as an impact on their cultural traditions, the lifeways of the approximately 60 Navajo households that continue to reside within the Black Mesa Complex would be most directly affected by extension of the LOM permit.

Special Condition No. 1 of the existing LOM permit requires Peabody to take into account any sacred and ceremonial sites brought to the attention of Peabody by local residents, clans, or representatives of the Hopi Tribe or Navajo Nation tribal governments. Based on prior experience, it is estimated that perhaps 10 to 15 additional sacred or ceremonial sites might be reported through 2026 within the currently unpermitted area.

The Hopi and Navajo have traditional cultural affiliations with human remains associated with archaeological sites within the Black Mesa Complex. Although the Black Mesa Archaeological Project excavated many burials, only a sample of the archaeological sites was excavated and there could be burials at the unexcavated sites. The passage of NAGPRA in 1990 stipulated that Federal agencies inventory and repatriate excavated human remains. Special Condition 4 of Permit AZ-0001C issued July 6, 1990 required Peabody to comply with NAGPRA by identifying and respectfully treating any human remains associated with unexcavated archaeological sites in areas to be disturbed by mining activities.

That condition is included in the current Permit AZ-0001D, and if Alternative A were approved, the condition would apply to the additional 18,984 acres of the currently unpermitted area that would be incorporated into the permit area.

Assuming that experience in fulfilling the permit conditions is a reasonable indication of what to expect in the future, it is estimated that mining within the currently unpermitted area through 2026 would require testing of approximately 20 to 25 archaeological sites for burials and perhaps 25 to 30 more human remains might be found and need to be moved. Because policies and procedures are in place for treating burials and sacred or ceremonial sites, the projected level of impact is rated as moderate.

Construction activities related to development of a new coal-haul road on the Hopi Indian Reservation from the J-23 coal resource area in the Kayenta mining operation area to the coal-preparation facilities in the Black Mesa mining operation area would be confined to a corridor about 500 feet wide and 2 miles long. An intensive field survey of the corridor identified two archaeological and historical sites that are evaluated as eligible for the National Register (Table 4-36). Construction of the road is unlikely to disturb the entire width of the corridor, but because a final design for the road has not been prepared, it is not known whether the sites would be disturbed or not. Regardless, the projected potential impacts on two sites are rated as minor.

Table 4-36 Potential Adverse Effects on Cultural Resources within the Coal-Haul Road Corridor¹

Site Name/ Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status ²	Effects, Recommended Treatment ²	
<i>Archaeological and Historical Sites</i>						
1	045-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, C, D	potential adverse effect, data recovery if avoidance not feasible
2	046-2005(Hopi)	Hopi	Navajo	sweat lodge	eligible, Criteria A, D	potential adverse effect, consult with former users and treat if avoidance not feasible

NOTES: ¹The inventory is based on conceptual designs. Effects would be reassessed pursuant to a Section 106 Programmatic Agreement during the post-EIS preparation of final designs.

² Recommendations regarding eligibility, effect, and treatment are indicated; agency consultations are ongoing. Refer to Section 3.10 for summary of eligibility criteria or 36 CFR 60 for detailed definitions.

The Hopi and Navajo consider all of Black Mesa to be a significant traditional cultural property. A Hopi study team and a Navajo study team concluded that the proposed construction of the coal-haul road would not adversely affect the significant traditional cultural values of Black Mesa. Therefore, the coal-haul road is projected to have no impacts on traditional cultural resources.

4.10.1.2 Coal-Slurry Pipeline

4.10.1.2.1 Coal-Slurry Pipeline: Existing Route

Archaeological and Historical Resources. Thirty-six archaeological and historical resources listed in or eligible for the National Register have been inventoried along the existing route of the coal-slurry pipeline. Most pipeline reconstruction activities would be confined to a previously disturbed 50-foot-wide right-of-way across many of those resources, but conceptual designs indicated that construction activities within temporary construction easements are likely to adversely affect parts of 23 of those resources (Table 4-37). Two of these sites may have been excavated to mitigate the impacts of the original pipeline construction, and if so, any remaining significant values at those sites might not be adversely affected.

**Table 4-37 Potential Adverse Effects on Archaeological and Historical Sites
along the Existing Coal-Slurry Pipeline Route¹**

Site Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status ²	Effects, Recommended Treatment ²	
<i>Existing Alignment</i>						
1	026-2005(Hopi)	Hopi	Ancestral Pueblo (Anasazi)	feature and artifact scatter	eligible, Criteria A, D	adverse effect, avoid or test and recover data
2	031-2005(Hopi)	Hopi	Navajo	habitation	eligible, Criteria A, C, D	adverse effect, avoid or recover data (ethnographic/ archival research)
3	032-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	adverse effect, avoid or test and recover data
4	034-2005(Hopi), possibly Dot Klish Village, Ariz D:10:1(PC) ³	Hopi	Ancestral Pueblo	habitation	eligible, Criteria A, C, D	no adverse effect if it is determined that the affected area was previously excavated; if not, adverse effect, avoid or test and recover data
5	038-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	adverse effect, avoid or test and recover data
6	042-2005(Hopi)	Hopi	Ancestral Pueblo	temporary camp	eligible, Criteria A, C, D	adverse effect, avoid or test and recover data
7	043-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	adverse effect, avoid or test and recover data
8	044-2005(Hopi), possibly Ariz D:9:1(PC) ³	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, C, D	no adverse effect if it is determined that the affected area was previously excavated; if not, adverse effect, avoid or test and recover data
9	AZ H:9:41(ASM)	ASLD	Cohonina	artifact scatter	eligible, Criterion D	adverse effect, avoid or test and recover data
10	AZ H:9:42(ASM)	ASLD	Cohonina	artifact scatter	eligible, Criterion D	adverse effect, avoid or test and recover data
11	AZ H:9:43(ASM)	ASLD	Cohonina	field house, artifact scatter	eligible, Criterion D	adverse effect, avoid or test and recover data
12	AZ H:10:120(ASM)	ASLD, private	Cohonina	field house with associated artifacts	eligible, Criterion D	adverse effect, avoid or test and recover data
13	AZ H:10:130(ASM)	ASLD	prehistoric	scatter of flaked stone (Mount Floyd volcanic field)	eligible, Criterion D	adverse effect, avoid or test and recover data
14	AZ H:10:131(ASM)	private	prehistoric	scatter of flaked stone (Mount Floyd volcanic field)	eligible, Criterion D	adverse effect, avoid or test and recover data
15	AZ H:10:132(ASM)	ASLD, private	prehistoric	scatter of flaked stone (Mount Floyd volcanic field)	eligible, Criterion D	adverse effect, avoid or test and recover data
16	AZ H:10:133(ASM)	ASLD	prehistoric	scatter of flaked stone (Mount Floyd volcanic field)	eligible, Criterion D	adverse effect, avoid or test and recover data
17	AZ H:10:134(ASM)	ASLD, private	Cohonina/ Cerbat	artifact scatter (Mount Floyd volcanic field)	eligible, Criterion D	adverse effect, avoid or test and recover data
18	AZ H:10:135(ASM)	ASLD	prehistoric	scatter of flaked stone (Mount Floyd volcanic field)	eligible, Criterion D	adverse effect, avoid or test and recover data

	Site Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status ²	Effects, Recommended Treatment ²
19	AZ H:10:136(ASM)	private	prehistoric	scatter of flaked stone (Mount Floyd volcanic field)	eligible, Criterion D	adverse effect, avoid or test and recover data
20	AZ H:10:137(ASM)	private	prehistoric	scatter of flaked stone (Mount Floyd volcanic field)	eligible, Criterion D	adverse effect, avoid or test and recover data
21	AZ H:10:138(ASM)	private	prehistoric	scatter of flaked stone (Mount Floyd volcanic field)	eligible, Criterion D	adverse effect, avoid or test and recover data
22	AZ H:10:139(ASM)	private	Cohonina/ Cerbat	artifact scatter (Mount Floyd volcanic field)	eligible, Criterion D	adverse effect, avoid or test and recover data
23	AZ H:11:41(ASM)	private	Cohonina	field house	eligible, Criterion D	adverse effect, avoid or test and recover data

NOTES: ¹ The inventory is based on conceptual designs. Supplemental surveys would be conducted as needed pursuant to a Section 106 Programmatic Agreement during the post-EIS preparation of final designs.

² Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing.

³ Site may have been excavated to mitigate the impacts of the original pipeline construction.

⁴ ASLD = State Trust Land managed by the Arizona State Land Department.

Of these 23 sites, 8 are on the Hopi Reservation, and 15 are west of the Hopi and Navajo Reservations. One of the sites is an Ancestral Pueblo habitation site, and 6 others also reflect Ancestral Pueblo occupation of the region, including one temporary camp, and 5 artifact scatters. One site is a historical Navajo habitation. Seven sites reflect prehistoric Cohonina or Cerbat occupation of northwestern Arizona—3 sites with field houses, and 4 artifact scatters without features. The 8 other sites are scatters of flaked stone in the Mount Floyd volcanic field. Although culturally or temporally diagnostic artifacts have not been found on these sites, they probably were used by the Cohonina and Cerbat cultures, and perhaps during the earlier Archaic era as well.

All of the resources that might be adversely affected are significant and eligible for the National Register because of their potential to yield important information about the prehistory and history of the region (Criterion D). The Hopi also consider all Ancestral Pueblo sites to be significant under Criterion A because of their association with important events in Hopi history, and sites with remnants of architecture to be eligible under Criterion C because they represent distinctive types. Efforts would be made during preparation of final designs to avoid or reduce impacts on the National Register-eligible properties. For sites that cannot be avoided, there is good potential to satisfactorily mitigate the impacts through data recovery studies. Because of this potential and the prior disturbance of the affected sites, the projected impacts are rated as moderate.

Traditional Cultural Resources. Reconstruction of the coal-slurry pipeline along the existing route has potential to adversely affect 10 traditional Hopi cultural resources and 1 traditional Hualapai cultural resource (Table 4-38). These include areas where eagles and other raptors are collected for ceremonial uses, ceremonial areas and shrines, trails, landscape features, trails, ancestral sites, and water sources. The pipeline reconstruction mostly would be limited to a previously disturbed corridor, but the effects are potentially adverse. Those effects and measures to avoid, reduce, or mitigate adverse effects would be discussed pursuant to a Section 106 Programmatic Agreement if Alternative A is approved. Because of the prior disturbance and potential to reduce or mitigate adverse effects, the impacts are rated as moderate.

Table 4-38 Potential Impacts on Traditional Cultural Resources along the Existing Coal-Slurry Pipeline¹

	Resource	Cultural Affiliation	National Register Status²	Effects, Recommended Treatment²
1	Kiikiqō, petroglyphs, and pictographs, site 032-2005	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoidance recommended
2	Hotvela Sun Clan eagle gathering area	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoidance recommended
3	Hotvela Fire Clan eagle gathering area	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoidance recommended
4	Salt pilgrimage trail	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoidance recommended
5	Owaqōl ritual race track	Hopi	eligible, Criterion A	crossed, adverse effect, avoidance recommended
6	Tuutuskya (offering place)	Hopi	eligible, Criterion A	crossed, adverse effect, avoidance recommended
7	Orayvi Greasewood Clan eagle gathering area	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoidance recommended
8	Songōopavi Bear Clan eagle gathering area	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoidance recommended
9	Palavayu (Little Colorado River), sacred watercourse	Hopi	eligible, Criterion A	crossed, adverse effect, avoidance recommended
10	Koohonina trail	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoidance recommended
11	Tuckayou Spring	Hualapai	eligible, Criterion A	possible blockage of downstream flow, adverse effect, reconstruct pipeline to allow flow over the pipeline

NOTES: ¹ The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 Programmatic Agreement during the post-EIS preparation of final designs.

² Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or 36 CFR 60 for detailed definitions. It is recognized that avoidance of some resources, such as linear trails, is impossible, and measures to reduce or mitigate impacts would be implemented in consultation with the appropriate tribe.

4.10.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignment (Agencies’ Preferred Alternative)

Archaeological and Historical Resources. The agencies’ preferred route with realignments could affect nine more archaeological and historical sites eligible for the National Register than reconstruction of the pipeline along the existing right-of-way. Eight of these resources are Ancestral Pueblo archaeological sites located within a 400-foot-wide corridor along Moenkopi Wash (Table 4-39). Three of these sites are habitation sites, two appear to be temporary camps, and three are artifact scatters, petroglyphs (rock art). Impacts cannot be determined until final designs are prepared, but it is anticipated that a total of no more than 1 mile of the pipeline would be realigned in this segment and there is good potential to avoid impacts on all of these sites. The Kingman realignment is likely to adversely affect one additional National Register-eligible site, which is the archaeological remnants of the razed Harris Station along the Atchison, Topeka & Santa Fe Railroad.

**Table 4-39 Potential Impacts on Archaeological and Historical Sites
along the Coal-Slurry Pipeline Realignment¹**

Site Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status ²	Effects, Recommended Treatment ²	
<i>Moenkopi Wash Realignments</i>						
1	033-2005(Hopi)	Hopi	Ancestral Pueblo	habitation (?), possible pit house, artifact scatter	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
2	035-2005(Hopi)	Hopi	Ancestral Pueblo	petroglyphs and artifact scatter	eligible, Criteria A, C, D	potential adverse effect, avoid or test and recover data
3	036-2005(Hopi)	Hopi	Ancestral Pueblo	petroglyphs	eligible, Criteria A, C, D	potential adverse effect, avoid or test and recover data
4	037-2005(Hopi)	Hopi	Ancestral Pueblo	petroglyphs and artifact scatter	eligible, Criteria A, C, D	potential adverse effect, avoid or test and recover data
5	039-2005(Hopi)	Hopi	Ancestral Pueblo	temporary camp, 1-room structure, artifact scatter	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
6	040-2005(Hopi)	Hopi	Ancestral Pueblo	temporary camp	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
7	041-2005(Hopi)	Hopi	Ancestral Pueblo	habitation	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
8	AZ J-37-05(NNHPD)	Navajo	Ancestral Pueblo	habitation	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
<i>Kingman Reroute</i>						
1	Harris Station, AZ F:16:61(ASM)	BLM, private	Euro-American	remnants of 1890s–1940s railroad station	eligible, Criteria D	potential adverse effect, avoid or test and recover data

NOTES: ¹ The inventory is based on conceptual design. Supplemental surveys would be conducted as needed pursuant to a Section 106 Programmatic Agreement during the post-EIS preparation of final designs.

² Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or 36 CFR 60 for detailed definitions.

All nine of the additional sites that might be affected by the realignments are eligible for the National Register because of their potential to yield important information about the prehistory and history of the region (Criterion D). The Hopi also consider the Ancestral Pueblo sites to be significant under Criterion A because of their association with important events in Hopi history, and sites with petroglyphs to be eligible under Criterion C because they are representative of a style of rock art. Efforts would be made during preparation of final designs to avoid or reduce impacts on these sites, but if they cannot be avoided, there is good potential to satisfactorily mitigate the impacts through data recovery studies. Because of this potential and the prior disturbance, the projected impacts are rated as moderate.

Traditional Cultural Resources. Reconstruction of the coal-slurry pipeline with the Moenkopi Wash realignments would not adversely affect any more traditional cultural resources than would reconstruction along the existing right-of-way. The level of impacts is rated as moderate.

One traditional Hualapai cultural resource, a historical cemetery, is located about 1 mile from the proposed Kingman reroute. Reconstruction of the coal-slurry pipeline along that reroute is not expected to affect the cemetery.

4.10.1.3 C Aquifer Water-Supply System (Agencies' Preferred Alternative)

4.10.1.3.1 Well Field

Archaeological and Historical Resources. A records review of the proposed well field identified 11 archaeological and historical sites evaluated as eligible for the National Register or as requiring

archaeological testing to complete their evaluation (Table 4-40). Five of these sites are scatters of prehistoric flaked stone that may date to the Archaic or Ancestral Pueblo periods. Two other sites reflect Ancestral Pueblo occupation, and include a habitation site and an artifact scatter with petroglyphs. The three other sites are related to livestock grazing by Navajos or Euro-Americans. The well field has not been designed, but there is considerable flexibility in selecting the specific location of wells (as many as 21) and associated power lines, access roads, and collector pipelines. Consequently, there is considerable potential for avoiding adverse effects on archaeological and historical sites as the well field is designed, and potential impacts are rated as minor.

Table 4-40 Potential Impacts on Archaeological and Historical Sites within the C-Aquifer Well Field¹

Site Number		Jurisdiction	Cultural Affiliation	Site Type	National Register Status ²	Effects, Recommended Treatment ²
1	011-2004(Hopi)	Hopi	Archaic, Ancestral Pueblo (?)	scatter of flaked stone	eligible, Criterion D	potential adverse effect, avoid or test and recover data
2	013-2004(Hopi)	Hopi	Euro-American	post-1900 livestock pens, windmill, water tanks	eligible, Criterion D, possibly A	potential adverse effect, avoid or test and recover data
3	AZ-N-56-3(NNHPD)	Navajo	Ancestral Pueblo (Anasazi)	Pueblo III habitation site	eligible, Criterion D	potential adverse effect, avoid or test and recover data
4	AZ-N-56-4(NNHPD)	Navajo	Ancestral Pueblo (Anasazi)	petroglyph and artifact scatter	eligible, Criterion D	potential adverse effect, avoid or test and recover data
5	AZ-N-56-6(NNHPD)	Navajo	prehistoric	scatter of flaked stone	eligibility testing recommended, Criterion D	potential adverse effect, avoid or test and recover data
6	AZ-N-56-7(NNHPD)	Navajo	prehistoric	scatter of flaked stone	eligibility testing recommended, Criterion D	potential adverse effect, avoid or test and recover data
7	AZ-N-56-8(NNHPD)	Navajo	prehistoric	scatter of flaked stone	eligibility testing recommended, Criterion D	potential adverse effect, avoid or test and recover data
8	AZ-N-56-9(NNHPD)	Navajo	Navajo	1930s–1960s sheep dipping station	eligible, Criterion D, possibly A	potential adverse effect, avoid or test and recover data
9	AZ-N-41-10(NNHPD)	Navajo	prehistoric	scatter of flaked stone	eligibility testing recommended, Criterion D	potential adverse effect, avoid or test and recover data
10	AZ-N-56-11(NNHPD)	Navajo	Navajo	1890s–1950s rocks alignments and scatter of artifacts (possible herding camp)	eligible, Criterion D	potential adverse effect, avoid or test and recover data
11	AZ-O-49-1(NNHPD)	Navajo	prehistoric, Navajo	scatter of flaked stone (Tolchaco gravels), 1930s cistern and inscribed concrete marker	prehistoric component eligible, Criterion D; historic-period component not eligible	potential adverse effect, avoid or test and recover data

NOTES: ¹ The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 Programmatic Agreement during the post-EIS preparation of final designs.

² Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or 36 CFR 60 for detailed definitions.

Traditional Cultural Resources. Four traditional cultural resources have been inventoried within areas that could be affected by development of the C-aquifer well field, but only one of these—an area where the Hopi collect eagles for ceremonial uses—is likely to be adversely affected (Table 4-41). Consultations would be conducted with the HCPO pursuant to a Section 106 Programmatic Agreement to seek ways to avoid, reduce, or mitigate those impacts.

The Hopi consider all sources of surface water, whether in springs, or ephemeral or permanent streams, to have traditional cultural significance. Clear Creek and Chevelon Creek were identified as two specific traditional Hopi cultural resources within areas that might be affected by pumping of groundwater from the C aquifer. Hydrogeological modeling of the impacts of the proposed pumping of groundwater, even at the highest rate being considered, indicated the reduction in base flow within those creeks, which are about 26 to 33 miles east of the well field, would not be measurable (refer to Section 4.3), and no adverse effects are anticipated.

Table 4-41 Potential Impacts on Traditional Cultural Resources within the C-Aquifer Well Field and Related Surface Water¹

	Resource	Cultural Affiliation	National Register Status²	Effects, Recommended Treatment²
1	Songòopavi Bearstrap clan eagle collecting area	Hopi	eligible, Criterion A	within 1 mile, adverse effect, recommend avoidance
<i>Surface Water</i>				
1	Sakwawayu/ Lemovayu (Clear Creek) shrine	Hopi	eligible, Criterion A	No measurable decrease in stream flows
2	Sakwawayu (Chevelon Creek)	Hopi	eligible, Criterion A	No measurable decrease in stream flows
<i>Shallow Groundwater Used for Traditional Livestock Grazing</i>				
1	wells in the Leupp vicinity	Navajo	not historic properties	dropping water table may dry up wells; alternative water supply would be provided for traditional livestock grazing

NOTES:

¹ The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 Programmatic Agreement during the post-EIS preparation of final designs.

² Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or 36 CFR 60 for detailed definitions.

Springs and other water resources also are important to traditional Navajo culture. Some Navajo continue traditional grazing of livestock in the well field area and rely on shallow wells to provide water for their herds. Development of the C aquifer water supply could cause those wells to go dry. Although the wells are not historic properties, this could result in adverse impacts on traditional lifeways. The project proponents would provide an alternative water source for livestock grazing to mitigate the impacts of groundwater drawdown.

One traditional Hopi cultural resource and an aspect of traditional Navajo lifeways could be affected. Because of the potential to mitigate the effects, the impacts are rated as minor.

4.10.1.3.2 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

Archaeological and Historical Resources. Twenty-three archaeological and historical resources evaluated as eligible for the National Register have been identified within areas that could be affected by construction of the eastern alignment of the C aquifer water-supply pipeline and associated access roads, substation, and power line (Table 4-42). The surveyed area included options for installing the pipeline on either side of the roads that are followed along much of the eastern route, as well as alternative locations for a substation and power line routes. Therefore, it is unlikely that all 23 of the identified resources would be affected. However, additional archaeological and historical sites might be subject to potential effects because the area of construction disturbance might be expanded as final designs are prepared for facilities such as the pump stations.

Table 4-42 Potential Impacts on Archaeological and Historical Sites along the C Aquifer Water-Supply Pipeline and Related Facilities: Eastern Route¹

Site Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status ²	Effects, Recommended Treatment ²	
Proposed Water Pipeline						
1	013-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
2	014-2005(Hopi), NA14487(?)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
3	015-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter and possible shrine	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
4	016-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, C, D	potential adverse effect, avoid or test and recover data
5	017-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
6	019-2005(Hopi) ³	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
7	020-2005(Hopi) ³	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
8	021-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
9	022-2005(Hopi)	Hopi	Ancestral Pueblo	rock alignment (possible field house)	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
10	023-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
11	024-2005(Hopi)	Hopi	Ancestral Pueblo	habitation	eligible, Criteria A, C, D	potential adverse effect, avoid or test and recover data
12	025-2005(Hopi)	Hopi	Ancestral Pueblo	habitation	eligible, Criteria A, C, D	potential adverse effect, avoid or test and recover data
13	027-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
14	028-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
15	029-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
16	030-2005(Hopi)	Hopi	Ancestral Pueblo	artifact scatter	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
17	048-2005(Hopi), JUA 80-07	Hopi	Ancestral Pueblo	habitation	eligible, Criteria A, C, D	potential adverse effect, avoid or test and recover data
18	AZ-J-43-40(NNHPD)	Navajo	Ancestral Pueblo (Anasazi)	Pueblo I-II field house	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data

	Site Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status ²	Effects, Recommended Treatment ²
19	AZ-J-44-19(NNHPD)	Navajo	Ancestral Pueblo (Anasazi)	Pueblo II field house	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
20	AZ-O-31-3(NNHPD)	Navajo	Ancestral Pueblo (Anasazi)	Pueblo I habitation	eligible, Criteria A, D	potential adverse effect, avoid or test and recover data
21	AZ-O-48-1(NNHPD)	Navajo	Ancestral Pueblo (Anasazi)	Pueblo II habitation	eligible, Criteria A, D, partially excavated	potential adverse effect, avoid or test and recover data
22	AZ-O-48-19(NNHPD)	Navajo	Archaic	scatter of flaked stone	eligible, Criterion D	potential adverse effect, avoid or test and recover data
23	AZ-O-48-40(NNHPD)	Navajo	Euro-American	circa 1920 steel, through-truss bridge	eligible, Criterion C	potential adverse effect, design reuse to preserve historic features

NOTES: ¹ The inventory is based on conceptual designs and does not include the locations of two pumping stations, and other facilities such as holding tanks. The survey included options for locating the pipeline on either side of existing roads in some locations, so all of the sites probably would not be affected. Supplemental surveys would be conducted pursuant to a Section 106 Programmatic Agreement during the post-EIS preparation of final designs and additional sites might be identified.

² Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or 36 CFR 60 for detailed definitions.

³ Located along the west Kykotsmovi area subalternative.

Twenty-one of the 23 sites are related to Ancestral Pueblo (Anasazi) occupation of the region, and include 5 habitation sites, 3 field houses, and 13 artifact scatters. Another scatter of flaked stone dates to the Archaic era.

The other recorded resource—an abandoned steel truss bridge—is being considered as one of two subalternatives for crossing the Little Colorado River. If the bridge were used to support the pipeline over the river, there is potential to adversely affect the historic integrity of the bridge if the addition of the pipeline was not according to the Secretary of the Interior’s Standards for Historic Preservation. On the other hand, adaptive reuse of the bridge might enhance the potential for preservation of the bridge in place. There are no National Register-eligible resources along the other subalternative crossing, which would involve boring beneath the river.

The other subalternative for the eastern route of the water-supply pipeline is in the Kykotsmovi area. Two of the Ancestral Pueblo artifact scatters are located along the west Kykotsmovi subalternative. Use of the east Kykotsmovi subalternative alignments would avoid potential impacts on those sites.

Construction of a water-supply pipeline along the eastern alternative alignment could affect numerous archaeological sites and a historical bridge. The projected impacts are rated as moderate.

Traditional Cultural Resources. Seventy-seven traditional cultural resources have been inventoried within areas that could be affected by development of the eastern route for the C aquifer water-supply pipeline and associated facilities, and current preliminary designs indicate 16 of those could be adversely affected (Table 4-43). Fourteen of those are significant to the Hopi, and include trails, plant collection areas, fields in the Kykotsmovi vicinity, eagle collecting areas, ceremonial areas, water resources, and an ancestral village. Potential effects and measures to avoid, reduce, or mitigate adverse effects would be considered pursuant to a Section 106 Programmatic Agreement if the eastern route is approved. Two resources of significance to Navajos are burials that may be close enough to the proposed route that they might be disturbed. If those burials could not be avoided, they would be treated pursuant to the NAGPRA and the

Navajo Nation Jishchaá policy. Because of the potential to reduce or mitigate adverse effects, the potential impacts are rated as moderate.

4.10.1.3.3 C Aquifer Water-Supply Pipeline: Western Route

Archaeological and Historical Resources. Because the western route for the water pipeline is only conceptually defined, the area of potential effects for construction impacts could not be delineated with sufficient detail to warrant intensive field survey to identify archaeological and historical resources along this alternative. A records and literature review identified more than 340 prior studies that had recorded almost 400 archaeological and historical sites within a 1-mile-wide corridor along the western route. The review indicated that the Kletthla Valley, Long House Valley, and northern Black Mesa, which are crossed by the western route, have some of the highest densities of archaeological sites in the region, and have a higher percentage of larger and more complex habitation sites than along the eastern route. The western route also is more than 30 percent longer than the eastern route. Therefore, it is very likely that use of the western route would adversely affect considerably more archaeological and historical sites and require substantially more time and funds to mitigate impacts than would use of the proposed route. Because there is good potential for satisfactory mitigation through data recovery, the impacts are rated as moderate.

Table 4-43 Potential Adverse Effects on Traditional Cultural Resources along the C Aquifer Water-Supply Pipeline and Related Facilities: Eastern Route¹

	Resource	Cultural Affiliation	National Register Status ²	Effects, Recommended Treatment ²
1	Songóopavi Bearstrap Clan eagle gathering area	Hopi	eligible, Criteria A, D	within 1 mile, adverse effect, avoid
2	Palavayu (Little Colorado River), sacred watercourse	Hopi	eligible, Criterion A	crossed, adverse effect, avoid
3	Songóopavi Bear Clan eagle gathering area	Hopi	eligible, Criteria A, D	within 1 mile, adverse effect, avoid
4	Traditional plant collection areas	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoid
5	Masqötö, spiritual area	Hopi	eligible, Criterion A	within 1 mile, adverse effect, avoid
6	Uyvaturyqa, Kwan Society eagle gathering area	Hopi	eligible, Criteria A, D	within 1 mile, adverse effect, avoid
7	Trail to San Francisco Peaks	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoid
8	Kiiqö along highway south of Kiiqötsmóvi	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoid
9	Farm fields along Oraibi Wash	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoid
10	Tep'va (Greasewood Spring)	Hopi	eligible, Criterion A	crossed, adverse effect, avoid
11	Traditional trail and wagon road (Route 22)	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoid
12	Tsongongöyakni, smoking circle	Hopi	eligible, Criteria A, D	within 1 mile, potential adverse effect, avoid
13	Tuutuskya (offering place) associated with Kiisiwu pilgrimage	Hopi	eligible, Criteria A, D	within 1 mile, potential adverse effect, avoid
14	Tuutuskya (offering place) on pilgrimage trail to Kiisiwu	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoid
15	Jishchaá, Burial 1	Navajo	protected by NAGPRA	possible disturbance, treat pursuant to Navajo Nation Jishchaá policy
16	Jishchaá, Burial 8	Navajo	protected by NAGPRA	possible disturbance, treat pursuant to Navajo Nation Jishchaá policy

NOTES: ¹ The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 Programmatic Agreement during the post-EIS preparation of final designs.

² Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or 36 CFR 60 for detailed definitions. It is recognized that avoidance of some resources, such as linear trails, is impossible, and measures to reduce or mitigate impacts would be implemented in consultation with the appropriate tribe.

Traditional Cultural Resources. Records reviews and limited interviewing identified 17 traditional Hopi cultural resources and 11 traditional Navajo cultural resources that could be affected by the western route for the C aquifer water-supply pipeline. Eleven of those could be adversely affected (Table 4-44). Ten of these are significant to the Hopi and include eagle collecting areas, a trail, and a water source. One historical Navajo burial also might be disturbed. Interviewing local Navajo residents along the route probably would identify numerous other, more specific traditional Navajo cultural resources, such as locations where traditional ceremonies have been conducted, abandoned house sites, remnants of corrals used in hunting game, and other burial locations. Although incomplete, the inventory indicates the impacts are likely to be moderate.

Table 4-44 Potential Adverse Effects on Traditional Cultural Resources along the C Aquifer Water-Supply Pipeline and Related Facilities: Western Route¹

	Resource	Cultural Affiliation	National Register Status²	Effects, Recommended Treatment²
1	Songôopavi Bearstrap Clan eagle gathering area ¹	Hopi	eligible, Criteria A, D	more than 1 mile away, adverse effect, avoid
2	Palavayu (Little Colorado River), sacred watercourse ¹	Hopi	eligible, Criterion A	crossed, adverse effect, avoid
3	Songôopavi Bear Clan eagle gathering area ¹	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoid
4	Hotvela Sand Clan eagle gathering area	Hopi	eligible, Criteria A, D	more than 1 mile away, adverse effect, avoid
5	Orayvi Greasewood Clan eagle gathering area	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoid
6	Salt pilgrimage trail	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoid
7	Naptsiwtaqa - Hotvela Fire Clan eagle gathering area	Hopi	eligible, Criteria A, D	within 1 mile, adverse effect, avoid
8	Hotvela Sun Clan eagle gathering area	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoid
9	Mariiya (Middle Mesa) eagle and plant area	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoid
10	Kwatupatsa - Hotvela Eagle Clan eagle gathering area	Hopi	eligible, Criteria A, D	crossed, adverse effect, avoid
11	Jishchaá, Burial 1 ¹	Navajo	protected by NAGPRA	possible disturbance, treat pursuant to Navajo Nation Jishchaá policy

NOTES: ¹ The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 Programmatic Agreement during the post-EIS preparation of final designs.

² Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or 36 CFR 60 for detailed definitions. It is recognized that avoidance of some resources, such as linear trails, is impossible, and measures to reduce or mitigate impacts would be implemented in consultation with the appropriate tribe.

4.10.1.4 Continued Use of the N Aquifer

Pumping of groundwater from the N aquifer would continue for well maintenance, and as a backup supply if there were outages in the C-aquifer supply. The expected maximum rate of pumping is no more than about half the current rate. An option for continued complete reliance on the N aquifer also is being considered as an alternative to building a new C aquifer water-supply system. The Hopi consider streams and springs within the area that could be affected by continued pumping of groundwater from the N aquifer to be traditional cultural resources. Hydrogeological modeling indicates that any of these options would result in no measurable reductions in baseflow within those streams and springs, and no adverse effects are anticipated under any N-aquifer pumping scenario.

4.10.2 Alternative B – Approval of the LOM Revision Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

Under Alternative B, the 18,984 acres of the unpermitted area would be incorporated into the area permitted for mining. However, the coal-slurry pipeline would not be reconstructed and operations would not resume, and the C aquifer water-supply system would not be developed. Impacts of those activities on cultural resources would be avoided. Impacts on cultural resources would be confined to the mining operations areas, and as discussed in Section 3.10, mitigation studies have been completed and requirements of Section 106 of the NHPA have been fulfilled for the entire coal lease area. In accordance with LOM permit conditions, Peabody would continue to address any cultural resources discoveries, identify and treat human remains, and take into account any sacred and ceremonial sites brought to their attention by local residents, clans, or representatives of the Hopi Tribe or Navajo Nation tribal governments.

4.10.3 Alternative C – Disapproval of the LOM Revision (No Action)

Under Alternative C, the Kayenta mining operation would continue through 2026 as currently permitted. The impacts on cultural resources would be similar to those of Alternative B, except that further mining would not be authorized within the 18,984 acres of the unpermitted area. That might result in avoiding impacts on approximately 5 unanticipated discoveries of cultural resources, 10 to 15 sacred sites or ceremonial areas, and 25 to 30 burials that may be within 20 to 25 archaeological sites.

4.11 SOCIAL AND ECONOMIC CONDITIONS

This section addresses the social and economic impacts of the Kayenta and Black Mesa mining operations (including ancillary facilities), the coal-slurry pipeline, and the C aquifer water-supply system upon the communities within the region of influence. Many types of historic and current data (presented in Chapter 3) were applied and projected, as appropriate, to quantify the economic impacts on the affected environment.

To estimate impacts of the alternatives on revenue, fluctuations in revenue that occurred in the past were reviewed. The future abilities of the various governmental entities to generate revenue were considered (including various revenue sources and rate-setting opportunities). Judgments about project consequences were made based on those considerations.

Assumptions. Several assumptions were made for the purposes of the impact assessment. These are described below.

There would be no substantial change in mining, construction, or reclamation technology over the life of the mining operations.

The government legislation and regulations controlling taxation, royalty payments, employment wage rates, and hiring practices generally would remain in effect. There would be neither major changes in the various rates nor changes in the manner in which government agencies receive the revenue. The revenue from water use, however (historically received as water royalties, see Table 3-31), is considered a special case. It is assumed that the revenue from mining-related water use would increase in Alternative A, at least as a result of the increase in water use to 6,000 af/yr. No assumption is made concerning any increase in water revenue that is a result of any other changes in royalties (such as the water royalty rates) or any other water revenue sources.

For most of the revenue sources, it is assumed the revenue to the Navajo Nation and to the Hopi Tribe that is attributable to each mine would be closely related to the amount of coal extracted from the mine in

any given year. Examples are the possessory interest tax, business activity tax, Navajo sales tax, Navajo fuel excise tax, coal royalties, and coal bonuses. It is assumed that the increased water-related revenue in Alternative A would come largely from the Black Mesa mining operation because of the high volume of water use by the coal-slurry pipeline.

The industry multipliers (Section 3.11, Table 3-27) are assumed to remain the same. Those industry multipliers express the relationship between the components of the Black Mesa Project and the regional economy.

Key dates that are part of the LOM permit revision application partly determined the assumed durations of project phases for socioeconomic analysis purposes. The activities that would occur under Alternative A were assumed as follows:

- The existing-conditions phase is based on conditions present on January 1, 2006, the first day that Mohave Generating Station was not operating. During the existing conditions phase, the Kayenta mining operation would continue (with 8.5 million tons of coal production annually), but the Black Mesa mining operation (with 4.8 million tons of coal production annually through 2005) would not. While design, right-of-way acquisition, and other preparations would occur with regard to the coal-slurry pipeline and C aquifer water-supply system, no pipeline construction would occur.
- The construction phase would begin on January 1, 2008, and last for 2 years (2008 through 2009). Reconstruction of the coal-slurry pipeline and construction of the C aquifer water-supply system would occur. During that phase, the Kayenta mining operation would continue.
- The operations phase would have a duration of 16 years (2010 through mid 2026). Under Alternative A, the Black Mesa mining operation would resume, and both the C aquifer water-supply system and the coal-slurry pipeline would operate. Coal production for the complex would be 14.7 million tons annually (with Black Mesa at an increased production level of 6.2 million tons annually and Kayenta continuing at the 8.5 million ton level). That production level, an increase of 10.5 percent from the 2005 level, would continue through 2026. The Black Mesa Complex would cease mining operations in 2026.
- The reclamation phase for the permitted area would begin in 2026 and continue through 2028.

For Alternative B or C, it is assumed that a steady rate of mining activity would occur at the Kayenta mining operation. Since the production of coal by the Kayenta mining operation would be the same under Alternative A, B, or C, most socioeconomic effects of the Kayenta mining operation alone would be the same under any of the alternatives. Under Alternative B, unpermitted parts of the mine lease area would be incorporated into the permit area. The Black Mesa mining operation infrastructure (offices, roads, etc.) would be used as necessary by the Kayenta mining operation. Under Alternative C, the unpermitted area would not be permitted at all, and its reclamation phase, including the Black Mesa mining operation infrastructure, could begin as early as 2007.

Impacts Common to All Alternatives. Peabody provides free wood (a byproduct of grubbing that is often used as firewood), coal, and potable water to residents at two water stands within the lease area. Peabody would continue to provide these items under all alternatives, and there would be no change in these incidental benefits.

4.11.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.11.1.1 Black Mesa Complex

Continued operation of the Kayenta mining operation, restoration of the Black Mesa mining operation, increased coal production at the Black Mesa mining operation, and construction and operation of the remaining components of this alternative would result the following:

- Direct economic effects from employment at the Black Mesa Complex
- Indirect multiplier economic effects on jobs, production, and income
- Direct economic effects from Black Mesa Complex revenue collected by the tribes and state agencies
- Social effects from the changes in the types and intensity of activities in the area, and relocation of households

These effects are discussed below.

Direct economic effects from employment. If the Black Mesa operations resume, about 350 employees would be required for the Black Mesa mining operation during the operation phase, for a total of about 835 employees at the Black Mesa Complex. This would be an increase of 79 employees over the 2005 levels, to staff the increased coal production. The restored and additional jobs would be at year 2010 wages equivalent to the \$40,000 to \$62,000 range for mining jobs in 2001. These would be the highest paid private-sector jobs in the Hopi Reservation and the Arizona portion of the Navajo Reservation. This is considered to be a major beneficial effect.

Indirect multiplier economic effects. Using the mining industry's multiplier effects on the regional economy, there would be beneficial effects of employment and income resulting from the resumed Black Mesa mining operation as follows:

- For the 350 Black Mesa mining operation jobs, about 385 jobs would be created elsewhere in the local or regional economy
- For every dollar paid for the coal, there would be 40 cents paid for goods or services elsewhere in the local or regional economy
- For every dollar of income earned by mine workers, 0.4 dollar of income would be earned by others elsewhere in the local or regional economy

Direct economic revenue effects. The revenue from the Black Mesa Complex to the Hopi Tribe and the Navajo Nation, for revenue sources other than water royalties, would increase about 10.5 percent because of the increase in the amount of coal produced. The annual revenue to the two tribes from coal production would be about \$15.5 million for the Hopi Tribe and about \$37.9 million for the Navajo Nation. With construction and operation of the C aquifer water-supply system, water royalties would be paid to the Navajo Nation associated with the use of 6,000 af/yr of water from the C aquifer. If the N aquifer would continue to be used, water royalties would increase for the tribes due to increased mining-related water use, from 4,400 af/yr to 6,000 af/yr.

It is anticipated the local area of influence of the Black Mesa Complex, which includes the Hopi village of Moenkopi and 14 Navajo chapters, would continue to be the home of 90 percent of the Black Mesa

Complex employees. Beyond the jobs at the Black Mesa Complex, the local area would experience the majority of the additional multiplier effects of the mining industry. Fees associated with Peabody's CAA Title V permit would be a new Navajo Nation revenue source. Authority for the Title V permit program shifted from USEPA to NNEPA in 2004. The NNEPA will carry out the authority for the next renewal of Peabody's 5-year permit, with any required revisions. The fee amounts cannot be anticipated at this time.

If the Black Mesa mining operation resumes, the sales tax payments from Peabody to the State of Arizona would likely be restored from the \$10.5 million figure expected in 2006 (see Section 3.11.2.4) to amounts at or above the 2005 total (\$18.1 million). Peabody does not yet have a projection of its likely property tax amounts for the periods covering the shutdown or the resumption of the Black Mesa mining operation.

There would be short-term economic impacts when mining removes grazing lands. There are 68 homes dispersed throughout the lease area and some residents are ranchers whose livestock graze on both undisturbed and reclaimed land.

Social effects. Increasing coal production at the Black Mesa mining operation would result in an increase in disturbances to the nearby residences that could cause increased intrusions to the rural setting and lifestyle within the local area of influence; however, it is expected this increase would not be detectable given the amount of disturbance already ongoing or that occurred on a regular basis prior to 2006.

As noted earlier, 17 residences (families) would need to be relocated out of areas to be mined. The households would have three relocation choices: (1) relocate to a place of their choice on or near their customary use area with which the tribe and Peabody concur (i.e., where future mining would not require another relocation), (2) relocate elsewhere on the reservation off of Black Mesa, or (3) accept cash and relocate on their own. Peabody would pay for relocation (or pay cash) one time.

Long-term effects. Once all mining operations have ceased and all the disturbed areas have been reclaimed, Peabody would release these lands back to the tribes' control. Land reclamation would result in a long-term beneficial economic effect by improving the quality and the quantity of the forage. Research conducted by Peabody for the Kayenta mine in 1997 indicated that revegetated areas, as compared to undisturbed lands, had 4 to 6.5 times as much useable forage in the spring and 3.7 to 25.4 times as much useable forage in the fall (OSM 2005c). Peabody reported that by 2004, 18 families were grazing livestock on 3,700 acres of reclaimed pasture (OSM 2005c).

There would be a permanent loss of mining-related employment, the indirect multiplier economic effects, and coal production-related revenues to the Hopi Tribe, Navajo nation, applicable counties, and the State of Arizona after mining and reclamation activities have been completed.

Coal-Washing Facility. Construction of the coal-washing facility would provide several temporary jobs, constituting an employment and income effect upon the local area. Davis-Bacon wages would apply to the project. For equipment operators in heavy construction, the most recent Davis-Bacon wages ranged from \$17.00 to \$22.00. Median wages for construction laborers in Navajo County in 2003 were about \$10.00 for a laborer and \$22.00 for a first-line supervisor.

Coal-Slurry Preparation Plant. Resumption of the Black Mesa mining operation would cause the plant to reopen with approximately the same number of employees (34) as in 2005, which would have a direct beneficial effect.

Coal-Haul Road. The temporary addition of construction jobs related to the new coal-haul road would provide a direct beneficial effect on the local area over the temporary construction phase. There would be no employment associated with the coal-haul road over the operational phase.

4.11.1.2 Coal-Slurry Pipeline

The socioeconomic effects of the coal-slurry pipeline reconstruction and resumption of operation would be the same regardless of the route selected. That is because the routes are similar enough that the small differences between them would not change the labor pool, taxing authorities, or other population groups or geographic areas that would be affected by the project.

Under the proposed project, mining would resume in mid 2009, 15 to 20 operational employees would be hired to staff the pipeline's booster-pump station locations and BMPI's office in Flagstaff. The jobs would continue through 2026. Reconstruction of the coal-slurry pipeline would provide a temporary employment opportunity during the construction phase for individuals throughout the region (primarily those living on the Hopi and Navajo Reservations, and in Flagstaff, Bullhead City, and Laughlin), and especially within the coal-slurry pipeline's local area of influence. This comprises the Navajo Nation chapters of Forest Lake, Coalmine Mesa, and Cameron; two Hopi areas defined by the boundaries of two tribal block groups (areas within census tracts); and the Kingman area, defined by the boundaries of six census tracts. .

Reconstruction of the pipeline would provide substantial revenue during the construction phase. Sales tax receipts for construction materials, lodging, and fuel would be the largest construction revenue sources. BMPI has not yet been advised by any of the State and local taxing authorities as to the effect of its reconstruction on its future taxes.

4.11.1.3 Project Water Supply

4.11.1.3.1 C Aquifer Water-Supply System

4.11.1.3.1.1 Water Withdrawal

The reduction of the use of the N-aquifer wells in the area of the mines would lessen the concern that mining withdrawals interfere with water use for other purposes. The users include those Hopi and Navajo communities which rely on the public water supply from about 70 municipal wells that tap the N aquifer. The users also include those who use N-aquifer water for grazing and agriculture.

Under the 11,600 af/yr subalternative, 5,600 af/yr of C-aquifer water would be available in 2010 for use by the Hopi Tribe (2,000 af/yr) and the Navajo Nation (3,600 af/yr) to support potential domestic, municipal, industrial, and commercial uses. In addition, under this subalternative, the 6,000 af/yr used for mining and coal slurry would become available for Navajo uses as Kayenta and Black Mesa mining and reclamation operation phases are completed and the water is no longer needed for those purposes. The spur pipeline construction necessary to deliver the water to tribal communities is not considered in this EIS. The communities that would receive the water have not been identified and the dates when these projects would be undertaken are not known at this time.

It is possible to project how the additional supply of 5,600 af/yr of water could accommodate economic development. The Hopi Tribe has designated the N aquifer water for nonindustrial use, so the Hopi tribe looks to the C aquifer water for industrial and other economic development use. The following are two examples of the employment that could be supported by the 2,000 af/yr supply of C-aquifer water:

- Low water-use businesses (150 gallons of water per employee per day), almost 8,700 employees; or
- High water-use businesses (800 gallons of water per employee per day), more than 1,600 employees

The C-aquifer water supply (2,000 af/yr) could have a major short-term beneficial effect upon economic development efforts for the Hopi Tribe. That beneficial effect would depend on the development of the spur pipeline that is not a part of this EIS.

The Navajo Nation has indicated that the C-aquifer water would be used for a variety of uses. The employment that could be supported by the 3,600 af/yr supply of C-aquifer water, calculated as for the Hopi Tribe, would be as follows:

- Low water-use businesses (150 gallons of water per employee per day), more than 15,000 employees; or
- High water-use businesses (800 gallons of water per employee per day), nearly 3,000 employees

On the other hand, much of the Navajo Nation's 3,600 af/yr of C-aquifer water might go to household use. Navajo Reservation households currently use far less than the 150 gallons of water per person per day consumed on average by urban Arizonans (City of Mesa 2006). As economic development brings a higher standard of living, it is assumed that Navajo Reservation households might increase their water use to 100 gallons of water per person per day. At that rate, more than 8,500 households (at an average household size of 3.77 persons) could be supplied by 3,600 af/yr.

The C-aquifer water supply (3,600 af/yr) could have a major beneficial effect on economic development and the Navajo nation's efforts to expand its potable water supply system to outlying communities. That beneficial effect would depend on the development of the spur pipeline, which is not a part of this EIS.

As noted above, under the 11,600 af/yr subalternative, the 6,000 af/yr of water used for mining and coal slurry would become available for Navajo uses as Kayenta and Black Mesa mining and reclamation operation phases are completed and the water is no longer needed for those purposes. The use of this additional 6,000 af/yr could have a major long-term beneficial effect on economic development and household water supply efforts for the Navajo Nation. The advance knowledge that the 6,000 af/yr water supply would later become available would be an additional economic benefit. Proprietors of businesses would first choose to locate where they would be served by the 5,600 af/yr water supply. Once established, they could plan for the availability of the 6,000 af/yr water supply over the long term. Proprietors could, for example, plan for later expansion or for the location of branch operations.

Under the 6,000 af/yr subalternative, it is likely that many of the communities near the water-supply pipeline would not become connected to a central water system, and the C aquifer water-supply system would cease operation at the end of the mining operation and land reclamation of the Black Mesa Project. There are currently no other water supply plans of nearly the size of the C-aquifer water supply system for the Hopi Reservation or the western Navajo Reservation.

4.11.1.3.1.2 Infrastructure

Construction of the well field, pipeline, and associated facilities would provide temporary employment opportunities in the local area of influence, which would include the Navajo Nation chapters of Leupp, Bird Springs, Tolani Lake (either route), and Coalmine Mesa (western route only). Also, construction

would provide substantial revenue during the construction phase. Sales tax receipts for construction materials, lodging, and fuel would be the largest construction revenue source.

Operation and maintenance of these facilities would result in long-term employment opportunities. The lease agreements associated with the water-supply system infrastructure would provide for annual payments to the Hopi Tribe and Navajo Nation. The eastern route of the C aquifer water-supply pipeline would occupy 54 miles of right-of-way on the Hopi Reservation and 54 miles of right-of-way on the Navajo Reservation. If, instead, the water-supply pipeline were constructed on the western route, all 137 miles of right-of-way would be on the Navajo Reservation. The amount of right-of-way related revenue to each tribe would depend upon which route would be selected. Property tax revenue would be distributed to the Coconino County school districts that serve the local area.

An access road related to the pipeline would be constructed between WSP Mileposts 71 and 76, in the Hardrock area. While a paved road within that area would be beneficial, it probably would not be of measurable economic benefit unless it became part of a continuous connection north to Highway 160. If such a connection were in place, workers could commute to the mining operations and beyond.

The additional electrical infrastructure for the water pipeline also could provide the opportunity to install residential connections along the pipeline in the well field area. Connections in Kykotsmovi could support the existing electrical system and lessen the potential for outages. A 69kV transmission line with available capacity could be extended into the planned Tawaovi community.

The incidental opportunity by which the project water supply would be available to tribal communities is discussed in Section 4.11.1.3.1.1. Spur pipelines would need to be developed to serve Hopi and Navajo communities. The impact of developing the spur pipelines is not considered in this EIS.

4.11.1.3.2 N Aquifer Water-Supply System

If the N aquifer water-supply system were used exclusively to supply the mining operations and coal-slurry pipeline, there would be no change in employment associated with operation and maintenance of the water supply. There would be no temporary construction employment and no extended-operations employment effect. There would be concerns about the perceived effects of increased water withdrawals on local water availability for domestic use, grazing, and agriculture.

4.11.2 Alternative B – Conditional Approval of the LOM Revision Application Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

4.11.2.1 Black Mesa Complex

Under Alternative B, the 18,984 acres of the currently unpermitted Black Mesa mining operation would be incorporated into the area permitted for mining. The coal-haul road would be constructed to facilitate handling and delivery of coal throughout the Black Mesa Complex. The permitted area would continue to supply coal to the Navajo Generating Station at the rate of 8.5 million tons of coal production annually from the present time to 2026. No construction would occur during the years from 2006 to 2009, and no increase in mining would occur from 2010 to 2026. There would be no changes, therefore no impacts, in the following during the period from 2006 to 2026:

- Employment at the Kayenta mining operation;
- Construction employment for the coal-washing facility;
- Mining industry-related regional multiplier effects upon jobs, production, or income; and
- Revenue to governmental agencies (other than water use revenue).

Peabody would continue to provide free wood, coal, and potable water to residents, at two water stands within the lease area. Fewer acres would be disturbed at the Black Mesa Complex, so less land would be affected that is important to grazing or to traditional economic activities such as materials gathering for food, clothing, shelter, or crafts. With fewer acres disturbed and then reclaimed, grazing activities would not be interrupted. On the other hand, there would be fewer acres where post-mining reclamation would improve forage yields.

4.11.2.2 Coal-Slurry Pipeline

The coal-slurry pipeline would not be reconstructed and the coal-slurry pipeline would not resume operation. Therefore, there would be none of the following:

- Construction or operational employment for the coal-slurry pipeline;
- Pipeline-construction industry-related regional multiplier effects upon jobs, production, or income; or
- Revenue to governmental agencies.

4.11.2.3 Project Water Supply

The new C aquifer water-supply system would not be constructed. Therefore, there would be none of the following:

- Construction or operational employment for the water infrastructure;
- Pipeline-construction industry-related regional multiplier effects upon jobs, production, or income;
- Revenue to governmental agencies; and
- Opportunity for tribal domestic, municipal, industrial, and commercial water supply

The lack of construction of any project-related water infrastructure would preclude the economic development opportunity for the tribes related to the location of that infrastructure.

4.11.3 Alternative C – Disapproval of the LOM Revision (No Action)

Under Alternative C, the Kayenta mining operation would continue through 2026 as currently permitted. The impacts on social and economic conditions would be similar to those of Alternative B, except that further mining would not be authorized within the 18,984 acres of the unpermitted area of the Black Mesa Complex. In addition to a reduction in the total number of acres disturbed, as in Alternative B, no acres in the unpermitted area, specifically, would be disturbed and there would be no project-related impact on any lands important to the traditional economy.

4.12 ENVIRONMENTAL JUSTICE

The reservations in the project area are both minority and low-income areas. The counties most affected by the project—Navajo, Coconino, and Apache—have higher proportions of poverty populations than does the State of Arizona. Four Kingman-area census tracts within the project area also have a higher proportion of those living in poverty than in Mohave County overall.

The economies of minority and low-income communities are often less resilient than the economies of other communities. These populations generally are dependent upon their surrounding environment (e.g., subsistence living), more susceptible to pollution and environmental degradation (e.g., reduced access to health care), and often less mobile or transient than other populations (e.g., unable to relocate to avoid potential impacts). Adverse social and economic effects within these populations are often more intense.

Assumptions. American Indian environmental justice populations on or near reservations are the majority population because the reservations are tribal homelands. No specific assumptions are made about long-term regional income levels, but a high proportion of the population is in poverty now, and historically, very few areas have emerged rapidly from poverty. Poverty has persisted for decades on the reservations and in Apache and Navajo counties overall. It is assumed that for at least two decades much of the region would have a higher proportion of persons in poverty than would Arizona, Nevada, or the United States.

The poverty level was defined in 2003 Census Series P-60, Income and Poverty, as a money income threshold of \$9,573 for a one-person household (under 65 years of age) through a figure of \$18,660 for a four-person family with two related children under 18 years of age, to a figure of \$35,572 for a nine or more person family with eight related children under 18 years of age. The report's geographic breakdown of proportions of persons in poverty goes only to a statewide level. The total percentage of people in poverty in Arizona is listed in the report as 13.9 percent for Arizona and 9.0 percent for Nevada. Meanwhile the percent of persons in poverty in the year 2000 (latest available figures) for the Hopi reservation was 38.9 percent, and for the Navajo reservation was 41.9 percent.

In implementing the project, all applicable Hopi Tribe and/or Navajo Nation requirements, as applicable, would be met with regard to hiring preferences and with regard to business entities' procurements of materials or services.

All economic effects (including employment, revenue, and economic development) addressed in the social and economic conditions section, also apply to the environmental justice population. Two additional types of effects are discussed in this section—additional economic effects on low-income and minority areas and cultural effects upon the American Indian population. In every case, the bulk of both the beneficial effects and the adverse effects would apply to the environmental justice population.

4.12.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.12.1.1 Black Mesa Complex

A great majority of the jobs at and related to the mines are held by American Indians. In addition, the Kayenta community, which has an economy driven by the mines, and the entire local area of 14 Navajo chapters and the Hopi village of Moenkopi are American Indian communities. Directly or indirectly, the mines provide the bulk of the higher paid jobs in this low-income local area. The temporary construction jobs for facilities at the mines also would represent highly paid jobs in the area.

The governments that are recipients of many of the revenues from the mines are American Indian tribal governments. The communities that might have access to a new water supply that could support economic

development efforts are American Indian communities. While the Kayenta school district that most benefits from mining tax revenue is an Arizona public school district, a majority of the students and employees of the district are American Indian.

The population directly affected by and concerned about the effects of water withdrawals upon the continuing availability of local water for grazing and agriculture is almost entirely an American Indian population.

The households that would experience the effects of mining on grazing lands are American Indian households. Health and safety impacts of continued mining operations would affect largely minority and low-income populations. The required adherence to various occupational health and safety regulations would include the continuation of onsite occupational health-treatment facilities.

Generally air quality is in compliance with the NAAQS. However, particulate matter (e.g., fugitive dust from the mining operations) is the air pollutant that remains a concern to residents in the immediate vicinity of the Black Mesa Complex.

At the Black Mesa Complex, Peabody provides free firewood (a byproduct of grubbing that is often used as firewood), coal, and potable water at two water stands local residents, most of whom are American Indian.

Coal-Washing Facility and Coal-Haul Road. The workforce that would construct the coal-washing facility and coal-haul road would include many American Indians. The wages would be as indicated in Section 4.11.1, which would be higher than the wages typical for the area. The coal-washing facility would be operated by mine employees; therefore, the employment effects from operation of the facility would be similar, or the same, as for the mines.

4.12.1.2 Coal-Slurry Pipeline

It is assumed that approximately 50 percent of the coal-slurry pipeline reconstruction workforce would be members of the Hopi Tribe and Navajo Nation. Though temporary, such employment opportunities provide wages that would be higher than typical for the area. American Indians also would experience the bulk of the other employment and revenue effects of the coal-slurry pipeline.

4.12.1.3 Project Water Supply

4.12.1.3.1 C Aquifer Water-Supply System

4.12.1.3.1.1 Water Withdrawal

The 11,600 af/yr pumping subalternative represents a capacity of 6,000 af/yr of water for project-related purposes (mining and coal slurry) and an opportunity to realize an additional 5,600 af/yr for tribal use. Under this subalternative, at the end of the LOM, the 6,000 af/yr also could become available for Navajo tribal use. Long-term community and economic development for the Hopi and Navajo environmental justice populations would be enhanced by the availability of water. Under the 6,000 af/yr subalternative, the C aquifer water-supply system would cease operation when it is no longer needed for mine-related purposes.

The reduction in use of the N-aquifer wells by the Black Mesa Complex would lessen the concern that N-aquifer mining withdrawals would interfere with water use for grazing, agriculture, and domestic wells, and address the stated concerns of traditional tribal members with the use of the N aquifer.

4.12.1.3.1.2 Infrastructure

It is assumed that approximately 50 percent of the construction workforce would be members of the Hopi Tribe or Navajo Nation. Though temporary, such employment opportunities provide wages that would be higher than typical for the area.

A permanent access road would be built from WSP Mileposts 71 to 76. If, with other non-project road construction, it were extended north from Arizona Route 264 (adjacent to the pipeline) to the mines, developing the route would improve the transportation network for Hopi and Navajo residents, especially the Hopi villages and the Navajo chapters of Forest Lake and Hard Rock. Such a road would provide improved access to jobs, health care, schools, and other facilities.

There would be 15 jobs to maintain the pipeline and operate the pumping stations. The new electrical transmission infrastructure and any water-distribution system built from the water-supply pipeline could bring power and water to some of the lowest income Hopi and Navajo areas.

4.12.1.3.2 N Aquifer Water-Supply System

If the N aquifer were used as the sole water supply, the continuing and increased use of the N-aquifer wells by the Black Mesa Complex would result in continued concern that withdrawing water from the N aquifer for mine-related purposes would interfere with water use for grazing, agriculture, and domestic wells. Almost all of the use of the N aquifer other than by the Black Mesa Complex is by the American Indian population.

4.12.2 Alternative B – Conditional Approval of the LOM Revision Application Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

4.12.2.1 Black Mesa Complex

The 18,984 additional acres would be incorporated into the area permitted for mining. Section 4.11.2.1 indicates the lack of several short-term social and economic benefits under Alternative B, compared to Alternative A. The local area that would experience the lack of benefits would be the American Indian community.

If Alternative B were chosen, there would be no reconstruction and operation of the coal-slurry pipeline and no new water-supply system, so short-term construction-related economic benefits would not be realized by the American Indian communities. Similarly, the long-term benefits associated with restarting and increasing coal production would also not be realized. And, the incidental opportunity to deliver water for domestic, municipal, industrial, and commercial uses to American Indian communities along the pipeline would not be realized as a result of this project.

4.12.3 Alternative C – Disapproval of the LOM Revision (No Action)

4.12.3.1 Black Mesa Complex

The impacts would be similar to those of Alternative B.

Mine reclamation would occur sooner in the Black Mesa mining operation area than would be the case in the other alternatives. With the absence of mining activities on the lands of the unpermitted area, the tribal people would cease to be affected by such things as mining traffic and noise from that area of the Black Mesa Complex. Mining's interference would cease with regard to a variety of available plants used for medicinal, ceremonial, and household needs, as well as a great reliance on firewood from the

piñon/juniper woodland. Over the long term, since fewer lands would be mined and reclaimed, less land would ultimately have improved productivity for grazing. Revenues related to coal production to both tribes would cease earlier than under either of the other two alternatives, eliminating substantial resources and programs that assist Environmental Justice populations in the region and local area of influence.

4.13 INDIAN TRIBAL ASSETS

The Indian tribal assets that would be affected or consumed as a result of the proposed actions under each of the alternatives would be coal, water, land, grazing habitat, and traditional uses of the land.

All of the coal that would be mined at the Black Mesa Complex is an Indian tribal asset. The affected lands that are Indian tribal assets comprise lands on the Hopi and Navajo Indian Reservations that would be a part of the project, including the land surface where coal mining would occur, the lands occupied by rights-of-way and easements related to mining, the coal slurry pipeline, the C-aquifer well field, and the water-supply pipeline (Alternative A only). The water that would be affected includes the water that would continue to be withdrawn from the N aquifer and in Alternative A, the water that would be withdrawn from the C aquifer. The particular amounts of Indian trust assets affected by the project would vary by alternative.

The trust responsibilities of the United States that are pertinent to the project, as described in Section 3.13, would be carried out throughout the life of the project. While Peabody's coal leases described in Section 3.13 are not components of the Black Mesa Project, any renegotiation of the leases that would occur over the duration of the project would be subject to the approval of BIA under 25 U.S.C.

4.13.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

Several of the agreements that commit Indian tribal assets to the project are continuing agreements. The Navajo Nation Council has supported the use of Indian trust assets for the Black Mesa Project when it has approved the coal mining leases, coal-slurry preparation plant lease, and right-of-way permits for the project. The Hopi Tribe has supported the use of Indian tribal assets for the Black Mesa Project when it has approved the coal-mining lease and rights-of-way for the project.

The amount of coal to be mined by the Black Mesa mining operation under Alternative A would increase from 4.8 million tons per year to 6.2 million tons per year. The approval of that increase would be a part of the approval of the LOM revision by OSM. Annual coal production at the Kayenta mining operation would not change from the current 8.5 million tons per year.

The land surface in the lease area would be disturbed by the mining operations and then would be reclaimed for grazing and other uses, restoring the land and vegetative asset to higher forage productivity than what existed prior to mining.

Black Mesa Project facilities would occupy land subject to the following new agreements under the agencies' preferred routing alternatives and any subalternatives:

- A right-of-way permit for the 127 acres of the coal haul road corridor, between Peabody and the Hopi Tribe, subject to approval by BIA and the tribe;
- Permits (permanent right-of-way) and easements for the coal-slurry pipeline, including portions of the existing route and some additional acreage, between the BMPI and the Hopi Tribe

(218 total acres), and the Navajo Nation (450 total acres for pipeline and two pump stations), subject to approval by BIA and the tribes; and

- Permits (permanent right-of-way) and easements for the water-supply system components, between the system's owner and the tribes, and also subject to approval by BIA. Under the 11,600 af/yr subalternative, the Navajo Nation would issue right-of-way permits for approximately 83 total acres for the well field. Hart Ranch, which is owned by the Hopi Tribe, but which is not tribal trust land, would be the location of four wells. All of the 639 acres of permanent right-of-way for the water-supply pipeline, roads, power lines, and pump stations would be on tribal trust land, much of it on the Hopi Reservation and much of it on the Navajo Reservation. There is not yet enough information on the locations of all of the facilities to estimate the proportion of right-of-way that would be on each reservation. Under the 6,000 af/yr subalterantive, there would be less acreage needed for the well field, and no wells would be located on the Hart Ranch.

The western water-supply pipeline route subalternative would be entirely on the Navajo Nation and the water-supply system right-of-way agreements would be between the system's owner and the Navajo Nation only, for a total of approximately 1,032 acres.

The C-aquifer water withdrawal would be up to 6,000 af/yr under the proposed action and 11,600 af/yr under the agencies' preferred alternative. The Navajo Nation would receive royalties from the system's owner for the use of 6,000 af/yr of project-related water during the LOM.

As described in Section 2.2.1.2.1.1.2, under the 11,600 af/yr subalternative, the Hopi Tribe and Navajo Nation would have an option to pay the incremental costs of increasing water production from the C aquifer and increasing the size of the water-supply pipeline in anticipation of the potential future use of the system for tribal purposes. During the life of the project, the 5,600 af/yr increment above the water needed for project-related purposes would be available for Hopi (2,000 af/yr) and Navajo (3,600 af/yr) tribal use. When the 6,000 af/yr is no longer needed for the project it would be used by the Navajo Nation, if the appropriate infrastructure is constructed.

This study assumes that pumping the C aquifer water up to 11,600 af/yr would continue for the estimated 50-year life of the pipeline (until 2060). The impacts on the water resource of a C aquifer water-supply system are stated in this EIS (Section 4.4.1.4).

Spur pipelines would need to be constructed to deliver any of this water to Hopi and Navajo communities; the impact of developing spur pipelines is not considered in this EIS. Any future Federal actions on such spur pipelines would be subject to NEPA analysis at the time of plan development.

Under any of the C aquifer water-supply system options, there would also be project-related supplemental use of N aquifer water. The amount of N aquifer water pumped would be reduced from the current (prior to 2006) rates.

There is also an alternative (Section 2.2.1.2.2.2) whereby the C aquifer water-supply system would not be built and the N aquifer would supply up to 6,000 af/yr for the project. The impacts on the water resource of increasing N aquifer use are stated in this EIS (Section 4.4.1.5.2). Under this alternative, the reason for the administrative delay of OSM's permanent Indian Lands Program permitting decision described in Section 2.1.1.2 would not be resolved. The delay of permitting decisions for the Black Mesa mining operation and Black Mesa coal-slurry preparation plant stemmed from the concerns of the Hopi Tribe and Navajo Nation regarding use of N-aquifer water for the coal slurry and mine-related purposes.

4.13.2 Alternative B – Conditional Approval of the LOM Revision Application Without Approval of the Black Mesa Mining Operations, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

Mining would not resume at the Black Mesa mining operation and annual coal production at the Kayenta mining operation would not change from the current 8.5 million tons per year.

Areas previously disturbed by the Black Mesa mining operation and areas never mined would be incorporated into the expanded permit area for the Black Mesa Complex but it is unlikely that mining would begin in any areas that have never been mined (Section 2.2.2). Therefore, the only new land surface disturbance in the lease area by the mining operations would be in those particular coal resource areas which have been previously disturbed in part. The Black Mesa mining operation infrastructure would be used as needed for the Kayenta mining operation. The coal-haul road would be constructed; a permit between Peabody and the Hopi Tribe, subject to approval by BIA, would be needed for 127 acres of right-of-way.

Neither the coal-slurry pipeline nor the C-aquifer water-supply system would be constructed under Alternative B so their impacts related to land and water Indian trust assets would not occur.

Therefore, compared to Alternative A, a smaller portion of the coal resource Indian tribal assets would be consumed through the life of the mining operations (by 2026) and there would be less disruption of grazing and traditional uses on the land. N-aquifer water in amounts averaging 1,240 af/yr would be used from 2006 to 2025.

4.13.3 Alternative C – Disapproval of the LOM Revision (No Action)

Mining would not resume at the Black Mesa mining operation and annual coal production at the Kayenta mining operation would not change from the current 8.5 million tons per year.

Only areas previously disturbed by the Black Mesa mining operation would be incorporated into the expanded permit area for the Black Mesa Complex (Section 2.2.3). The Black Mesa mining operation infrastructure would not be used for the Kayenta mining operation and would be reclaimed.

Neither the coal-slurry pipeline nor the C-aquifer water-supply system would be constructed under Alternative B so their impacts related to land and water Indian tribal assets would not occur.

Therefore, compared to Alternative A, a smaller portion of the coal resource Indian trust assets would be consumed through the life of the mining operations (by 2026). There would be less disruption of grazing, traditional uses on the land, and less use of the land surface for project purposes in general than in Alternative A or B. N-aquifer water in amounts averaging 1,246 af/yr would be used from 2006 to 2025.

4.14 NOISE AND VIBRATION

The study area is generally very rural and sparsely populated or uninhabited; however, homes are present in areas, some located within 250 feet of project facilities. Homes, schools, churches, and medical facilities are considered sensitive receptors for noise and vibration. Ambient noise levels throughout much of the rural study area are estimated to be less than 50 A-weighted decibels (dBA) during daytime hours and 30 dBA during the nighttime hours. This is consistent with OSM's 1990 EIS, which predicted sound levels ranging from 15 to 52 dBA for the evening hours, from 13 to 56 dBA for morning hours, and an averaged day/night sound level (L_{dn}) ranging from 33 to 43 dBA. This noise environment would be characterized as "comfortable" to "quiet" (refer to Table 3-42).

The region of influence is the geographic area that could potentially be affected by changes in noise or vibration levels due to this project. The region of influence varies for different project components. For example, the region of influence for blasting at the mines would extend up to several miles from the source. The region of influence for less intensive noise and vibration sources, such as coal-slurry and water-supply pipeline booster pumps or truck traffic, would be a few hundred feet or less. Noise impacts occur only where there are people or, in some cases, animals (noise sensitive receptors); therefore, the region of influence for noise impacts is directly related to the location of the receptors.

Noise. The main issue regarding noise is the extent to which a change in environmental noise over existing conditions would be perceived by sensitive receptors. No noise monitoring or modeling were conducted for this study. The level of noise impacts was determined by considering the baseline noise levels within an area (whether the area was generally quiet or noisy) and then what increase (or decrease) the proposed action would be expected to produce to these baseline noise levels.

Most noise impacts would last only through the LOM and subsequent reclamation periods (through 2029). The exception is noise impacts associated with the life of the water-supply pipeline. The 11,600 af/yr pumping alternative would last for at least 50 years for Hopi and Navajo use—beyond the time frame of mining.

Vibration. Vibration impacts were determined by using the Blasting Guidance Manual, which was developed by OSM to prevent injury and damage to public and private property outside the mine permit area. To verify compliance with the Blasting Guidance Manual and the vibration standards within the Manual, a continuous ground vibration and air overpressure monitoring program is required. OSM requires that airblast levels be limited to a maximum of 134 dB (peak); therefore, airblast levels exceeding this would be considered major impacts. Ground vibrations cannot exceed peak particle velocity of 1.25 inches per second at a distance of 300 feet or 0.75 inches per second at 5,000 feet (Rosenthal and Morlock 1987). Measurements in excess of these limits would be major impacts. Vibration and airblast levels below the listed values are not considered capable of producing injury or property damage, but may cause annoyance and would, therefore, be considered moderate to minor impacts depending on distance to the receptor.

4.14.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.14.1.1 Black Mesa Complex

Noise. Under Alternative A, mining operations would extend through 2026. When the Black Mesa mining operation resumes in mid 2009, coal production at the Black Mesa Complex would be at a level of 14.7 million tons annually, an increase of 10.5 percent from the 2005 level. The increased production would cause an associated increase in blasting and in truck transport of the mined materials within the Black Mesa Complex.

Noise sources include blasting and associated noise, and coal transport by trucks and by the Black Mesa and Lake Powell Railroad. Postmining reclamation activities would require vehicular and equipment use for earth-moving and planting, producing minor to moderate noise impacts.

As mining operations expand, more residences become exposed to the noise and vibration of blasting operations. To comply with 30 CFR 816.61(d), Peabody relocates persons living within 3,000 feet of blasting operations as a mitigation measure. According to the mining plan under this alternative, an additional 17 relocations are planned through 2026 to move residents impacted by blasting yet within their customary use areas inside the Black Mesa Complex boundary (Wendt 2005).

Some residents within the Black Mesa Complex near transportation routes and within range of blasting warning signals would experience slight increases in noise. The increase in coal production would engender a corresponding increase in transport-truck activity, but effects would be minor—a 10.5 percent increase in truck activity would cause less than a 3 dBA change. The combined increase in blasting signals, blasting, and truck activity is estimated to increase noise levels by about 1 to 2 decibels in locations that are considered quiet, a minor to negligible impact, since a change of 3 dBA is considered the limit of detection for the average human ear. The number of warning and all clear signals produced at blasting sites by a 100-watt-or-greater audible-speaker warning device—audible at 0.5 mile—also would increase.

Construction of the coal-washing facility would have a short-term effect on the closest sensitive receptors (within the Black Mesa Complex). Operation of the facility would contribute only negligible noise increases because the operations would be enclosed in buildings.

Resumed operation of the coal-slurry preparation plant would return daytime noise levels at receptors to approximately 45 to 55 dBA, punctuated with occasional audible noise from blasting activity.

The coal-haul road would pass within approximately 250 feet of one residence. Haul trucks may produce a sound level in excess of 80 dBA at this distance to the receptor (see Section 3.13.1).

In 2026, transport truck traffic would decline to that only necessary for reclamation, the coal-slurry preparation plant would cease operations, as would the Black Mesa and Lake Powell Railroad. Residents near the railroad would experience a cessation in noise from railroad operations. With the elimination of coal transport trucks and the railroad, noise levels at many residences would decline up to 10 to 15 dBA in some areas—a long-term decrease in noise levels.

Vibration. Blasting must abide by limits for overpeak sound-pressure levels set forth in 30 CFR 816.67. Peabody has conducted a continuous airblast-monitoring program since 1994, using six permanent recording locations and portable instrumentation. The locations and monitoring thresholds of these monitoring stations were determined in consultation with OSM. Since monitoring began, air overpressure levels have remained below the 134 dB standard. Monitoring for vibration impacts would continue under this alternative. Vibration impacts over the life of mining are expected to be similar to those experienced today (within regulatory requirements) and would be short term.

Blasting would cease with the end of mining operations, resulting in long-term beneficial effects to the nearest receptors.

4.14.1.2 Coal-Slurry Pipeline

4.14.1.2.1 Coal-Slurry Pipeline: Existing Route

The primary noise sources associated with the coal-slurry pipeline are the booster-pump stations. The sound of the pumps is muffled by the surrounding steel-sided building. Pump station operations upon the resumption of pipeline operation would not change. Alternative A would neither require larger capacity pumps at the existing booster-pump stations, nor an increase in the number of pump stations. Therefore, there would be no noise impacts on residences along the pipeline route. Temporary noise impacts from reconstruction and installation of the pipeline may be moderate but would be very short term. Residences are located at a distance where impacts from vibration would be negligible to none.

4.14.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignment (Agencies' Preferred Alternative)

The coal-slurry pipeline realignments would require no change in pump station operation; consequently, there would be no long-term noise impacts in the vicinities of the alternative realignments. During reconstruction of the pipeline, residential noise and vibration impacts would be of the same magnitude as for the existing alignment alternative.

4.14.1.3 Project Water-Supply

4.14.1.3.1 C Aquifer Water-Supply System

4.14.1.3.1.1 Infrastructure

4.14.1.3.1.1.1 Well Field

Residences within the well field area near the community of Leupp and the BNSF are the noise receptors of most concern regarding exposure to additional noise sources from the proposed project, as they are already exposed to relatively high levels of traffic noise (approximately 70 dBA L_{dn} and 75 dBA L_{dn} , respectively). Even with this contextual consideration, all noise impacts from the well field would be negligible to minor under Alternative A.

During the construction phase, drilling and installation of the wells and construction of the associated pipelines, transmission lines and other structures would produce short-term noise impacts. These impacts would be similar to, and within levels considered acceptable for, new housing construction (refer to Section 3.13). During the operational phase, the well pumps would be submerged and would generate barely audible noise to nearby residences. (Precise locations for wells are unknown at this time.) Under Alternative A, this negligible increase in noise would exist throughout the life of the mining operations. Under the 11,600 af/yr alternative, the wells would be in use by Hopi and Navajo communities for at least 50 years, so impacts are considered long-term.

Residences in the vicinity are far enough away from the proposed construction areas that the temporary (short-term) vibration impacts would be negligible.

4.14.1.3.1.1.2 C Aquifer Water-Supply Pipeline

The eastern route would require two pump stations, new 69kV power lines, and access roads. The pumps would be housed within structures, mitigating any external noise. The pump stations would be located no closer than 0.25 mile to the nearest residences, and would be barely audible if at all. Noise produced by 69kV power lines is generally limited to corona noise during inclement weather, and dissipates quickly beyond the right-of-way line. Access roads would not be used constantly but only for inspection and maintenance activities. Sporadic maintenance traffic would generate minor impacts (less than 1 dB difference). There are residential areas along most of the alignment, and two schools and a church in the Kykotsmovi area. Some areas already experience relatively high noise levels where there are traffic and industrial uses within 0.5 mile (65 dBA). Even with these contextual considerations, all impacts of the pipeline and existing noise sources taken together would be no greater than minor.

Construction of all facilities would produce temporary minor increases to noise levels within their respective vicinities. Blasting to remove rock could occasionally be required during construction of the pipeline. Blasting would be conducted following a plan in accordance with construction activity regulations. For some nearby receptors the blasting would be very loud and would cause vibration effects, but would be within regulatory limits used in devising the plan. Blasting would be minimized by limiting it to those situations where there is no alternative.

Noise related to operation of the western route of the water-supply pipeline would be the same as that for the eastern route. Construction effects from blasting under this alternative would be the same as those described for the western alternative. There are fewer residential locations along this route.

4.14.2 Alternative B – Conditional Approval of the LOM Revision Application Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

4.14.2.1 Black Mesa Complex

Under Alternative B, the Kayenta mining operation would continue at current levels. The unpermitted area would be incorporated into the area permitted for mining. The noise impacts related to would be caused by a smaller number but the same type of blasting events, the same volume of truck and rail traffic, and the same volume of postmining reclamation activity as those under Alternative A. The Kayenta mining operation could occur on the previously unpermitted area as well as the previous, permanent, permit area.

4.14.3 Alternative C – Disapproval of the LOM Revision (No Action)

Under Alternative C, the Kayenta mining operation would continue through 2026 as currently permitted. Noise impacts would be similar to those of Alternative B, except that further mining would not be authorized within the 18,984 acres of the currently unpermitted area, so no mining noise impacts would occur in the former Black Mesa mining operation area. Short-term reclamation activities would occur in the former Black Mesa mining operation area.

4.15 VISUAL RESOURCES

Criteria used to determine project impacts on visual resources were adapted from BLM and Forestry Service methodologies (BLM Manual Handbook 8431 and the Forest Service Scenery Management Systems Manual [FS SMS 1995]) and professional judgment. Criteria used to assess the magnitude of impacts were derived from BLM's 8400 series manual (Visual Resource Inventory and Contrast Rating System 1986), which establishes methodology to measure potential impacts on visual resources based on visual contrast. For this project, visual contrast is a measure of the degree of perceived change that would occur in the landscape due to the construction, operation, and reclamation of the project components. Contrast due to modification to landforms, destruction or disturbance of vegetation, and introduction of structures into the landscape were evaluated separately, and then together to determine the overall visual contrast. Contrast types are described in Table 4-45.

For the purposes of this analysis, impacts would result from substantial degradation of the character or scenic quality of a landscape, where the form, line, color, and texture qualities that make it unique or identifiable, or that establish a "sense of place" are interfered with, or introduction of substantial visual changes in the landscape that would be seen from highly sensitive viewpoints (e.g., residences, recreation areas, and scenic roads). This could include partial or full-view blockage of scenic viewsheds (e.g., mountains, mesas, ridgelines, and riparian corridors) where views are currently unobstructed.

Two types of impacts were evaluated—impacts on general scenic quality and impacts on views as related to specific viewers. Impacts on views were determined by identifying viewer sensitivity. For example, high-sensitivity viewers include residents, recreationists, and recreational destination travelers, and moderate-sensitivity viewers included viewers within commercial settings, and travelers along roads within the project area. Impacts on high- to moderate-sensitivity viewers were determined by consideration of existing scenic quality, project-introduced visual contrast, and distance zones.

Table 4-45 Contrast Types Defined

Contrast Type	Definition
Landform contrast	Landform contrast is the change in landform patterns caused by exposure of soils, disturbance to natural contours and/or geologic formations, and other noticeable modifications uncharacteristic to the natural landscape.
Vegetation contrast	Vegetation contrast is established by examining the diversity and complexity of existing vegetation and determining to what degree vegetation would be disturbed to construct roads, maintain right-of-way, and locate new project facilities. Typically, the more diverse and dense the vegetation the higher the contrast level. The removal of vegetation in a vacant/undeveloped area can create a distinct line, which inherently draws viewer attention to the modification.
Structure contrast	Structure contrast is the change by which proposed project facilities would differ from the surrounding landscape character. The introduction of new or modified structures into the existing landscape would create visual changes; however, these changes may not be as noticeable in a previously disturbed setting with the same or similar structures (e.g., replacing the existing coal-slurry pipeline in the same corridor). The most substantial structural contrasts would result from the introduction of new facilities into an undisturbed setting. Adjacent development, including power lines, roads, pipelines, or other utility facilities, reduces the degree of structural contrast. Typically, the construction of project facilities is less noticeable in industrial settings or in areas where other features dominate the setting.
Visual contrast	Visual contrast is derived from a combined analysis of landform, vegetation, and structure contrast. Visual contrast is a measure of the degree of perceived change that would occur in the landscape due to the construction and operation of the project. Visual contrast typically results from (1) landform modifications that are necessary to upgrade and construct new access roads, (2) removal of vegetation to construct roads and maintain right-of-way, and (3) introduction of new structures in the landscape.

For the analysis, it was assumed that the 69kV power lines would be sited in the same right-of-way as the collector pipelines in the well field and in the same right-of-way as the proposed water-supply pipeline (with the exception of Kykotsmovi, where the 69kV power line could be located east of the town). Also, it was assumed that no new above-ground structures (i.e., power lines, pump stations, or water storage tanks) would be required along the coal-slurry pipeline or alternative realignments.

Within the study area, proposed above-ground facilities (e.g., water-storage tank, pump station, power lines) would be constructed in different landscapes and could be seen by several types of viewers. Six simulations of these project facilities were created from selected viewpoints in order to evaluate potential typical viewing conditions. These six simulations are listed below and provided in Appendix J.

- Simulation 1: Well collection field – proposed water storage tank
- Simulation 2: Proposed pump station(s) Milepost 30
- Simulation 3: Proposed pump station Milepost 73
- Simulation 4: 69kV power line along Indian Route 2
- Simulation 5: 69kV power line near Kykotsmovi
- Simulation 6: 220/69kV substation west of Leupp

4.15.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.15.1.1 Black Mesa Complex

Under Alternative A, the expansion of mining into areas adjacent to the Kayenta mining operation and the resumed Black Mesa mining operation would cause minor visual impacts; new mining activity in separate areas would cause visual fragmentation of the natural landscape, with a moderate short-term impact on scenic quality. Removal of earth and vegetation would create visual contrast within the environment that would be mitigated later with reclamation. Re-establishment of landform contours and vegetation would reduce visual impacts in the long term.

Impacts on scenic quality and views from residential areas within the Black Mesa Complex due to construction of the coal-washing facility would be negligible, as the mining operation is an industrial landscape with a heavily modified appearance. Future mining activities at the Black Mesa Complex could potentially be visible to high-sensitivity residential viewers, with varying impacts, depending on the viewing distance.

Construction of the coal-haul road would be considered a moderate impact due to the removal of piñon/juniper and a noticeable disturbance of landform within a Class B landscape.

Moderate short-term impacts would result when activities related to construction of the coal-washing facility and coal-haul road occur within immediate-foreground to foreground distance zones.

4.15.1.2 Coal-Slurry Pipeline

4.15.1.2.1 Coal-Slurry Pipeline: Existing Route

Under Alternative A, the new pipeline would be placed adjacent to the existing pipeline or within the existing pipeline trench, and long-term impacts on scenic quality would be negligible. No new maintenance roads or above-ground facilities would be added. Relatively low levels of vegetation removal and landform disturbance would occur, and visible ground disturbance would be mitigated by re-establishment of vegetation.

The greatest viewer impacts along the existing route would occur to high-sensitivity viewers along the western end of the coal-slurry pipeline within the Black Mountains ACEC, but those impacts would be minor. Although the area is Class A landscape, no overhead structures would be added, and the route is within the existing pipeline corridor, which would minimize visual contrast in the landscape. Viewers along the remainder of the route would experience very little impact—the alignment passes through Class B, C, and D landscapes where mitigation would return the landscape to existing conditions. No overhead structures would be added.

Moderate impacts on residential views due to construction activities associated with pipeline replacement would occur along the existing route. All other impacts would be no greater than minor (e.g., impacts on moderate-sensitivity viewers in commercial use areas or roadways) including minor impacts on viewers within immediate-foreground to foreground distance zones in remote locations along the pipeline route.

The use of the existing alignment in the Moenkopi Wash and Kingman areas would cause less vegetation removal and landform disturbance than would the realignments. Visible ground disturbance would be mitigated by re-establishment of vegetation. In the area west of Kingman there would be more impacts on residential views due to construction activities associated with pipeline replacement, because there are more residences, than with the realignment.

4.15.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignment (Agencies' Preferred Alternative)

Installation of the coal-slurry pipeline along the alternative alignments would have the following short-term, minor effects on scenic quality and viewers:

Moenkopi Wash. A new pipeline corridor and maintenance road would disturb landform and vegetation in a previously undisturbed Class B landscape. However, visual contrast would be weak to moderate, with negligible to minor impact on scenic quality and viewers.

Kingman Reroute. Impacts on scenic quality and viewers would be negligible because the route would parallel existing power lines and roads and there are fewer residences.

4.15.1.2.2.1 Agency Visual Management Compatibility

The majority of the project area is State Trust Land, tribal land, or private land where no visual management objectives apply. Most BLM lands traversed by the coal-slurry pipeline and realignments are BLM Class IV lands, where only moderate visual modification or development may be introduced. (BLM landscape classifications range from Class I to Class V, with Class I the highest rating). The route also parallels the northern boundary of the Mount Nutt Wilderness Area and traverses the Black Mountain ACEC (Class I and Class II landscapes, respectively). Class I management objectives are to preserve the existing character of the landscape. The level of change to the landscape here should not attract attention. Class II management objectives restrict changes in form, line, color, and texture within the landscape—activities in the area should not be visually evident or attract attention.

The existing coal-slurry pipeline route traverses BLM-managed land between Seligman and Bullhead City, where impacts related to replacement of the existing pipeline would be compatible with BLM management objectives.

The pipeline passes through a very small segment of land managed by the Forest Service (on the northern edge of the Williams Ranger District, Kaibab National Forest), where management objectives allow moderate modification. Pipeline replacement within the existing route would be in compliance with the Forest Service's Scenery Management System, as it would not interfere with the existing character of the landscape.

The Kingman reroute would be in compliance with agency management objectives for two BLM VRM Class II areas between (approximately) CSP Mileposts 6.5 and 7.5 and CSP Mileposts 25.5 and 28 (i.e., mileposts along the reroute). Existing utilities and linear features in the first segment—power lines and existing roads that could be used for maintenance—would reduce visual contrast. In addition, scenic quality impacts on a flat landscape of Class C scenic quality would be considered low. From CSP Mileposts 26 to 28, the alignment passes just north of a Class I area. However, since the route is not within the designated Class I area and modifications to the adjacent landscape would be minimal and would not attract attention, the route would be in compliance with management objectives.

4.15.1.3 Project Water Supply

4.15.1.3.1 C Aquifer Water-Supply System

4.15.1.3.1.1 Infrastructure

4.15.1.3.1.1.1 Well Field

Under Alternative A, installation of water pumps at the well locations and the electrical line required to power them would have negligible to minor impacts to scenic quality as a result of weak project contrast.

These facilities would be slightly noticeable; however, they would not detract from the overall scenic quality level of the surrounding landscape. The visual impacts associated with the creation of maintenance roads and disturbance to the vegetation and landform, if required, could potentially result in detectable but slight impacts to scenic quality.

Detectable but slight impacts potentially would be observed by high sensitivity viewers within immediate foreground to foreground distance zones, depending on the final selected location of the pumps within the well field area. The pumps and power line would be slightly noticeable to these viewers; however, these facilities would not be dominant structures within the viewsheds.

Installation of a large water-storage tank would affect scenic quality from views in two locations within the well field. The tank would be noticeable on the horizon and would detract from the area's scenic quality (Appendix J, Simulation 1).

4.15.1.3.1.1.2 C Aquifer Water-Supply Pipeline

C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

Two pump stations along the water-supply pipeline near the Tolani Lake area and the Hardrock area (at WSP Mileposts 30 and 73, respectively) would be dominant visual features in the landscape, and would diminish scenic quality (Appendix J, Simulations 2 and 3).

Detectable but slight impacts on scenic quality would occur along the water-supply pipeline where vegetation would be removed where a 69kV power line would be constructed and vegetation would be removed (Appendix J, Simulation 4), and where the pipeline would be adjacent to Oraibi and Dinnebito Washes. Impacts on scenic quality along the remainder of the eastern route would be negligible. The route's location next to existing utilities (a high-voltage transmission line and electrical distribution lines) and existing roads and highways would reduce the visual contrast introduced into the landscape, as well as minimize the need to build new maintenance roads.

Moderate to minor viewer impacts would occur in two locations: (1) pump stations within Class C landscapes would be visible to residential viewers south of Leupp, Arizona, and (2) water storage tanks at WSP Milepost 10 would be visually dominant in the landscape. Mitigation would help minimize visual contrast.

Some minor viewer impacts would occur along the pipeline route where high-sensitivity viewers are within immediate-foreground distance zones. Minor impacts were identified within the well field, in and around Kykotsmovi, and to the north (Appendix J, Simulation 5) and just south of the mine lease area. Viewer impacts would be negligible along most of the pipeline route because facilities would be adjacent to roadways or other previously disturbed landscapes.

Minor viewer impacts also would occur on moderate-sensitivity viewers of previously undisturbed, highly vegetated areas (from approximately WSP Mileposts 37 to 52; north of Kykotsmovi from WSP Mileposts 64 to 71; and near the Black Mesa Complex boundary) along the water-supply pipeline. However, because the route would parallel existing linear features (i.e., roads and power lines), the majority of impacts (on moderate-sensitivity viewers) would be negligible.

Moderate short-term viewer impacts would occur where high-sensitivity viewers are within immediate-foreground distance zones and have unobstructed views of construction activities related to pump stations, water-storage tanks, and substations. All other impacts would be minor.

Water-Supply Pipeline: Western Route

Under Alternative A, moderate scenic quality impacts would occur along the western route where pump stations would be built, and where the power line and maintenance road would be built in previously undisturbed Class A landscapes. Disturbance of landform (a new road) and introduction of an overhead structure (69kV power line) would diminish scenic quality from approximately Mileposts 43 to 52 and from approximately WSP Mileposts 73 to 82.

Minor scenic quality impacts would occur where the same facilities would be introduced into Class B landscapes (from approximately WSP Mileposts 36 to 59 and from approximately WSP Mileposts 72 to 91), and where vegetation would be removed and a new maintenance road constructed (from approximately WSP Mileposts 128 to 134).

There would be negligible scenic quality impacts in Class C and D landscapes as a result of the ability to parallel existing roads and utility corridors (in the well-collection field and along the water-supply pipeline from the well field to approximately WSP Milepost 36; from WSP Mileposts 59 to 72; WSP Mileposts 92 to 128; and within the active area of the Black Mesa mining operation).

Pump stations and other project-related facilities would be noticeable in the northern portion of the route along U.S. 160, a heavily traveled access route to Navajo National Monument and Monument Valley Tribal Park—viewer impacts would be detectable. There would be no viewer impacts along the remainder of the route, as there are few high-sensitivity viewers within 0.5 mile of the facility sites, and the route would parallel existing roads and facilities.

Moderate viewer impacts would occur in one location (approximately WSP Milepost 68) where a pump station would be installed within the immediate-foreground distance zones of moderate-sensitivity viewers. Minor viewer impacts would occur on moderate-sensitivity viewers within immediate-foreground distance zones, from approximately WSP Mileposts 58 to 75 (a Class B landscape), and in scattered locations along the Kletha Valley, where facilities would parallel existing linear features.

Moderate short-term viewer impacts associated with construction activities along the western route would occur primarily in areas adjacent to pump station locations (i.e., WSP Mileposts 27.5, 68, 91, and 118). Minor impacts would occur in areas where power line construction and pipeline placement would be necessary within immediate foreground to foreground distance zones from residential viewers. The largest amount of short-term minor level impacts as a result of construction activities would occur in the Kletha Valley area because of travelers using U.S. 160 and existing development adjacent to the highway.

4.15.2 Alternative B – Conditional Approval of the LOM Revision Application Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

The Kayenta mining operation would operate through at least 2026 and the unpermitted area would be incorporated into the area permitted for mining. It is currently expected that after 2026, operations at the Kayenta mining operation would cease and the mined land would be reclaimed. Impacts would be the same as those for the Kayenta mining operation discussed in Alternative A. Visual impacts associated with the C-aquifer well field and pipeline and with the reconstruction of the coal-slurry pipeline would not occur.

4.15.3 Alternative C – Disapproval of the LOM Revision (No Action)

The Kayenta mining operation would operate through at least 2026. It is currently expected that after 2026, the Kayenta mining operation would cease and the mined land would be reclaimed. The Black

Mesa mining operation would not resume operations, and the coal-washing facility and the coal-haul road would not be constructed. There would be an immediate reduction of impacts on visual resources, due to the reclamation of mining land in the former Black Mesa operation area. With reclamation of mining lands, scenic quality of the mining areas would improve. Visual impacts associated with the C-aquifer well field and pipeline and with the reconstruction of the coal-slurry pipeline would not occur.

4.16 TRANSPORTATION

4.16.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.16.1.1 Black Mesa Complex

On the Black Mesa Complex, roads are considered facilities that support the mining operation and have both short- and long-duration uses. The existing road system (approximately 543 acres) on the Black Mesa Complex would continue to be used until the mining and reclamation operations are completed. Minor access roads to exploration and development areas and pit and spoil ramps would be constructed and used for short durations of mining. Coal-haul roads, vehicle roads, mine vehicle roads, and maintenance roads would be used over a long duration. Peabody would locate, design, construct, use, maintain, and reclaim all roads needed in the permit area in a manner that minimizes impacts on the environment. About 127 acres outside the lease areas would be added to construct a new coal-haul road from the J-23 coal resource area on the permanently permitted area of the Black Mesa Complex to the coal-preparation facilities on the currently unpermitted area of the Black Mesa Complex. The roadway with a new surface right-of-way about 500 feet wide and 2 miles long would be constructed to improve travel efficiency. As part of the LOM revision, haul roads are proposed to be constructed in coal-resource areas N-09 and J-08/J-09 as needed for mining activities. Proposed additional acreage through 2026 is 478 acres. Also, Peabody proposes to realign public road Indian Route 41.

All roads that were used by Peabody or built and used by Peabody on or after December 16, 1977 will be reclaimed unless they have been approved by OSM as a part of the postmining land use. Because of the areal extent and nature of Peabody's mining activities, very few of the roads would be reclaimed until the end of mining and reclamation activities on the entire Black Mesa Complex. Exceptions include roads in the immediate vicinity of pits and ramps, which are created in the spoil and reclaimed as the general reclamation activities progress within a specific coal-resource area.

Local residents have road access to most parts of the permit area. Exceptions include the immediate vicinity of active coal mining areas and coal-handling facilities. Mining sometimes causes residential relocations (a land use impact), but has negligible effect on residents' mobility and access through the local area.

4.16.1.2 Coal-Slurry Pipeline

4.16.1.2.1 Coal-Slurry Pipeline: Existing Route

Pipeline installation would impede traffic flow temporarily along roadways in affected areas during construction. Construction in the Kingman and Laughlin areas, which experience higher traffic volumes and have more extensive road networks along the existing pipeline route, would exacerbate road delays, detours, and access disruptions. Effects on the road networks are minor to none, depending on the location.

Airports. There would be no impact on any of the airports or airstrips in the project area.

Railroads. Railroads crossed by the existing coal-slurry pipeline route would not be affected.

4.16.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignment (Agencies' Preferred Alternative)

Moenkopi Wash Realignment. Few properties would be affected by disrupted access. Transportation impacts would be similar to those along the existing route; however, a new access road built as part of this alternative would have potential to increase transportation routes in the area.

Kingman Reroute. Transportation impacts would be limited to disrupted access in some areas during construction, creating delays and detours, particularly at major intersections.

4.16.1.3 C Aquifer Water-Supply System

4.16.1.3.1 Well Field

Because of the rural nature of the area, construction along Indian Route 6930 in the well field area would have negligible impacts on traffic. Access to and in the well field area would be increased by the addition of project-related access roads, including improved access to Canyon Diablo, a historically significant scenic area, a negligible beneficial effect.

4.16.1.3.2 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

The eastern route would traverse rural areas and primary roads in densely populated areas, including the communities of Leupp and Kykotsmovi. In these areas, minor traffic impacts would occur during construction. Only a small portion of the pipeline (and none of the ancillary facilities) is located underneath a roadway, reducing construction-related interruption to traffic, so some areas would have no transportation impact. The extension of a permanent access road north from Arizona Route 264 to the Black Mesa Complex would be a minor beneficial effect.

Kykotsmovi Area Subalternatives. Construction would temporarily disrupt access to property along the primary transportation corridor and the bypass road in the community, and could delay or detour traffic.

Little Colorado River Crossing Subalternatives. The crossing of the Little Colorado River south of Indian Route 15 (a major arterial) would either use an abandoned, historic bridge resulting in no impacts since it currently does not serve transportation purposes, or would be horizontally drilled under the river.

4.16.1.3.3 C Aquifer Water-Supply Pipeline: Western Route

Only a small portion of the pipeline, and none of the ancillary facilities, is located underneath a roadway, reducing construction-related interruption of traffic.

Where the western route would intersect with or parallel primary or secondary roads, through-traffic would be temporarily affected during construction. Higher density suburban areas along U.S. 160 would experience impacts on traffic flow as a result of disrupted access and detours during construction activities. In rural areas, construction would impact traffic flow as a result of disrupted access and detours, though to a lesser extent than more urban and suburban areas because fewer roads are present, less traffic occurs on those roads, and through traffic might be accommodated more easily on rural roads.

The western route would have impacts similar to the eastern route at existing roadway intersections. About 50 percent of the route would parallel an existing transportation corridor, in comparison with 90 percent along the eastern route. New access roads would increase the transportation network in areas along the western alternative.

4.16.2 Alternative B – Conditional Approval of the LOM Revision Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

Under Alternative B, transportation impacts from mining operations associated with the Kayenta mining operation would be the same as those under Alternative A. Under Alternative B, mining associated with the Black Mesa mining operation would not resume and reclamation would be initiated. There would not be any increases in access.

4.16.3 Alternative C – Disapproval of the LOM Revision (No Action)

The mining operations would continue on the permanently permitted area of the Black Mesa Complex through 2026 (refer to impacts discussed under Alternative A). Mining on the currently unpermitted area of the Black Mesa Complex would not resume and reclamation would be initiated. There would not be any increases in access.

4.17 RECREATION

4.17.1 Alternative A (Agencies' Preferred Alternative) – Approval of the LOM Revision and All Associated Components of the Black Mesa Project

4.17.1.1 Black Mesa Complex

While no developed recreational facilities or areas are designated, recreation on the Black Mesa Complex is passive and dispersed. Typical recreational activities include hiking, horseback riding, and mine tourism. No hunting is allowed and fishing is discouraged. Off-highway vehicles are used by local residences, but use is normally limited to existing roads. The effects of mine operations on recreation or effects of recreation on mine operations are and would continue to be negligible. New roads (e.g., the coal-haul road), if open to the public, could provide improved access to areas with potential for recreation.

Effects of the presence or operation of mining on Navajo National Monument and Monument Valley Tribal Park, two prominent recreational resources in the vicinity of the Black Mesa Complex, would continue to be negligible.

4.17.1.2 Coal-Slurry Pipeline

4.17.1.2.1 Coal-Slurry Pipeline: Existing Route

Construction along the coal-slurry pipeline would temporarily impact developed recreational trails or byways (Camp Beale Loop Trail, Western/Arizona Trail, and San Francisco Peaks Scenic Road) and recreation areas (Cerbat Foothills Recreational Area, local parks and open space, Camp Beale Springs Historic Site, and Big Boquillas Ranch). Ground disturbance and restricted access would be temporary, lasting three days per 2,500-foot pipeline section. All land would be reclaimed promptly and all trails returned to use.

The existing route of the coal-slurry pipeline parallels the northern boundary of the Mount Nutt Wilderness Area for approximately 5 miles within a designated utility corridor; construction activities would be restricted to the corridor and would not extend into the wilderness area. Improvement of the existing access road, which is currently unimproved, would provide vehicular access to previously inaccessible areas. Construction activity along the boundary of the Mount Nutt Wilderness could create temporary dust, noise, and visual impairments that may detract from wilderness character for visitors who may be engaged in wilderness recreation activities. The pipeline would be properly designed so as not to

create some long-term impacts on wilderness naturalness from flyrock, tailings, and runoff during precipitation events or in the event of a pipeline rupture.

Horizontal drilling under the Colorado River would minimize disturbance to recreational activities along the river. Construction could temporarily restrict access to the trail adjacent to the Colorado River in Laughlin, Nevada. Based on historical performance of the existing pipeline, no failures and consequent releases of slurry have occurred under or near the Colorado River. Considering this and the proposed conceptual design of the new pipeline (Appendix A-2), a failure and release is unlikely. However, if a failure and release were to occur, the amount of slurry released cannot be determined. Using historical data on slurry pipeline releases that were not in proximity to the river, BMPI has estimated that the amount of slurry released may range from an average of 100 cubic yards (or less) to a maximum of 565 cubic yards. The impact could range from negligible to minor depending on the location and circumstances of failure. An emergency response plan that addresses cleanup and management of impacts, including the length of time required for cleanup, would be in place for the coal-slurry pipeline.

Construction impacts at each of the above-named areas would be negligible and temporary.

4.17.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignments (Agencies' Preferred Alternative)

Construction along the segments of pipeline in the Moenkopi Wash would have negligible impact on dispersed recreation by temporarily restricting access to areas with recreational opportunities.

Construction along the Kingman reroute would impact dispersed recreation by temporarily restricting access to areas with recreational opportunities. Impacts on Historic Route 66 and the Mount Nutt Wilderness Area along the existing alignment would be similar. This alignment avoids the Cerbat Recreational Area and Trails System and the Camp Beale Springs Historic Site and trail loop, and would prevent impacts on those areas. Construction across/under Hualapai Mountain Road Scenic Drive would cause delays to accessing the Hualapai Mountain Park, located southeast of Kingman. Construction impacts at each of the areas would be negligible and temporary.

4.17.1.3 C Aquifer Water-Supply System

4.17.1.3.1 Well Field

Construction of an access road to each of the wells (for construction and maintenance) could provide additional vehicular access to dispersed recreational areas such as Canyon Diablo, a historically significant scenic area, which would be a negligible impact. Dispersed recreation in Painted Desert areas within the well field would not be affected.

4.17.1.3.2 C Aquifer Water-Supply Pipeline

4.17.1.3.2.1 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

Construction along the existing access roads could increase vehicular access to dispersed recreation areas in the Painted Desert and to washes designated for conservation by the Hopi Tribe. Dispersed (scenic) recreational uses within the Painted Desert geographic area would not be affected by construction and operation of the water-supply pipeline because the scenic areas are located beyond the proposed alignment. However, construction and operation of the 69kV power line and pump stations could mar the unspoiled setting that is an element of the recreational experience within the Painted Desert geographic area, a negligible impact.

Kykotsmovi Area Subalternatives. Recreational opportunities within the community of Kykotsmovi—generally related to education or day care facilities—are not located within the areas of potential

disturbance, but may be impacted to a negligible degree by temporary access restrictions associated with construction, regardless of the subalternative selected.

Little Colorado River Crossing Subalternatives. Recreational opportunities within the community of Leupp are generally related to education or youth center facilities. These facilities are not located within the area of potential disturbance, and temporary access restrictions would have negligible impact. Dispersed recreation activities in and adjacent to the Little Colorado River may be temporarily disrupted by construction, a negligible impact. Disturbance to recreational activities along the river would be minimized by employing directional drilling under the Little Colorado River, a mitigation to which the applicant has committed.

4.17.1.3.3 C Aquifer Water-Supply Pipeline: Western Route

Construction and operation of the western alternative for the water-supply pipeline would increase vehicular access to dispersed recreation areas in the Painted Desert. Opportunities for dispersed (scenic) recreation would not be affected. However, the recreational experience could be affected where the 69kV power line and pump stations would detract from the scenic quality of the landscape. Construction could cause negligible impacts on traffic due to potential delays estimated to occur intermittently and at different locations as construction proceeded, more than 90 days along U.S. Highway 160, a heavily traveled access route to Navajo National Monument and Monument Valley Tribal Park.

4.17.2 Alternative B – Conditional Approval of the LOM Revision Without Approval of the Black Mesa Mining Operation, Coal-Slurry Preparation Plant, and C Aquifer Water-Supply System

Under Alternative B, impacts on recreation from mining operations would be the same as those under Alternative A. Mining areas on the currently unpermitted area of the Black Mesa Complex would be reclaimed, and upon sufficient restoration of the landscape, the lands would be available for dispersed recreation. Any impacts associated with the coal-slurry pipeline or C-aquifer water-supply system would not occur.

4.17.3 Alternative C – Disapproval of the LOM Revision (No Action)

Impacts on recreation from the Kayenta mining operation would be similar to those under Alternative A through 2026. At the end of 2026, mining operations would cease, and mining land would be reclaimed, allowing dispersed recreation on those areas of the lease area when the landscape is sufficiently restored. Mining areas on the currently unpermitted area of the Black Mesa Complex would be reclaimed, and upon sufficient restoration of the landscape, the lands would be available for dispersed recreation. Any impacts associated with the coal-slurry pipeline or C-aquifer water-supply system would not occur.

4.18 CONSERVATION MEASURES

This section discusses a suite of conservation measures that are proposed to offset the potential adverse effects of stream baseflow depletion caused by the proposed action on Little Colorado spinedace and its designated habitat, and roundtail chub. The purpose of the conservation measures is to aid in the survival, conservation, and recovery of two fish species: the federally listed Little Colorado spinedace and roundtail chub, which was formerly proposed for listing. The measures also would serve to improve and conserve Little Colorado spinedace designated critical habitat.

The conservation measures were developed through a series of meetings and field trips with the Black Mesa Project Biological Resources Subcommittee composed of Federal, tribal, and State, and the co-owners of the Mohave Generating Station wildlife and fishery experts (see Section 5.2.2). The

subcommittee developed an initial list of approximately 26 potential conservation measures that would benefit the covered species and their habitat. The actions were founded upon the conservation measures described in the Little Colorado Spinedace Recovery Plan (FWS 1998), East Clear Creek Watershed Recovery Strategy for the Little Colorado Spinedace (Forest Service 2006), draft State Conservation Agreement for the roundtail chub (AGFD in preparation), and agency experts with regulatory role in native fish conservation and management. The list of conservation measures under consideration captured a variety of actions including land purchases, hatchery rearing and stocking of covered species, fish barrier construction and renovation, habitat improvements, and research. The subcommittee evaluated and ranked each action to determine the relative conservation benefit to the species and their habitat, area (stem reach) or lineage of Little Colorado spinedace that would benefit, relationship to the Little Colorado spinedace Recovery Plan, conflicts with established state sportfish management direction, other potential social, economic, or environmental conflicts (e.g., landowner concerns), and the scope of the conservation measure relative to the expected impacts of the proposed action (i.e., was the measure commensurate with expected impacts).

Based on the analysis and ranking, and subsequent field visits to potential fish barrier sites, two measures were agreed upon by the team as having the highest conservation benefit to the species and their habitats (including designated critical habitat): (1) funding to implement watershed habitat improvement actions that were previously developed by the FWS and Forest Service and covered under an existing environmental assessment (Forest Service 2006) but needed additional funding for implementation; and (2) the establishment of a long-term conservation fund (endowment) to implement high priority native fish conservation projects in the Little Colorado River watershed (with emphasis on spinedace in the Chevelon Creek and East Clear Creek watersheds). The value of a two-tiered approach to the conservation measures was that they provide both immediate habitat improvements for the species and the actions would benefit and improve habitat and the status of the species over time (including implementation of conservation actions 50 years from the date the Black Mesa Project is initiated).

4.18.1 East Clear Creek Watershed Habitat Improvement Projects

To improve the status of the species and its habitat the co-owners propose to provide funding to implement a number of capital conservation projects described in the Forest Service's East Clear Creek Watershed Improvement Project Environmental Assessment (Forest Service 2006). The East Clear Creek Watershed Improvement Project covers conservation actions over approximately 70,000 acres in the East Clear Creek drainage. The overall purpose of the East Clear Creek Watershed Improvement Project is to reduce the threat of stand-replacing fire, improve meadow and stream course riparian function, and reduce impacts of recreation to meadows and riparian and stream habitats. To accomplish this goal, the proposed action includes more than 20 projects within four main treatment types: (1) restoring understory and overstory vegetative health and diversity; (2) reducing potential for stand-replacing wildfire; (3) restoring soils, meadow systems, and riparian areas; and (4) reducing effects of roads on riparian areas and threatened, endangered, and sensitive species habitat. The biological subcommittee reviewed the individual projects contained within the East Clear Creek Watershed Improvement Project and selected those that had the most clear and direct benefits to Little Colorado spinedace and its habitat (including designated critical habitat) and roundtail chub. Specifically, five projects were chosen that are expected to increase water yield, and improve the function of wet meadows (i.e., provides for water retention during wet periods causing slower and sustained release into downstream channels) and/or directly protect and/or improve occupied spinedace habitat (Table 4-46). The direct benefits of each individual project to spinedace and its habitat are described in detail in the East Clear Creek Watershed Improvement Project; in general, the proposed projects would improve spinedace and chub habitat through reductions of sediment, provide for a more natural hydrograph, increase instream flow volume and duration, and/or improve bank storage capacity and soil conditions. Because the actual cost of each project was estimated

and to allow for contingencies, the co-owners propose to fund projects in Group A (Table 4-46) up to \$316,819. If funds remain after these five projects are implemented, the balance would be provided to implement natural channel design projects (Group B). Should one or more of the capital conservation projects identified in Table 4-46 not be feasible (e.g., Forest Service decides not to implement a specific project, or a project already has been completed), the co-owners would coordinate with FWS and Forest Service to identify other projects (up to \$316,819) within the East Clear Creek Watershed Improvement Project EA that provide equal conservation benefit to the fish species. The funding for the projects would be provided when all project permits and approvals have been obtained and are concurrent with the start of construction.

Table 4-46 Proposed Capital Conservation Projects (described in the East Clear Creek Watershed Health Improvement EA) to Offset Impacts on Federally Listed Fish Species

Project	Benefit	Year(s) Implemented	Estimated Cost (includes inflation)	Cost with 100% Contingency
<i>GROUP A</i>				
Create area closures at Dane Springs and Dines Tank for protection of spinedace habitat	Reduction of sediment and disturbance frequency. Protect extant population of spinedace from recreation impacts.	3, 4	\$44,142	\$88,263
Remove tank and rehabilitate 1 site at Dick Hart	Reduction of sediment into aquatic system	2	\$18,200	\$36,400
Stabilize stream crossings	Reduction of sediment entering system	1, 2, 3, 4, 5	\$49,836	\$99,672
Rehabilitate or remove any stream channel wood structures located in Buck Springs and Houston Draw	Improve stream channel function and improve aquatic habitat	2	\$22,881	\$45,762
Thin trees on approximately 83 acres in upland areas above Merritt, McFarland, Limestone Tank, and Upper Buck Springs	Increase flow duration of springs	3, 5	\$23,361	\$46,722
TOTAL			\$158,410	\$316,819
<i>GROUP B</i>				
Contribute to natural channel design projects, layback banks/ hydromulch at one or more sites identified in the East Clear Creek Watershed Health Improvement EA	Reduced sediment entering system and improved bank storage capacity would increase flow duration	5, 7	Up to \$158,410	
Maximum Contribution Group A+B			\$316,819	

4.18.2 Annual Endowment for the Conservation of Native Fish Species

To provide for actions that would improve the status of the species and improve habitat conditions (including designated Little Colorado spinedace critical habitat) over the long term, the co-owners propose to establish a dedicated annual endowment to support the implementation of high priority native fish conservation projects in the Little Colorado River Watershed. The amount that would be provided on an annual basis is \$40,000 per year for 50 years. The endowment concept was developed and agreed to within the Biological Resources Subcommittee meetings. The benefits of the endowment for spinedace and roundtail conservation and recovery were identified as providing for long-term funding that (1) offset project impacts and provides a net conservation benefit to the species and their habitat; (2) augments Federal and State native fish conservation efforts; (3) can be used in an adaptive management approach—improving conservation measures as new information and priorities change over time; and (4) would be flexible and thus can be applied to a variety of actions and projects to achieve maximum benefit to the species. High priority projects are those tiered to existing strategies or compliance documents (e.g., East Clear Creek Watershed Recovery Strategy, State Conservation Agreements, Forest Service Plans, Recovery Plans). It is expected that the types of projects may change over time as resource agency priorities change and new information concerning the species is incorporated into conservation efforts.

Below are detailed descriptions of the endowment priorities, management, and structure.

Priority Species (listed in order of importance)

1. Little Colorado spinedace
2. Roundtail chub
3. Bluehead and Little Colorado suckers
4. Speckled dace

Priority Project Locations

1. Chevelon Creek watershed
2. East Clear Creek watershed
3. Other sub-watersheds in Little Colorado River basin that have extant populations, designated critical habitat and/or that have been identified as important for native fish conservation (e.g., Silver Creek, Nutrioso, mainstem Little Colorado River from Winslow to Greer).

Priority Project Types

Highest priority projects are those that directly protect extant native fish populations or replicate populations; second priorities are those that may indirectly benefit/protect extant populations through methods involving riparian habitat improvements within the designated critical habitat reaches or occupied reaches (increased stream flow, improved water quality, etc.) or hatchery production; third priorities are those projects that improve unoccupied, but potentially suitable native fish habitat; lowest priorities are those projects that do not provide clear on-the-ground benefits (e.g., native fish education and/or outreach projects).

Conservation projects could include (not an exhaustive list):

- Construction and maintenance of fish barriers
- Stream renovations (management/control of nonnative fish and crayfish, or other harmful nonnative organisms) and repatriations of native fishes
- Watershed/stream habitat restoration projects and post-project monitoring to assess native fish benefits
- Culture of native fish, hatchery support, and supplemental stocking
- Development and maintenance of artificial refugia
- Protection and monitoring of instream flow
- Land and water purchases
- Stream habitat inventories and evaluation to assess fish habitat
- Public education and outreach

4.18.2.1 Endowment Limitations and Constraints

- Funds *may not be used* to implement conservation actions or reasonable and prudent measures required of other entities by any agency (Federal, tribal, State) to mitigate impacts associated with any other development projects.
- Funds may be used to incrementally enhance or augment other mitigation or conservation projects, or may be used as matching funds, to provide additional benefits to native fish species.
- Funds *may not be used* for costs associated with agency overheads, e.g., oversight of the endowment payments, labor costs associated with participation on the technical subcommittee, or agency overhead associated with endowment project allocation.
- Funds may be used for labor or other costs associated with specific approved conservation projects (e.g., direct labor charges for stream restoration). However, agency labor charges for conservation projects should be kept to a minimum. Agencies should use base funding from other sources prior to seeking money from this endowment to pay for staff time.

4.18.2.2 Project and Endowment Decision-Making Process

Two tiered approach for project identification and funding allocation:

1. Technical subcommittee for project identification; and
2. FWS and AGFD management review and approval of proposed projects:
 - A technical biological subcommittee would be established: led (co-chaired) by FWS and AGFD and include the applicants and consulting agencies. The members of the subcommittee may request, as appropriate and deemed necessary, input from the interested parties (e.g., Forest Service spinedace recovery team members, university researchers).
 - The subcommittee shall identify potential projects and may develop a multi-year endowment implementation plan or strategy (may be tiered to the East Clear Creek Watershed Recovery Strategy, Conservation Table developed during Black Mesa discussions, Little Colorado Spinedace Recovery Plan, Integrated Fisheries Management

Plan for the Little Colorado River Watershed, State Conservation Agreement for native fish species, projects developed by the Native Fish Conservation Team, Forest Service Land Management Plans or existing projects).

- FWS and AGFD co-chairs would organize an annual (or other appropriate interval) meeting and invite interested agencies, organizations, and persons.
- The subcommittee would recommend annually (or other appropriate time period) to FWS Arizona Ecological Services Office (AESO) Field Supervisor and AGFD Habitat Branch Chief, for review and approval, a proposed project summary list, and any recommended changes regarding the endowment allocation management and administration.
- The subcommittee may recommend no projects in any given year in order to build the endowment for larger, more costly projects later.
- Recommendations for projects to be undertaken must be provided at least six months prior to the initiation of planning for the next fiscal year. A decision on which projects to fund must occur no later than the initiation of planning for the next fiscal year.
- Oversight role of FWS AESO Field Supervisor and AGFD Habitat Program Branch Chief:
 - FWS and AGFD have the authority to manage federally listed native fish in Arizona off of tribal lands.
 - AGFD also has the authority to manage nonnative fish, including sportfish, and other aquatic wildlife in Arizona off of tribal lands.
 - A Memorandum of Agreement (MOA) (or other appropriate agreement) would be developed between FWS (AESO Field Supervisor) and AGFD (Director) to facilitate joint participation and collaboration in endowment allocation.
 - The Endowment MOA could be tiered to an existing MOA between the agencies entitled “State Wildlife Agency Participation in Implementing the Endangered Species Act: State of Arizona” and a Cooperative Agreement pursuant to Section 6 of the Endangered Species Act (which requires the State to maintain an adequate conservation program for all species of mutual concern).
 - The existing MOA identifies the Habitat Branch Chief of AGFD and the Field Supervisor of the AESO as respective leads for Section 7 Consultation.
 - AESO Field Supervisor and Habitat Branch Chief would review and approve endowment allocation for proposed projects by the established Endowment Financial Manager.
 - The Endowment MOA would establish and recognize the function of the subcommittee for project/plan identification and development, and identify the roles and responsibility of the AGFD and FWS co-chairs.
 - FWS and/or the AGFD (as mutually agreed to on a project basis) would be the responsible agency (s) to enter into additional cooperative agreements, Memorandum of Understanding, MOAs, collection agreements, contracts etc. with other agencies, organizations, or companies to implement conservation projects using the funding.
 - The FWS may consider and approve, in collaboration with AGFD, the addition to the endowment, other sources of funding (e.g., conservation or mitigation funds associated with other Federal or non-Federal projects in the watershed that affect native fish).

- The FWS and/or AGFD (as mutually agreed to) shall track project level endowment expenditures being used for fish projects and project results.

4.18.2.3 Endowment Structure

- Annual endowment payments would begin the same year in which C-aquifer pumping by the Black Mesa Project commences and would continue for 50 years.
- Co-owners would fund an annuity or other financial instrument that would provide \$40,000 per year for 50 years.
- The endowment would be funded and administered for the duration of the project (50 years).
- The funding instrument (annuity or other investment) would provide annual payments of \$40,000 to a financial administrator determined by the co-owners in coordination and approved by FWS AESO Field Supervisor and the AGFD Habitat Branch Chief. The financial administrator would be responsible for holding, investing, and allocating the funds as directed by the FWS in coordination with AGFD.

4.19 MITIGATION

This section describes the standard practices, best management practices, and mitigation measures that the applicants commit to employ in constructing, operating, and maintaining the project components. Similar information is provided in Appendix A-1, a summary of mining and reclamation procedures; Appendix A-2, a summary of typical pipeline construction; and Appendix A-3, a summary of the water-supply system construction. As part of the design and engineering efforts prior to construction, BMPI and SRP would identify more detailed, area-specific mitigation, which would be reviewed with the appropriate land-managing agencies (e.g., Hopi Tribe, Navajo Nation, BIA, Forest Service, BLM) or land owners.

4.19.1 Measures Common to All Project Components

Noxious Weeds and Invasive Species. Consistent with Arizona Department of Agriculture Rule R3-4-244, equipment used in an area infested with regulated or restricted noxious weeds would have all soil and debris removed prior to relocation to a noninfested area. In addition, areas infested with noxious weeds would be treated under an integrated weed-management plan. Treatments may involve manual removal, herbicide application, or biological control methods.

An integrated noxious-weed management plan would be developed that would include identification of noxious weeds in the project area, weed-management goals and objectives, and preventative and control measures. Weed-control methods would be selected based on the management goals for the species, the nature of the surrounding environment, and methods recommended by Federal, State, and local weed-management agencies. The plan would be developed and implemented in coordination with the Plant Services Division of the Arizona Department of Agriculture, Federal and tribal agencies when their lands are involved, and local weed-management associations. Measures to prevent the spread of noxious weeds could include, but are not limited to, the following:

- Contractors' vehicles and equipment would be inspected and treated as necessary to ensure that they are free of soil and debris capable of transporting noxious-weeds seeds or roots.
- Noxious-weed populations in or near the construction area would be treated at the start of construction to prevent seed dispersal into land disturbed by construction. Controls could include physical removal or herbicides.

- Periodic surveys would take place during the construction period and revegetation periods to identify and treat noxious weed infestations in a timely manner.
- Potential areas of topsoil salvage would be assessed for presence and abundance of noxious weeds prior to salvage. Topsoil from heavily infested areas would be treated by spraying, or taken off site for disposal, or buried during construction.
- Disturbed areas would be revegetated as soon as feasible following construction. If permanent seeding cannot occur due to the time of year, mulch and a mulch tackifier would be used for temporary erosion control until seeding can occur.
- Fertilizer would not be used in revegetated areas (except agricultural areas) because it can enhance the growth of noxious weeds.
- Certified weed-free mulch would be used for reclamation, and weed-free straw would be used for sediment barriers.

Threatened and Endangered Species and Sensitive Plant Species. Preconstruction surveys would be conducted in suitable habitat during an appropriate season for reliable observation of the target species (survey periods may vary by species). Where found, appropriate mitigation would be developed in consultation with wildlife and conservation agencies. Mitigation may include avoidance, use of temporary fencing, transplanting, and salvage of soil seed banks.

Visual. Areas disturbed by earth-moving activities would be restored to the approximate original contour and would include backfilling and grading of the mined area using spoil stockpiles to approximate the original shape, topographic relief, and drainage patterns, thereby minimizing the impact on the landscape.

To minimize impacts from ground-disturbing activities associated with the reconstruction of the coal-slurry pipeline and construction of the water-supply system, the following would be implemented to the extent practicable. The alignments of new pipeline and any new roads would follow the landform contours in designated areas where practicable to minimize ground disturbance and/or reduce scarring (visual contrast) of the landscape, providing that such alignment does not affect other resource values substantively. In areas to be cleared, vegetation would be removed in natural patterns to the extent practicable, to minimize visual contrast. Project facilities (e.g., water-supply-pipeline pump stations, water storage tank, substations) would be painted a color and to blend and be compatible with the surrounding landscape.

The water-supply pipeline and associated 69kV transmission lines would be sited along existing roads where possible to minimize visual impacts. Nonreflective self-weathering poles would be used to minimize the visibility of the transmission line structures. Where possible, the transmission line would be co-located with existing utilities to reduce the addition of new structures into landscapes.

Cultural Resources. If the project is approved, consideration of impacts on cultural resources would continue as final designs are prepared for the various project components during post-EIS phases of project implementation. Supplemental surveys would be conducted as necessary to complete the inventory of cultural resources within the area of potential effects. Effects on National Register-listed or -eligible cultural resources would be reassessed, and measures to avoid, reduce, or mitigate any identified adverse effects would be implemented after completion of consultations in compliance with Section 106 of the NHPA. The highest priority goal would be to avoid adverse effects wherever feasible when preparing final designs for the various project components. Design of some facilities is relatively flexible, such as the location of wells in the proposed C-aquifer well field, and consequently there is considerable potential to avoid construction impacts as final designs are prepared. Other components of the project are less flexible. Many of the cultural resources that might not be avoidable are important for their potential

to yield important information. Satisfactory mitigation of adverse effects on those types of resources commonly is achieved through research studies that recover and preserve that information before the sites are disturbed or destroyed. Most of the archaeological resources that could be affected are relatively simple, nonhabitation sites that would require only modest research efforts to investigate and document.

Some resources, such as the bridge across the Little Colorado River, have other types of values that warrant preservation in place. If the bridge were selected as the option for supporting the C aquifer water-supply pipeline across the river, efforts would be made to design the adaptive reuse of the bridge to avoid or minimize any loss of historical integrity in accordance with the Standards and Guidelines of the Secretary of the Interior.

Disturbances to human remains and funerary objects that might be associated with affected cultural resource sites are among the most sensitive potential impacts. If any burials cannot be avoided, they would be treated in accordance with the appropriate regulatory requirements, which are tied to land ownership. On tribal and Federal lands, human burials would be treated in accordance with the NAGPRA and implemented through permits issued pursuant to the Archaeological Resources Protection Act. Treatment of any remains on the Navajo Nation also would be consistent with the Navajo Nation Jischáá' policy. Any human remains on Arizona State Trust Lands or private lands within the State would be treated in accordance with the Arizona Antiquities Act (ARS Sections 15-1631, 41-841 et seq.) and Arizona Burial Law (ARS Section 41-865). In the unlikely event that human remains were found along the short segment of the coal-slurry pipeline in Nevada, they would be reported to Clark County law enforcement. If these were determined to be ancient Indian remains, the Nevada SHPO would be notified in accordance with Nevada Revised Statutes, Section 383.170 to determine appropriate treatment.

Treatment to address impacts on traditional cultural resources would be developed and implemented in consultation with tribal preservation offices, and as appropriate, with traditional residents and customary users. Treatment could involve a variety of strategies, such as minor shifts in alignments to avoid traditional fields or plant collecting areas, timing of construction activities to avoid disturbing nesting raptors, and design of facilities to minimize changes in views of and views from traditional cultural resources.

In May 2005, OSM initiated consultations pursuant to Section 106 of the NHPA. Ongoing consultations are under way to develop a Section 106 Programmatic Agreement among the applicants and appropriate agencies. Supplemental inventory and evaluation of cultural resources, refinement of the plan to assess effects, and development and implementation of measures to avoid, reduce, or mitigate impacts would continue during post-EIS phases pursuant to that Programmatic Agreement.

4.19.2 Black Mesa Complex

As stated previously, site reclamation is an important part of the mining process and must comply with SMCRA. The mining operations and reclamation plans established for the Black Mesa Complex prevent and/or mitigate impacts from mining for all of the affected resources. Appendix A-1 provides a summary of reclamation procedures that would be undertaken as part of the proposed project, and the comprehensive operations required to mitigate impacts of mining at the Black Mesa Complex. The SMCRA bonding program, administered by OSM, mitigates any long-term, postmining damage by ensuring performance of the reclamation plan past the period of active mining, through continuous monitoring, inspection, and financial incentive.

4.19.2.1 Mine Facilities

4.19.2.1.1 Water-Control Facilities

Peabody would be required to design, construct, and maintain appropriate sediment-control measures including, but not limited to, sediment ponds, diversions, culverts, and other sediment- and water-control structures in accordance with 30 CFR 816.45 to prevent, to the extent practicable, additional contributions of sediment to stream flow or to runoff outside the permit area due to mining activity, and to minimize erosion. Sediment-control measures include practices used within and adjacent to the mining-disturbance areas. Sediment-control measures consist of the use of proper mining and reclamation methods and sediment-control practices, singly or in combination. Sediment-control methods may include, but are not limited to, the following:

- Limiting disturbance to the smallest practicable area at any one time during the mining and construction operation;
- Stabilizing graded material in a timely manner to promote a reduction in the rate and volume of runoff;
- Retaining sediment within disturbed area;
- Diverting runoff away from disturbance areas, including stockpiles, back slopes, and material storage;
- Diverting runoff through disturbed areas using stabilized earth channels, culverts, or pipes so as to prevent, to the extent practicable, additional contributions of sediment to stream flow or to runoff outside the permit area;
- Using straw dikes, silt fences, small V-ditches, riprap, mulches, check dams, ripping, contour furrowing, vegetative sediment filters, small depressions, sediment traps, and other measures that would reduce overland flow velocity, reduce runoff volume, or trap sediment; and
- Maintaining sufficient ground moisture in traffic areas to reduce the potential for wind and water erosion.

Siltation structures or sedimentation ponds are used primarily for controlling sediment from all disturbed areas, except those permitted areas that are exempted by the requirements of these regulations. Other alternative sediment-control methods may be used in conjunction with the siltation structures or, in the case of the permitted areas that are exempt (i.e., roads), they may be used individually.

Temporary Sedimentation Ponds. Peabody would construct sedimentation ponds to control runoff and sediment from disturbed areas pursuant to 30 CFR 816.46, 816.47, 816.49, and 816.56 (refer to Map 3-7). Sediment ponds generally are recognized in the coal-mining industry as the best available control technology to prevent, to the extent practicable, additional contributions of suspended solids sediment to stream flow or runoff outside the permit area due to mining disturbance. All surface drainage from the disturbed areas would pass through a siltation structure before leaving the permit area, except in certain small areas that are exempt from these regulations. In the exempt areas, alternative sediment-control methods would be used to eliminate additional contributions of sediment off the permit area. Most of the sediment ponds are designed to be temporary, and would be reclaimed when they are no longer needed to treat runoff from disturbed areas. Certain temporary ponds would be proposed for permanent retention in the post-mining landscape, but would be required to be upgraded to meet permanent impoundment regulatory requirements. Sedimentation ponds and impoundments are designed to comply with the requirements of 30 CFR 780.11, 780.12, 780.25, 816.46, 816.47, 816.49, and 816.56, and other applicable regulations.

Permanent Impoundments. Fifty-one water sources consisting of three categories of impoundments determined to be needed to provide water for wildlife and livestock would be or are being proposed to remain after the mining is completed (refer to Map 3-7). Being multi-purpose structures, these structures are used for sediment control during the life of the mine and reclamation operations and would be converted to permanent structures prior to final bond release.

Mine Safety and Health Administration-Size Impoundment Structures. Peabody uses 11 existing structures that meet the criteria of 30 CFR 77.216(a). Two structures would be temporary and 9 structures would be permanent. The primary purpose of these structures, except for the Kayenta Mine Fresh-Water Pond, is to control sediment from disturbed mining areas. The Kayenta Mine Fresh-Water Pond's purpose is to hold pumped groundwater from nearby N-aquifer wells that is used for dust suppression.

4.19.2.1.2 Topsoil Stockpiles

Where prompt replacement of topsoil recovered ahead of mining disturbances is infeasible, numerous topsoil stockpiles would be developed throughout the mine areas to store topsoil pursuant to 30 CFR 780.14(b)(5) and 816.22(c) until it is needed for revegetation operations. Stockpiled topsoil typically remains in place from less than 3 months to more than 10 years, depending on the location with respect to revegetation operations and the revegetation schedule. Using best management practices, stockpiles would be placed on a stable site protected from wind and water erosion, and would not be disturbed until required for redistribution.

4.19.2.1.3 Transportation Facilities

Primary and ancillary roads are located, designed, constructed, used, maintained, and reclaimed in accordance with the regulations and performance standards set forth under 30 CFR 816.150 and 816.151. Appropriate regulatory approval must be obtained for mine-related road crossings of stream buffer zones prior to construction of these crossings.

All roads used or built by Peabody on or after December 16, 1977 will be reclaimed, unless they have been approved by the regulatory authority as a part of the post-mining land use plan. Because of the size and nature of Peabody's mining activities, very few of the roads in the latter category will be reclaimed until the end of mining activities on the entire leasehold. Exceptions include roads in the immediate vicinity of pits and ramps, which are created in the spoil and reclaimed as the general reclamation activities progress within a specific coal resource area.

4.19.2.1.4 Support Facilities

New support facilities would be approved by OSM prior to construction regardless of their location. All disturbances for construction of facilities to support mining operations would be located within a designated disturbance area. Maintenance of all facilities and reclamation of temporary facilities would be in accordance with the approved mining plan.

4.19.2.2 Coal Mining

Peabody must conduct coal-mining activities in a manner that conserves and protects the coal resource in accordance with 25 CFR Subchapter I. The BLM provides inspection and enforcement to ensure protection and conservation of the coal reserve, and also is responsible for independently verifying Peabody's coal production. Coal mining on Black Mesa is a complicated process involving extraction of nonconcentrated, multiple coal seams having varying overburden depths and innerburden thicknesses. The complicated nature of the coal-seam geology has resulted in the selection and application of equipment providing highly efficient and effective coal removal.

4.19.2.2.1 Mining Methods and Equipment

Clearing and Grubbing. Immediately prior to topsoil removal, the area to be mined would be cleared of large vegetation consisting primarily of piñon and juniper trees to facilitate topsoil recovery. The vegetation debris removed would be placed at locations that would not interfere with mining operations. A majority of this material is made available to local residents as firewood and the remainder is either piled at the edges of the mining area to provide cover and nesting habitat for wildlife or buried in the pit during mining operations.

Topsoil Removal. All suitable topsoil would be removed from disturbed areas prior to initiating mining or mining-related activities. Prior to the start of removal operations, the proper salvage depth would be staked or otherwise identified under the supervision of a soil scientist or other qualified person. Salvage-depth information must be adhered to by equipment operators. Topsoil material would be removed throughout the year, weather permitting in 1,000- to 2,000-foot-long by 300-foot-wide sections. It is removed using scrapers or other earth-moving equipment and either hauled directly to recontoured areas for redistribution or transported to topsoil storage areas (stockpiles) located throughout the mine area for storage prior to eventual redistribution. Topsoil materials would be removed up to 1,500 to 2,000 feet in advance of the active mining operation (i.e., active pit highwall) for safety and resource protection reasons.

Peabody routinely implements dust control measures for topsoil stripping and redistribution operations. The cut of the topsoil removal areas and the ingress and egress routes to this area are included in watering operations. The ingress and egress routes to the topsoil lay-down area, where the final grading has occurred, also are watered. To reduce compaction, the lay-down area generally is not watered. Similarly, topsoil removal operations that place salvaged soil in stockpiles include watering as described above and often on the stockpile itself. Additional watering operations are conducted in the access routes to and from the equipment parking lot and the equipment parking and support areas.

Overburden Removal. After being drilled and blasted, overburden material covering the shallowest coal seam would be removed. The overburden would be placed in piles in the previously mined pit along the side of the current cut using draglines and auxiliary excavating equipment. This process would be repeated in sequential fashion as the pit advances into the coalfield (Appendix A-1, Figures A-1 and A-2). Overburden and spoil material that would be used as topsoil supplements is identified and removed in much the same manner as topsoil material.

Air Quality Control. Fugitive dust controls at the Black Mesa Complex focus on those substantive sources of PM₁₀ emissions, which typically contribute the most to ambient levels of that pollutant: e.g., draglines, shovels, and haul roads. The fugitive dust control plan for the Black Mesa Complex currently uses the following activities, practices, and equipment to ensure that the mining operations do not result in a pattern of ambient PM₁₀ impacts in excess of the applicable NAAQS:

- Exposed surface areas are protected and stabilized to control erosion and attendant fugitive dust by timely revegetation, stabilization of topsoil stockpiles, and revegetation management;
- Rills and gullies, which form in regraded and topsoiled areas, are filled, regraded, or otherwise stabilized;
- Exposed surface areas are minimized to the extent practicable;
- Before or during loading, shot coal is watered as necessary;
- The drop height from earth excavating equipment is minimized to the extent feasible;

- Haulage and ancillary mine roads are watered at frequencies dependent upon the amount and timing of use, condition of the roads, and the amount of dust observed when in use;
- Frequently used haul roads and light-duty roads are chemically treated at least twice per year with a dust suppressant (35 percent magnesium chloride or equivalent at a chemical-to-water ratio of approximately 5:1);
- Magnesium chloride is stored year-round on site for use in spot treatment of roads, when necessary;
- Some light-duty roads and parking lots are paved;
- Water injection or rotoclones are employed on all overburden drills;
- Haul-truck speeds are mechanically limited to 30 miles per hour, and all other vehicles are limited to 45 miles per hour, or as posted;
- Sprays of water or water and a surfactant are installed and used at coal-handling and conveying equipment;
- Spoil and coal fires are suppressed and extinguished as soon as reasonably and safely possible;
- All conveyors are covered; and
- Chutes, drapes, or other means are used to enclose conveyor transfer points, screens, and crushers.

In addition, a comprehensive meteorological and ambient PM₁₀ monitoring program at the Black Mesa Complex is used to determine the effectiveness of those dust-control practices. Should monitoring data indicate that ambient PM₁₀ standards are being threatened by impacts from mining operations, the Black Mesa Complex can adjust the nature, extent, and frequency of its various, available dust control measures as necessary to reduce those impacts in order to maintain compliance with the applicable NAAQS. These practices and programs would continue under the LOM revision.

4.19.2.3 Reclamation

Surface Stabilization. Peabody has included a plan in the LOM revision permit application, that would be implemented, for establishing a reclaimed landscape that minimizes erosion and supports post-mining land uses. Under this plan, factors such as hill slope gradient and length, soil properties, surface-soil mechanical manipulation techniques, site characteristics, and revegetation practices are evaluated using prescribed criteria to design the surface form, soil placement, and drainage plan. The Revised Universal Soil Loss Equation is applied to evaluate the effectiveness of the surface stabilization practices and determine the need for, and spacing of, gradient terraces on steeper slopes. Gradient terraces and down drains, in conjunction with surface protection and erosion control techniques, may be used when necessary to maintain landscape stability. With this plan, soil losses are predicted to be less than soil losses in pre-mining conditions.

Post-Mining Land Uses. The primary historical land use in the area has been livestock grazing—primarily sheep and goats. In recent years, the numbers of cattle and horses have increased. Other land uses include agriculture (primarily dry-land corn production), gathering of plant materials (for cultural, medicinal, and edible purposes), commercial trapping, various forms of outdoor recreation, and preservation of wildlife habitat. Reclamation efforts at the mine are directed toward restoring the land to be used for livestock grazing, wildlife habitat, and cultural plant use.

Post-Mining Topography. Backfilling and grading operations are designed to produce a diverse topography similar to the original landform, as discussed above regarding the surface stabilization plan.

Mine-Soil Reconstruction. Topsoil and topsoil-supplement redistribution operations would ensure the replacement of a minimum of 4 feet of suitable plant growth media for revegetation, of which a minimum of 9 to 12 inches would be topsoil. Graded spoils determined to be suitable as a rooting medium would be covered by a minimum of 9 to 12 inches of topsoil. Graded spoils determined to be unsuitable would be covered with a minimum of 4 feet of suitable material (overburden and/or topsoil). Redistribution of plant-growth media would be accomplished whenever weather and soil moisture conditions permit, using scrapers, bulldozers, front-end loaders, backhoes, and end-dumps, and miscellaneous support equipment (road graders, water trucks, and farm tractors). This material is obtained from topsoil storage piles or hauled directly from topsoil material removal areas and supplemental sources (highwalls and spoil banks). Scoria or red rock that is suitable for plant growth would be used in localized areas for reclamation of cultural plants, woody plants, and wildlife habitat.

Mine spoils would be scarified prior to or immediately after topsoil material is distributed, to increase adhesion at the interface between the respective materials and relieve compaction. After redistribution operations are complete, contour furrows would be installed perpendicular to the slope. Revegetation treatments such as seeding, mulching, and erosion repair would be conducted on the contour to reduce the potential for downslope water flow.

Revegetation Plan. The revegetation plan has been developed to meet the requirements of 30 CFR 816.95, 816.97, 816.111, 816.113, 816.114, 816.116, and 816.133. Following topsoil replacement, surface mechanical manipulations, and seedbed preparation, revegetation would be completed using a combination of applied seed mixes, mulching, and seedling planting programs. The best technologically available practices would be used to accomplish all revegetation activities. The Rangeland Seed Mix, the primary seed mix used for revegetation, is composed of a minimum of 21 species, including warm and cool season grasses, forbs, and shrubs. The predominantly native seed mix is designed to meet the requirements of the regulations cited above and meet nutritional requirements for livestock and wildlife. The Rangeland Seed Mix is split into drilled and broadcast components based on seedbed ecology needs of the seeded species and physical seed characteristics. Specialized seeding equipment is used to seed both components at the proper depths in one pass to reduce equipment traffic on the reclaimed surface. Several additional seed mixes are used in revegetating drainages or establishing wildlife habitat and sites for re-establishing cultural plants. The primary seeding season is from May to September, with a secondary seeding season available during spring and fall when ground conditions permit equipment operations.

Immediately following seeding of topsoiled areas, a native grass hay mulch would be applied at 2 tons per acre and crimped. Native grass hay is more effective than straw and does not establish volunteer crops. Sites established with suitable plant growth substrates such as red rock or scoria are not mulched because of rough surface configuration and high coarse-fragment content. Following revegetation activities, the reclaimed areas would be fenced to exclude livestock and monitored for vegetation establishment.

Peabody, in consultation with the Hopi Tribe and Navajo Nation, has developed a list of more than 120 culturally important plants at Black Mesa, based on published ethnobotanical studies and contacts with medicine men, herbalists, and residents of Black Mesa (Appendix F, Table F-2). Peabody has developed and implemented a cultural plant restoration program on select reclaimed areas that also serves to re-establish woodland and wildlife habitat. Typically, sites of one to several acres are prepared on north-facing slopes using red rock (scoria) suitable plant growth substrates. These sites are developed to simulate native site requirements of the target species. The sites contain numerous planting microsites due

to roughened conditions created during substrate replacement operations. Plant materials are developed from local native seed collections with some regional sourcing as needed to ensure that plants are adapted to environmental conditions at the site and are capable of regeneration. This ecological approach considers plant adaptations and symbiotic relationships common to plants in the arid Southwest. More than 50 grass, forb, shrub, and tree cultural plant species are commonly included in this program. This program would continue to be implemented under the LOM revision.

Piñon/juniper woodland sites would be re-established as a part of the cultural plant restoration program. Typically, seedlings of piñon pine, Utah juniper, and to a lesser extent Gambel oak, are included in these planting efforts. Planted tree densities are 250 to 350 stems per acre and the minimum established density is 75 trees per acre. Live piñon transplants from salvage of 3- to 5-foot-tall trees in grubbing areas ahead of mining are transplanted annually to complement tree seedling planting.

Revegetation practices to restore wildlife habitat would include the overall rangeland-seeding program, cultural plant and piñon/juniper woodland restoration, and additional woody species plantings around ponds and small depressions. The revegetation program is designed to establish diverse vegetation capable of meeting wildlife nutritional needs and other habitat factors such as cover or nesting. High-density shrub areas (greater than 800 stems per acre) are interspersed within the reclaimed landscape. Cultural plant/woodland/wildlife habitat sites also are interspersed within the reclaimed landscape. These features combine to increase edge and habitat diversity.

Revegetation Success. Revegetation success standards and their evaluation are structured to meet the criteria of 30 CFR 816.111 and 816.116. Standards are based on a combination of native reference areas and approved technical standards that reflect environmental site conditions, ecological considerations, and post-mining land uses. The criteria for evaluation follow both 30 CFR 816 requirements and other Federal guidelines and address the parameters of cover, production, woody density, and diversity. Revegetated areas would be included in an annual vegetation monitoring program to identify any needed remedial action, document trend and vegetation performance of reclaimed areas, contribute to the database for revegetation success evaluations, and would provide data for implementation of post-mining land uses. The vegetation monitoring data are used to establish grazing levels in an approved grazing management program designed to enhance vegetation community characteristics and demonstrate achievable post-mining land uses.

4.19.2.4 Protection of Fish and Wildlife, and Related Environmental Values

Peabody's plan for protection of fish, wildlife, and related environmental values addresses the requirements of 30 CFR 816.97. The previous discussion under Revegetation Plan addresses re-establishment, mitigation, and enhancement of vegetative habit features and needs. Various sections of the approved permits address operations conducted to minimize hazards to raptors from electric power lines and how to design, locate, and operate roads and facilities that avoid or minimize impacts on wildlife and permit passage. These also would apply to the LOM revision.

Nonvegetative wildlife-habitat-enhancement-or-replacement features include linear rock features and rock structures established at 1 acre per 100 acres with specified design criteria in the AZ-0001 and AZ-0001D permits. Raptor perches are established at a density of 1 acre per 400 acres. The perches are constructed based on the most appropriate technologically sound design criteria at the time of installation.

As described above, impoundments significantly enhance habitat, establish wetland vegetation, and provide a critical habitat feature previously not readily available in the pre-mine landscape.

Threatened and Endangered Species, and Species of Special Concern. Peabody promptly notifies the regulatory authorities of any Federal-, tribal-, or State-listed species occurring on the permit area and conducts the required mitigation or monitoring following consultation. Surveys for nesting raptors in advance of active mining operations are conducted annually, and mitigation procedures are implemented as necessary after consultation with the regulatory authority if nesting raptors are located within the survey area. Prairie dog colonies are monitored annually for areal extent and sign of black-footed ferrets. If the size of a prairie dog colony exceeds the minimum acreage requirements in effect at the time, black-footed ferret surveys are conducted in accordance with guidelines specified by the regulatory authority. Mexican spotted owl surveys and monitoring were conducted over a 7-year period ending in 2000. Mexican spotted owl surveys would be reinitiated when mining activities are within 2 miles of any known nest site or the mixed-conifer habitat type adjacent to the lease area. Surveys or monitoring would be coordinated with the regulatory authority following approved protocols.

4.19.3 Coal-Slurry Pipeline and Water-Supply System

Any new pipeline alignment would be carefully surveyed and located to avoid areas of difficult terrain and other sensitive environmental and human features. Where possible and to avoid unnecessary destruction of vegetation, the width of the construction right-of-way for the pipelines, limited to 65 feet under Alternative A, would be narrowed when practicable where construction takes place in dense woodland and riparian vegetation.

There are no agency authorities that permit and regulate the pipelines or well field. For the coal-slurry pipeline, the provisions of the American Society of Mechanical Engineers (ASME) Code B31.11, “Slurry Transportation Piping Systems,” would be followed in the design, construction, operation, and maintenance of the coal-slurry pipeline. For the water-supply system (well field, collector pipelines, pump stations, and water-supply pipeline), provisions of the American Water Works Association (AWWA) would be followed in the design, construction, operation, and maintenance. The construction supervisor would ensure that pipeline-construction activities are completed in conformance with all applicable requirements and that all environmental mitigation measures are identified and implemented. All mitigation requirements would be incorporated into the project construction specifications and disseminated during preconstruction briefings so that mitigation requirements are understood by on-site construction and inspection personnel. Both the construction and maintenance activities would be performed in a manner that would minimize adverse effects on environmental and cultural resource values. The Hopi Tribe and Navajo Nation would be consulted to ensure that all clearing, grading, and construction activities where they have jurisdiction are conducted in such a manner as to minimize disturbance to traditional life ways.

Environmental inspectors would oversee all field activities. The environmental inspectors’ responsibilities would include, but not be limited to, inspecting erosion control, water resources, cultural resources, vegetation, protected wildlife species, and protected areas. The environmental inspectors also would evaluate the success of revegetation and stabilization of the right-of-way following construction. All erosion-control devices are to remain in place and in a functional condition until stabilization is achieved, at which time the temporary erosion-control devices would be removed and disposed of in compliance with conditions agreed upon for the project.

Water Quality Control. Construction activities would be performed by methods that would prevent entrance, or accidental spillage, of solid matter, contaminants, debris and other pollutants and wastes into streams, flowing or dry watercourses, lakes, and underground water sources. Such pollutants and wastes include but are not limited to refuse, garbage, cement, concrete, sanitary waste, industrial waste, radioactive substances, liquid or semi-liquid petroleum products (oil), aggregate processing tailings,

mineral salts, thermal pollution, and drilling fluids other than water. All construction activities would be performed under a Storm Water Pollution Prevention Plan (SWPPP).

Dust Abatement. The construction work would comply with all applicable Federal, tribal, State, and local laws and regulations regarding the prevention, control and abatement of dust pollution. The construction activities would use efficient methods wherever and whenever required to prevent dust nuisance or damage to persons, property, or activities, including but not limited to crops, orchards, cultivated fields, livestock, wildlife habitats, dwellings and residences, agricultural activities, recreational activities, traffic, and similar conditions. Methods of mixing, handling, and storing cement, concrete aggregate, and other fine particulate matter would include means of eliminating atmospheric discharges of dust. The construction activities also would use watering trucks for dust abatement, where required.

Air Quality Control. Construction activities would comply with applicable Federal, tribal, State, and local laws and regulations concerning the prevention and control of air pollution. The construction activities would use such methods and devices as are reasonably available to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants. Equipment and vehicles that show excessive emissions of exhaust gases would not be operated until corrective repairs or adjustments have been made to reduce such emissions to acceptable levels.

Noise Abatement. Measures to reduce noise generated from construction activities when the activities are within 0.5 mile of a noise sensitive receptor (occupied dwelling) would be implemented, when required. The need for such measures would be determined during construction after evaluating the conditions on site (e.g., prevailing wind direction, the proximity of noise sensitive receptors, terrain, or presence of natural sound buffers that may alleviate the need for implementing noise reduction measures). Such measures may include, but are not limited to, the use of temporary sound baffle walls.

Light Pollution Abatement. Permanent and/or temporary artificial lighting used during construction and for permanent operations and maintenance would be directed to shine downward at an angle less than horizontal and aimed so that it is directed away from any residences and shielded so as not to include a residence in its direct beam. Any lighting would abide by Hopi Tribe and/or Navajo Nation laws governing light pollution. If there are none, the lighting would conform to State or county laws governing light pollution, whichever is more stringent.

Transportation. Construction of the pipelines under Alternative A would interfere with some transportation routes. Mitigation measures are as follows:

- Major intersections would be bored or trenched and steel plated until the pipeline is installed.
- A traffic management plan would be established prior to construction activities.
- Owners and/or tenants of affected properties would be contacted prior to construction to explain the construction process and give them opportunity to identify any special conditions or concerns that should be incorporated into construction plans. Residents and businesses would again be notified two weeks before construction (regarding construction dates, work hours, traffic detours, and contact numbers of the proponent and the contractor). Emergency response agencies also would be notified of the work schedule.
- Access to property would be provided by placing steel plates across trenches during construction (except during trenching operations).

Preservation of Historical and Archaeological Data. During the construction activities, if evidence of a burial site or possible scientific, prehistoric, historic, or archaeological data is discovered, the work would cease immediately at that location and the appropriate land-management staff would be notified. During construction, care would be exercised so as not to disturb or damage artifacts, fossils, or grave sites uncovered during any activities such as clearing, grading, or excavation operations. Cooperation and assistance, as may be necessary, would be provided as requested to the appropriate tribal or other authorities to preserve the burial site and/or findings for removal or other disposition by the appropriate agency. All work would be conducted in accordance with the approved Historic Properties Management Plan for the project.

Raptors and Migratory Birds. Raptor surveys would be conducted prior to construction of the pipelines. The survey area should cover an area of 0.5 mile on either side of the pipeline. It would use a combination of aerial and ground surveys in order to adequately cover the potential area of impact. Protective buffer zones would be established around active nests during construction to avoid disturbance and loss of active nests wherever possible. Typical buffer zones include 0.25 to 0.33 mile for more tolerant species such as red-tailed hawk and up to a mile for sensitive species such as ferruginous hawk. Buffer zones would be established in consultation with FWS, AGFD, and the tribes based on site-specific factors, and would be maintained until the young have fledged.

Electrical transmission lines would be designed to prevent or minimize the risk of electrocution, using methods described in *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996* (Avian Power Line Interaction Committee 1996).

To assist in compliance with the Migratory Bird Treaty Act, initial clearing of vegetation would be completed outside of the primary bird-nesting season of April 1 to July 31 to the extent practicable. Alternatively, nest surveys can be conducted ahead of construction to identify active nests and avoid harm to active nest sites.

Surveys for burrowing owls would be conducted near prairie dog towns and in round-tailed ground squirrel (*Spormophilus tereticaudus*) colonies (Mohave desertscrub and desert grassland) that would be affected by project activities, if construction occurs during the breeding season. Construction within 75 yards of an active nest would be avoided from April 1 to September 1 to the extent practicable. Passive relocation techniques would be used to move burrowing owls from occupied burrows in and near the construction zone during breeding season and the burrows destroyed to prevent reoccupation prior to construction.

Southwestern Willow Flycatcher. Clearing of tamarisk and other riparian vegetation would be completed between November and March, outside of the breeding season to the extent practicable.

Bighorn Sheep. Construction in bighorn sheep habitat in the Black Mountains would be avoided during the lambing season (February 1 to May 31) to the extent practicable, and in the bighorn sheep hunting season in December.

Desert Tortoise. Preconstruction tortoise surveys and handling would follow protocols developed by the FWS for Mohave population, and by AGFD for the Sonoran population. Qualified biological monitors would be used during construction to conduct preconstruction surveys and move any desert tortoise to safe locations. Burrows within the right-of-way would be inspected for presence of the species before being destroyed. Open trenches and other excavations would be fenced with temporary tortoise-proof fencing.

The Arizona BLM requires compensation for impacts on Sonoran desert tortoise habitat on public land for any disturbance that requires longer than 10 years to revegetate to preconstruction condition. Compensation is determined through a formula that includes varying rates in the three categories of desert tortoise habitat. Compensation and the formula are discussed in the *Management Plan for the Sonoran Desert Population of Desert Tortoise in Arizona* (Arizona Interagency Desert Tortoise Team 1996). At present, the number of acres that would be affected within the three categories is unknown, since the exact location of the pipeline has not yet been determined. Prior to construction when a more precise pipeline alignment has been designed, BMPI would coordinate with BLM to determine the amount of desert tortoise habitat affected and the amount of compensation that would be required.

Other Wildlife. To minimize the potential hazard of open trenches during construction, the following trenching guidelines would be applied during construction of the pipelines to the extent practicable:

- Keep trenching and backfilling crews close together, and minimize the length of open trench.
- Where trenches are left open and not backfilled, install short, lateral trenches or wooden planks for wildlife to escape from the trench, sloping to the surface at less than a 1:1 slope. In areas where this is not possible or practical, survey the open trench prior to beginning construction activities each day, and have trapped animals removed by a qualified biologist or trained technician.

Colorado River Fish. The horizontal drilling contractor would have a professionally prepared emergency rupture response plan and contingency crossing plan in place that outlines the protocol to monitor the construction, to stop work in the event of a rupture, and to contain and clean up drilling fluids and other deleterious substances. A geotechnical assessment would be conducted to determine if this drilling technique has a high chance of success and a low risk of rupture.

4.19.3.1 Clearing and Grading

Construction activities would exercise care to preserve the natural landscape and would be conducted to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for temporary and permanent work, approved roads, or excavation operations, all trees, native shrubbery, and other vegetation would be preserved and would be protected from damage as is practicable. Clearings and cuts through vegetation would be minimized to the greatest extent practicable, and the clearings and cuts required or otherwise authorized would be shaped irregularly to soften undesirable aesthetic impacts. On completion of the work, all work areas would be left in a condition that would facilitate revegetation, provide for proper drainage, and prevent erosion. All unnecessary destruction, scarring, damage, or defacing of the landscape resulting from the construction would be repaired or otherwise corrected.

Topsoil would be stripped and segregated from subsoil in accordance with landowner or land-manager agreements. Space would be provided for temporary storage of spoil material and topsoil salvaged from the excavation. The width of the right-of-way would be restricted to avoid undue surface disturbance to adjacent resources. No disturbance would be allowed beyond the right-of-way limits.

Brush and shrubs within the right-of-way would be cut or scraped at or near the ground level. Except for the area to be excavated for the trench, the vegetative root system and subsurface soils would be left intact to the greatest extent practicable. This would assist in stabilization of the soils within the right-of-way throughout construction. Timber and other vegetative debris may be chipped for use as erosion-control mulch, cut and stacked along the construction area, or otherwise disposed of in accordance with applicable regulations and landowner or land-manager preference.

Clearing, grading, or other construction activities would not be conducted during conditions when the soil in the right-of-way of access roads is too wet to adequately support construction equipment.

Best management practices that would be used to minimize soil erosion and sedimentation during pipeline construction follow. A SWPPP would be developed as part of final engineering and construction planning and would be implemented during construction. The plan would include measures to minimize soil erosion and sedimentation during and following pipeline construction. The following general soil erosion and sedimentation minimization best management practices would be included in the plan:

- Potentially erosion-sensitive areas would be identified and specific mitigation measures to address these areas included in the SWPPP.
- Weather would be considered when scheduling activities and monitored during construction to allow implementation of soil stabilization and sediment-control measures prior to the onset of adverse condition.
- Clearings and cuts through vegetation would be minimized to the extent practicable.
- Except for the areas to be excavated, the vegetative root system and subsurface soils in the construction zone would be left intact to the extent practicable.
- The quantity and duration of soil exposure would be minimized to the extent practicable.
- Dust-control measures would be implemented as needed to minimize nuisance dust. These measures could include application of water to vehicle traffic routes and excavation zones when constructing in populated or sensitive areas, avoidance of construction during adverse wind conditions, use of gravel on heavier-use roadways, and limitations on speed on unpaved areas.
- Temporary erosion controls would be installed and maintained during construction where site conditions warrant, to reduce water velocity and redirect runoff from precipitation.
- Suitable diffusers and/or energy dissipation techniques would be used when discharging project water to washes, charcos, or approved depressions.
- Original land contours would be restored to conform to adjacent areas as near as practicable.
- Vegetation compatible with the planned land use and existing biotic community would be re-established following final grading as agreed to by the relevant regulatory agencies, tribes, and/or private landowners.
- In agricultural areas, subsoil would be scarified and the segregated topsoil returned to its original grade.
- Permanent erosion and sediment-control measures such as diversion terraces would be installed as conditions warrant.
- Following construction, all erosion-control measures would be inspected and monitored as needed until final stabilization is achieved.

4.19.3.2 Excavation

Topsoil and subsoil would be sidecast to the same side of the trench in a two-pass excavation process. The first cut would be a shallow excavation that removes the topsoil and stockpiles it to the far edge of the nonwork side of the trench. The second cut would be the deeper excavation of 4 to 4.5 feet that removes the subsoil and also stockpiles it to the nonwork side but adjacent to the trench.

4.19.3.3 Construction Methods in Special Areas

Steep Topography. Where severe side slopes are encountered, two construction techniques typically would be used. Using the cut-and-fill technique, the upslope side of the construction right-of-way would be cut during grading. The material removed from the cut then would be used to fill the downslope edge of the right-of-way in order to provide a safe and level surface from which to operate the heavy equipment. Alternatively, side-hill construction could use “two-toning” to provide two levels of work area. Side-hill areas could require additional temporary workspace downslope in order to effectively use these techniques. During grade restoration, the spoil would be placed back into the cut to restore approximate original contours.

Areas of steep slopes may require the use of winching techniques. In such circumstances, construction would require the use of winching tractors to hold each piece of equipment while working on the slopes to address safety concerns. The use of winch tractors in such areas would be necessary during both construction and restoration phases. The slopes would be restored to approximate original contours, and frequent trench and slope breakers would be used to reduce runoff and direct flow to vegetated areas off the right-of-way.

Road and Utility Crossings. Paved roads and highways would be crossed by horizontal boring at a specified depth beneath the surface. This method would be employed to avoid disruption of traffic. Heavier-wall pipe would be installed under the crossing.

Underground pipelines or utilities generally would be undercrossed. For such crossings, prior contact with the utility would establish any requirements for work performance or restoration. Before construction begins, the “one-call system” would be used for locating and marking the existing utility. At a minimum, the bore typically would allow a clearance of 12 inches between the proposed pipeline and any other pipeline or utility. On either side of the crossing, the trench typically would not be excavated any closer than 5 feet from any existing pipeline or utility encountered in the right-of-way.

Water-body Crossings. There are several different construction methods that can be used to install pipelines at watercourse or water-body crossings. The pipeline installation method typically used depends on the size and sensitivity of the water body. The pipeline would cross some water bodies that are dry during much of the year. At these crossings, construction would occur during the dry season using conventional open-trench methods. The pipelines would be buried at sufficient depths, both on the banks and in the stream of the water body, to avoid future scouring that may expose or undermine the pipeline.

Typically, construction within water bodies would be completed as a distinct and independent construction operation from other work on the remainder of the right-of-way. This would allow the scheduling of crews and equipment to expedite construction activities across water bodies.

With the exception of the initial clearing equipment, only the equipment needed for excavation and backfilling would be allowed in the stream channel. All other construction equipment would cross the water body on temporary equipment or existing bridges.

Horizontal directional drilling involves the use of a remotely guided drill head driven by a rotary drill rig using a drilling mud system for lubrication, cutting return, and to maintain hole integrity. In certain cases, this method is preferable since the pipeline is drilled underneath the watercourse with very little disturbance to the bed or banks of the watercourse. Pipe sections somewhat longer than the length of the drilled hole are strung and welded opposite the drill rig and then pulled back through the hole using the drill rig.

Use of this technique involves drilling a pilot bore hole underneath the watercourse towards a surface target, back reaming the bore hole to the drill rig, then passing the reamer back to the opposite bank where the pipe is attached and pulled back toward the drilling rig. This process typically uses the freshwater gel mud system composed of a mixture of clean, fresh water as the base, a biodegradable or biopolymer drilling fluid lubricant as the viscosifier, and synthetic polymers to transport drilled spoil, reduce friction, and stabilize the bore hole. This method is less intrusive and is more favorable than an open-cut water crossing because it minimizes the potential to impact aquatic ecology.

One of the risks associated with horizontal directional drilling is the potential for drilling mud to escape into the environment as a result of a spill, tunnel collapse, or the rupture of mud to the surface. These ruptures are caused when excessive drilling pressure results in drilling mud moving vertically toward the surface. If a rupture occurs in a watercourse, the fine clay particles can settle onto the bottom of the watercourse. The risk of ruptures would be reduced through proper geotechnical assessment practices, adequate drill planning and execution, careful monitoring, and having appropriate equipment and response plans ready in the unlikely event that a rupture occurs.

Horizontal boring would be used to install the pipeline beneath the Colorado River between Laughlin, Nevada, and Bullhead City, Arizona, and under the Little Colorado River east of Cameron, Arizona. At the crossing of the Colorado River near Bullhead City, the bore would begin about 200 feet from the eastern edge of the Colorado River channel, extending under the Colorado River at a depth of approximately 50 feet below the channel bottom (90 feet below ground surface). The bore would continue underground for approximately 3,300 feet and would exit the ground inside the fenced yard of the Mohave Generating Station. This would virtually eliminate all surface disturbance on the Nevada side of the Colorado River. All drilling operations would be confined to a temporary workspace approximately 200 feet by 200 feet at the entry site, a 100-foot by 150-foot temporary workspace at the exit location, and right-of-way along the path of the horizontal bore that would include the staging area for pipe strings for the pull backs.

At the crossing of the Little Colorado River, east of Cameron, the existing pipeline is buried in a trench. Horizontal drilling would be used to install the new pipeline beneath the river. The pipeline would be buried deep enough below the surface of the water channel and banks to avoid future scouring and/or erosion.

Even though significantly more expensive, the directional bore beneath the Little Colorado River is presently the preferred alternative because it allows the pipe to be buried much deeper to avoid potential adverse impacts on the pipe from flood conditions, as well as resulting in less environmental impact.

Blasting. If blasting is necessary, all required authorizations would be obtained and all safety precautions observed. All blasting would be conducted in compliance with Federal, tribal, State, and local laws, regulations, and policies. After blasting has been completed, backhoes would be used to clean the trench for pipe installation.

4.19.3.4 Lowering and Backfilling

After the pipeline is lowered into the trench, the trench would be backfilled with the excavated soil. In areas where topsoil was segregated during trenching, the subsoil would be replaced in the trench first, followed by placement of the topsoil. Where the previously excavated material contains large rocks or other materials that could damage the pipe or coating, clean fill or protective coating, such as rock shield, would be placed around the pipe prior to backfilling. In order to maintain soil porosity in agricultural

areas, no soil tamping would be performed as part of the backfilling process. As a result, a small crown of material could be left to account for future settling.

4.19.3.5 Cleanup and Restoration

After the pipeline has been installed, backfilled, and successfully tested, the right-of-way, temporary work areas, and other disturbed areas would be finish-graded and any remaining construction debris would be disposed of properly. Original land contours would be restored to conform to adjacent areas to the degree practicable. In upland agricultural areas, subsoil would be decompacted and the segregated topsoil would be returned to its original horizon. Permanent erosion- and sediment-control measures, including diversion terraces and revegetation, would be installed at this time. In all wash crossings, the disturbed areas would be restored and revegetated. Additionally, each wash crossing would be re-inspected and monitored after the restoration activities have occurred to ensure that natural flow patterns and revegetation have successfully occurred. All viable, protected plants, including cacti and yucca, would be salvaged and used during restoration. Reseeding on public lands would be done with native species found in the area. Private and public property such as fences, gates, driveways, and roads disturbed by pipeline construction would be restored to original or better condition.

Revegetation for the coal-slurry pipeline and water-supply system would enhance and hasten natural revegetation. This would be achieved by creating a suitable soil seedbed through imprinting or other soil roughening technique, seeding of native species, and mulching. Fertilization is not likely to be needed because most native grasses and forbs are adapted to naturally low nutrient levels, and excess fertilizer is likely to favor invasive weed species at the expense of desired vegetation.

Because of the range of conditions along the pipelines, four different seed mixes would be developed. Proper seedbed preparation and mulching would vary according to area, and would be adapted to site condition. Seed mixes would include native shrubs, sub-shrubs, grasses, and forbs, and would have a minimum of 8 to 10 species. Mixes are needed for the following areas: Mix 1, for piñon/juniper and grassland areas; Mix 2, for Great Basin desertscrub; Mix 3, for desert grassland and for Mohave desertscrub (over about 2,000 feet in elevation); and Mix 4, for lower elevation Mohave desertscrub. The BLM Kingman Field Office recommends using hydromulch.

Areas of tamarisk riparian shrub disturbed during construction of the pipelines would be planted with native riparian vegetation suitable for site soil and hydrologic conditions such as coyote willow and cottonwood in mesic areas, native riparian plant species in drier areas.

Arizona protected native plants on public land, administered by the BLM Kingman Field Office, would be salvaged prior to construction and would be transplanted back into the right-of-way during revegetation.

All waste materials including, but not limited to, excess spoils, waste materials, rubbish, sanitary waste, roadway pavement materials, etc., would be disposed of at the conclusion of construction in approved disposal facilities according to its type. Excess rocks, not reburied in the trench, would be scattered within the right-of-way in a way that would not impede vehicle or game movement. Windrows of rock would not be allowed. Materials would be recycled whenever practical. The disposal of all materials would be in accordance with applicable Federal, tribal, State, and local laws and regulations.

Should a conflict exist in the requirements for cleanup and disposal of waste materials, the most stringent requirement would apply. Records would be kept of the types and amounts of waste materials produced during construction and of the disposal of all waste materials on or off the job site.

In addition, an environmental site assessment would be performed at the following construction locations:

- All hazardous waste accumulation areas
- All hazardous material and petroleum-dispensing and storage areas where the aggregate storage of hazardous materials or petroleum at the site is 110 gallons or more.

This site assessment would be performed by a qualified environmental consultant or equivalent and would document through appropriate analytical sampling and testing that all sites are free of the effects of contamination (i.e., contaminant concentrations are less than applicable Federal, tribal, State, or local action cleanup levels). Upon completion of the work, and following removal of all materials from the project area, work areas would be regraded and left in a neat manner conforming to the natural appearance of the landscape.

Hazardous materials, as defined by 40 CFR 261.3, as defined by Federal Standard No. 313, as amended, and any other hazardous materials or substances identified by Federal, tribal, State, and local laws or regulations that are used during construction would be disposed of in accordance with the applicable laws and regulations. Only disposal facilities that are approved for disposal of hazardous wastes would be used and records would be kept of all such disposal. Hazardous wastes would be recycled whenever possible.

All nonhazardous waste materials including, but not restricted to, refuse, garbage, sanitary waste, industrial wastes, oil and other petroleum products, and roadway pavement materials would be disposed of during construction by removal from the construction area to an approved disposal facility.

4.19.3.6 Hydrostatic Testing

Hydrostatic testing would be conducted to verify the integrity of the pipeline. Any significant loss of pressure indicates that a leak may have occurred and would require further inspection. The water required for hydrostatically testing the pipeline would be minimized by transferring the water used to test one section to the next section for testing, where possible. Where required, the test water would be discharged onto the surface of the ground within the right-of-way using energy dissipation and filtration devices (e.g., hay bales and silt fences) to reduce the velocity of the discharged water, thereby reducing potential for erosion.

4.20 MONITORING

Monitoring is the process of collecting information to measure conditions and determine if management strategies or compliance requirements are being met. Peabody conducts various types of monitoring programs at the Black Mesa Complex to meet objectives or requirements of several agencies including OSM, USEPA, BIA, and tribal agencies. BMPI and SRP would monitor activities of the coal-slurry pipeline reconstruction and water-supply system construction as well as monitor the effectiveness of reclamation after construction. Examples of monitoring programs are described below.

4.20.1 Black Mesa Complex

Hydrology. Peabody monitors surface water, including flow and water quality, at five stream sites at the Black Mesa Complex. Several permanent impoundments proposed for the post-mining landscape are monitored semi-annually for water levels and quality, and 10 springs are monitored annually for flow and water quality. These data are reported quarterly and in comprehensive Annual Hydrology Reports. Discharges from sediment ponds, although infrequent, are monitored in accordance with Peabody's NPDES Permit No. AZ0022179, and are reported monthly.

Groundwater at the Black Mesa Complex is monitored using several wells constructed in the Wepo Formation, alluvium, and in re-graded spoil. Monitoring consists of water levels and water quality once per year in Wepo and alluvial monitoring wells, and semi-annually at a select few Wepo and alluvial wells. These data are reported quarterly and in comprehensive Annual Hydrology Reports.

The N-aquifer production wells are monitored quarterly for a limited set of water quality parameters and annually for a full suite of water quality parameters. Water levels from the production wells are collected as conditions allow, but two N-aquifer observation wells are instrumented and record water levels continuously. These data are reported quarterly and in comprehensive Annual Hydrology Reports.

Peabody also collects samples from select locations in the water distribution system to comply with the Navajo Nation's Safe Drinking Water Act requirements, and analyzes them for bacteria and other water quality parameters as required. Bacteria analyses are reported monthly and supplemental water quality analyses are reported annually.

Details of the OSM-approved hydrologic monitoring conducted by Peabody at the Black Mesa Complex are contained in Chapter 16, Hydrologic Monitoring Program, in the AZ0001D permit documents for the Kayenta and Black Mesa mining operations.

Air Quality. Peabody maintains 12 air-quality monitors located at 11 sites at the Black Mesa Complex, where 24-hour composite samples for PM₁₀ are collected every six days. In support of the air-quality monitoring efforts, Peabody has established four meteorological towers where wind speed, wind direction, and temperature are monitored continuously. Three of these sites are equipped with precipitation gauges, and five other precipitation gauges are located at several of the air quality monitoring sites. PM₁₀ data and supporting meteorological information are reported quarterly and in comprehensive Annual Air Quality Monitoring Reports.

Details of the OSM-approved air quality and meteorological monitoring conducted by Peabody at the Black Mesa Complex are contained in Chapter 12, Air Quality, in the AZ0001D permit documents for the Kayenta and Black Mesa mining operations.

Soil and Spoil Sampling. Peabody monitors spoil quality prior to soil replacement on a 330-foot grid ensuring a suitable 3-foot-thick plant rooting zone is provided at the reclaimed surface. Topsoil replacement thickness is measured and verified by sampling a minimum of 1 site per 5 acres. These data are reported annually in comprehensive Reclamation Status and Monitoring Reports.

Vegetation Monitoring. Peabody has conducted annual vegetation monitoring at the Black Mesa Complex since the early 1980s. This has included monitoring in both the reclaimed and reference areas in most years. Select permanent transects and random sampling units in varying coal resource units are sampled in either spring or fall or both seasons. Reference areas are sampled in at least one season and sometimes both. Sampling in two seasons has been the normal procedure due to two peaks of vegetation growth resulting from bimodal precipitation patterns. The nearly 60 permanent transects are located in revegetated areas that are representative of ongoing reclamation efforts. These permanent transects document changing revegetation requirements, vegetation establishment and development under varying climatic conditions, or results of different or improved revegetation procedures. These transects also are located in unique or high-interest reclaimed areas such as scoria planting sites. The permanent transects allow for measurement of vegetation performance over time to document trend and successional change as well as the response to drought and subsequent recovery. Furthermore, the sampling of transects and selected random sample units measure achievement or progress towards revegetation success,

confirmation of reclamation methods, stocking rate information for managed grazing, and evaluation of ongoing grazing management programs.

The approved vegetation sampling and monitoring program is contained in Chapter 9, Vegetation Resources of the AZ-0001D permit. For bond-release evaluations, sampling intensities are set to meet sample adequacy requirements. All annual monitoring data are entered into a Peabody-developed vegetation database. The results of annual vegetation monitoring efforts are provided to the OSM, Hopi Tribe, Navajo Nation, and the BIA in the Annual Reclamation Status and Monitoring Report.

Wildlife Monitoring. Wildlife monitoring has been conducted at the Black Mesa Complex since the early 1980s. The core monitoring program is contained in Chapter 10, Fish and Wildlife Resources of the AZ-0001D permit. The monitoring program has addressed threatened and endangered and other special-interest species, mine front and nesting surveys for raptors, prairie dog colony and black footed ferret surveys, red tail hawk monitoring, and general wildlife presence on reclaimed and native areas within and adjacent to the Peabody lease area. Documentation of the large numbers of migratory birds passing through the Black Mesa region has been a major ongoing focus. During Peabody's historical monitoring period several high interest species have been monitored for consecutive periods. Included have been peregrine falcon surveys to identify any possible mining impacts. These have included general monitoring for presence and nesting and breeding surveys. These surveys were conducted from 1989 to 2000. Mexican spotted owls were surveyed from 1994 to 2001 to assess any potential impacts as mining moved closer to potential habitat and the 2-mile buffer adjacent to the Peabody lease area. Monitoring during this period included surveys for Mexican spotted owls presence, breeding populations, and prey habits. More recent monitoring efforts have intensified efforts to identify and document wildlife use in reclaimed areas, particularly mule deer and elk. Annual wildlife-monitoring reports are submitted to the OSM, Hopi Tribe, Navajo Nation, and BIA as a part of the comprehensive Annual Reclamation Status and Monitoring Report.

Reclamation. Monitoring of reclaimed areas has been described above under vegetation monitoring and soil and spoil sampling. Additionally, disturbances ahead of mining, mining areas and associated activities, final grading, topsoil replacement, and revegetation are monitored and tracked throughout the year using a GIS database. The database is updated monthly and forms the basis for annual reporting of these activities. As with the other disciplines detailed above, reclamation activities are reported to the OSM, Hopi Tribe, Navajo Nation, and BIA as a part of the comprehensive Annual Reclamation Status and Monitoring Report. The reclamation status report follows the requirements for reporting as outlined in OSM's reclamation status guidance document of November 15, 1998.

4.20.2 Coal-Slurry Pipeline and Water-Supply System

Following construction, the pipeline rights-of-way and well field would be monitored for reclamation success until vegetation is re-established as agreed upon with the land-managing agencies or land owner.

The pipelines would be operated and maintained in accordance with standard procedures established by the pipeline owners to ensure safe operation and integrity of the pipeline. The operation and maintenance of the pipeline would be performed by qualified and trained employees. Personnel would be capable of monitoring the pipeline's operating conditions as well as controlling flows and pressures through the pipeline.

Field operations personnel would make regular visits to the pipeline facilities. During these visits, they would inspect these facilities and conduct routine maintenance in conformance with established procedures. Qualified operating and service personnel would, as necessary, check and repair all

equipment to ensure safe and reliable operations. Emergency Response Plans would be prepared and made readily available during operations and maintenance.

The applicants are committed to a comprehensive program of monitoring pumping amounts, water levels, and water quality in the vicinity of the proposed C aquifer well field. The monitoring would occur during Black Mesa Project pumping and for a period of five years after project pumping ceases. The objective of the monitoring program is to identify possible impacts of project pumping on existing wells and stream flows. The components of the proposed groundwater monitoring program are listed in Table 4-47.

Table 4-47 Proposed Ground Water Monitoring Program, C Aquifer Well Field and Vicinity

Monitoring Component	Description
Pumping amounts	Measure and report monthly and annual well field pumping amounts for mine and tribal uses.
Water-level monitoring	Measure and report spring and fall static water levels in C aquifer monitoring wells (in spring and fall). Monitoring wells would be located: (1) within and adjacent to the well field; (2) in a radial pattern emanating from the well field; and (3) east, west, and between lower Clear and Chevelon Creeks.
Initial water-quality data	Measure and report initial water quality from project wells using parameters for municipal use water quality standards. Measure and report initial quality from monitoring wells using parameters for the water-quality standard associated with the historical use of the well water.
Water-quality monitoring	Periodically measure and report electrical conductance (EC) in each monitoring well. If EC increases by more than 20 percent, samples would be analyzed for all parameters of the relevant water-quality standard.
Other well data	Collect and report data provided by the tribes and others for initial water quality, annual pumping amounts, and annual water levels for wells in the area.

4.21 SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

4.21.1 Black Mesa Complex

For the purposes of this discussion, “short-term” impacts are those that would occur from the time when mining begins in a unit through reclamation of that unit when vegetation has been re-established (i.e., through regrading, replacement of topsoil, reseeding, and initial revegetation). Long-term impacts are defined as the period when vegetation is established and controlled grazing is permitted, through release of the property by Peabody.

Under Alternative A, both the Kayenta and Black Mesa mining operations would be committed to coal production and reclamation through 2029 (the Kayenta mining operation would continue through 2029 under all alternatives). The Black Mesa Project would enable Peabody to continue to supply a reliable, lower cost of fuel (coal) to the Mohave Generating Station to fuel its operations (coal would continue to be supplied to the Navajo Generating Station through 2026 under all alternatives).

Mining through mid-2026 would result in the construction of additional roads, power lines, fences, and other structures in areas where mining has been conducted since 1970. Over the short term, mining would continue to change the environment and commit resources, and then the area affected by mining would be reclaimed and returned to rangeland for grazing and wildlife habitat. Over the long term, use of the land for grazing would not be affected by mining operations.

Approximately 13,529 acres of land within the Black Mesa Complex would be disturbed by construction and mining during the life of the mines (8,062 by the Kayenta mining operation and 5,467 by the Black

Mesa mining operation). There would be long-term changes to the existing geology and topography from backfilling and grading operations; however, the modified topography would support, and in some places enhance, the proposed postmining land uses of grazing and wildlife habitat. Over the long term, soil and vegetation productivity would return to or exceed premining productivity because the reclaimed soil would be more uniform in depth, texture, and chemical and physical composition than the premining soils.

There also would be a short-term loss of vegetation and wildlife habitat. Native and introduced grasses and shrubs and islands of piñon/juniper would be planted after mining to restore vegetation in disturbed areas. Revegetation would establish mostly a grassland/shrubland mix, with islands of woodland habitat in the mined areas. The revegetation areas at the mines would have higher herbaceous productivity than existing communities, but there would be long-term loss of structural elements of the existing habitat such as woodland hiding and thermal cover, and cliffs and rock outcrops. Over the long term, the revegetated areas would support a diverse and productive wildlife community, but species adapted to woodlands would be displaced by species more adapted to grasslands and edge habitats. The retention of the large impoundments would be beneficial to a variety of wildlife over the long term.

Over the short term, mining would sustain the existing workforce through 2026—mine-related population and levels of public service would be sustained in the surrounding communities for that period. Long-term impacts potentially would be major on both the Hopi Tribe and Navajo Nation when coal and water royalties cease to be generated by mining activities. Over the short and long terms, the sociocultural influences of the mining operations would contribute to the overall modernization forces prevalent on the Hopi and Navajo Reservations.

Relocation of Navajo households living within the permit area would continue over the life of the mine. Residents would continue to be subjected to periodic noise from blasting and daily noise from other mining activities. Long-term effects would be diminished and eventually eliminated when reclamation is completed. This process would take generations, which would exacerbate the short- and long-term effects of social disruption to families living in the area.

4.21.2 Coal-Slurry Pipeline and Water-Supply System

For the purposes of this discussion, “short term” is defined as the period of time required for construction of the pipelines and reclamation following construction—a period of 5 years. “Long term” is defined as beyond the 5 years.

Most of the impacts on the environment would result from construction activities and would be short term. Effects include the disturbance of soils, temporary increase in potential for soil erosion, use of water during construction, and disturbance of habitat until the construction rights-of-way are reclaimed. Over the long term, some habitat would be lost from construction of above-ground facilities associated with the C aquifer water-supply system (e.g., well heads, access roads, water storage tank, power lines, pump stations, substations). Effects on air quality would be short term and localized, resulting from construction activities that create fugitive dust, and vehicle and equipment emissions.

Short-term and long-term impacts on cultural and paleontological resources would be similar to those of mining as discussed in the previous section. The presence of construction equipment and construction-related dust, and the visibility of disturbed areas within the landscape (until reclamation is complete) would impact scenic quality in project-related construction areas. Visible above-ground facilities would remain for the life of their usefulness. Local and regional economies would benefit from the construction of the pipelines. Local economic benefits from operation of the coal-slurry pipeline would not be realized

until the operation to supply coal to the Mohave Generating Station resumes. Local economies would benefit from new jobs and services to support the water-supply system and reinstated jobs and services to support the coal-slurry pipeline.

4.22 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

This section describes irreversible and irretrievable commitments of resources associated with implementation of the alternatives. A resource commitment is considered *irreversible* when primary or secondary impacts from its use limit future use options. Irreversible commitment applies primarily to nonrenewable resources, such as minerals or cultural resources, and to those resources that are renewable only over long time spans, such as soil productivity. A resource commitment is considered *irretrievable* when the use or consumption of the resource is neither renewable nor recoverable for use by future generations. Irretrievable commitment applies to the loss of production, harvest, or natural resources. For example, in the surface mining of coal, the removal of coal would be an irreversible and irretrievable commitment of resources. While the coal would be irreversibly committed from the geologic formations, it is also irretrievably committed when burned for electrical generation.

Another example of irreversible loss involves soil loss or erosion. Soil losses from handling, erosion losses from topsoil stockpiles, and other unavoidable erosion losses of native soils would be irreversible. CWA and SMCRA require that soil erosion and sedimentation be minimized and otherwise controlled to mitigate these effects to the maximum extent technologically feasible.

Impacts on terrestrial resources, such as vegetation communities and wildlife may be either permanent or temporary depending on the time frame considered. For instance, a mine site without piñon/juniper woodlands as the post-mining land use may still result revert to a woodland through natural succession—despite the problems of excess compaction, lack of native seed sources across the reclaimed area, and other site conditions that could hinder vegetation succession.

With sufficient time, although it may take hundreds of years, natural processes for mine soil improvement and succession can overcome conditions limiting reforestation, and the resource loss is not irreversible. Conversely, intensively managed reclaimed mine sites may never regain trees due to long-term use as industrial, residential, agricultural, or other non-vegetated uses. Reclamation techniques may exist to equal or exceed natural vegetative regeneration and productivity. In the cases where these techniques are applied, the loss of vegetation resources may be no less reversible than timber harvest. Reclamation of mine sites to vegetative community conditions may not reestablish wildlife habitat to pre-mining conditions. While no program can dictate post-mining land uses, many programs encourage and promote the tangible benefits for return of mined land to revegetated conditions to minimize and mitigate adverse effects.

Both irreversible and irretrievable impacts would occur under all alternatives on geology and minerals, soils, fish and wildlife, land use, cultural resources, and visual resources. Results are summarized Table 4-48.

Table 4-48 Irreversible and Irretrievable Commitment of Resources

Resources/ Related Issues	Type of Commitment/ Reason for Commitment	Alter- native	Irreversible	Irretrievable
Geology and Minerals	Under all alternatives, there would be an irreversible and irretrievable commitment of coal resources. Under Alternative A, this would occur from the Kayenta and Black Mesa mining operation extracting 270 million tons of coal. Under Alternatives B and C, this would result from the Kayenta mining operation extracting 170 million tons of coal.	A	Yes	Yes
		B	Yes	Yes
		C	Yes	Yes
Soils	The structure and characteristics of the original soil profiles would be irreversibly changed when land is disturbed for mining. Commitment of the resource would be irreversible in areas where mining activities take place. However, reclamation would occur immediately and there would not be an irretrievable loss of soil productivity as reclaimed areas would be recovered.	A	Yes	No
		B	Yes	No
		C	Yes	No
Fish and Wildlife	An irretrievable commitment of wildlife habitat would occur from the construction of facilities associated with mining operations, coal-slurry pipeline, and water-supply system. This would result in a permanent minor loss of wildlife habitat unless these facilities were removed and the areas rehabilitated.	A	Yes	Yes
		B	Yes	Yes
		C	Yes	Yes
Land Use	An irretrievable commitment of land use would occur from the construction of facilities associated with mining operations, coal-slurry pipeline, and the water-supply system. This would result in a permanent minor loss of forage production and cover from these areas unless these facilities were removed and the areas rehabilitated.	A	No	Yes
		B	No	No
		C	No	No
Cultural Environment	Damage to cultural resources is an irreversible and irretrievable impact. Damaged cultural resources might be restorable or reconstructible but they are nonrenewable. Destruction of cultural resources by mining and construction activities would be irreversible. All cultures change over time, but the proposed project could accelerate traditional lifeway changes, particularly for tribal members living in the project vicinity. Visual intrusions resulting from construction of above-ground facilities such as power lines, pump stations, and water-storage tanks, and operation and maintenance activities could affect cultural resources and traditional cultural resources throughout the life of the project. If the facilities are removed at the end of their use life, the original settings of the cultural resources might be retrievable. Traditional cultural values maybe irretrievably lost from construction of facilities and changes to visual resources.	A	Yes	Yes
		B	Yes	Yes
		C	Yes	Yes
		B	NA	NA
		C	NA	NA
Visual Resources	There would be an irreversible and irretrievable commitment of visual resources from altering the landscape. The process of removing and replacing overburden would change the visual quality for these landscapes. Restoration reduces the impacts on visual resources, but the landscape would be permanently changed. Change in the landscape from the presence of above-ground facilities including access roads (mines, coal-slurry pipeline, and water-supply system). When the facilities are removed at the end of their useful life, the landscape could be restored; however, there would be irreversible, irretrievable loss of the original visual resources.	A	Yes	Yes

4.23 INDIRECT EFFECTS ASSOCIATED WITH RESUMING OPERATION AT MOHAVE GENERATING STATION

On December 31, 2005, operation of the Mohave Generation Station was suspended until new air pollution control equipment required by a consent decree is installed (refer to Section 1.4.2). The Mohave Generating Station owners have indicated that without a new water source for slurry pipeline operations, they would be unable to renew their coal contract, which would prevent them from installing the controls needed to resume power plant operations. Therefore, under Alternative A, which approves the development and use of the C aquifer water-supply system for coal-slurry pipeline operations would have the indirect effect of allowing the Mohave Generating Station to resume operations. Under Alternatives B or C, the Mohave Generating Station would not resume operation, and other base-load generating stations in the region, primarily coal- or natural gas-fired facilities, would increase their electrical output to replace the lost power generation of the Mohave Generating Station. The environmental effects of these decisions are summarized below from the Preliminary Environmental Assessment for the Mohave Generating Station Continued Operation Potential Project (SCE 2004).

4.23.1 Hydrology

The Mohave Generating Station historically has used the Colorado River as its primary water supply, supplemented by reclaimed coal-slurry pipeline and monitoring well water. The plant historically has had an average water requirement of 17,500 af/yr for power plant cooling, process water, and domestic water purposes of which approximately 16,000 af/yr are from the Colorado River. If the Mohave Generating Station returns to service, the power plant's overall plant water demand would increase by approximately 2,300 af/yr due primarily to operate of the new air pollution control equipment but also due to the power plant's anticipated increased capacity factor. The increased demand would not result in an increase in Colorado River water use, but would be met by in-plant water reuse and conservation controls, supplemented by reclaimed water from local businesses. The Mohave Generating Station is a "zero discharge" facility. All wastewater is evaporated on the site. Under Alternative A, the power plant would continue to withdraw and use its historic Colorado River water allocation. Under Alternatives B or C, the power plant's Colorado River water allocation would be used by another water user in Nevada. There would be no net difference in Colorado River water use among the three alternatives. Therefore, the Alternative A would have no measurable effect on Colorado River water quantity or quality.

4.23.2 Air Quality

The Mohave Generating Station already has obtained the needed construction and operating permits to install the air pollution control equipment required by the consent decree to return the facility to service (Table 4-49). For most criteria pollutants, the future potential to emit from the station would be less than historic baseline emissions. In the case of CO and VOC, the potential to emit would be approximately 12 percent higher than historic emissions, since the future capacity factor of Mohave Generating Station is assumed to be higher than its recent historic baseline.

Table 4-49 Mohave Generating Station Criteria Pollutant Emissions

Air Pollutant	Two-Year Average (2000-2001) Tons Per Year ¹	Potential to Emit (2010-2026) Tons Per Year ²
NO _x	20,517	19,613
SO ₂	42,024	8,701
PM ₁₀	1,977	1,741
CO	1,209	1,364
VOC	145	163

NOTES:

¹ Mohave Generating Station baseline emissions from Permit to Construct application.

² Mohave Generating Station potential to emit from Permit to Construct application.

Under Alternative A, the power plant would emit air pollutants at its permitted levels. These emissions are generally reductions from historic levels and are allowed by the Mohave Generating Station Title V operating permit as being consistent with the Nevada state implementation plan to protect public health and welfare. CO and VOC increases are less than PSD review thresholds and are therefore not considered to be significant. The controls required by the consent decree were approved by USEPA Region IX as sufficient to address concerns related to Mohave Generating Station’s contribution to visibility impairment at the Grand Canyon National Park.

Under Alternatives B or C, air pollutants from the existing facility would not be emitted at permitted levels. However, emissions from other base load generating stations in the region, primarily coal or natural gas facilities, would occur at higher levels to replace the lost power generation capacity of the Mohave Generating Station. The net emissions from replacement generation may be higher or lower than from the Mohave Generating Station.

Alternative A would result in increased emissions from the Mohave Generating Station site. Alternatives B or C would result in an increase in emissions from other generating stations in the region, which may be higher or lower than emissions from the Mohave Generating Station. The Mohave Generating Station’s future potential to emit has been reviewed by the Nevada Division of Environmental Protection and USEPA Region IX and has been found to be consistent with state and federal implementation plans to protect public health and welfare, including visibility in Class I areas. Therefore, the preferred alternative would not be expected to have a significant adverse impact on local air quality.

4.23.3 Climate

If the Mohave Generating Station returns to service, CO₂ emissions from plant operations have been estimated to be 11.9 million tons/year. CO₂ emissions were estimated using the historic emission rate reported in the USEPA’s Acid Rain Electronic Data Reports (EDRs) multiplied by the future capacity factor in the application for the Permit to Construct. The Mohave Generating Station emissions would represent less than 0.05 percent of the 2004 emissions produced by electrical generation in the United States. In 2002, worldwide CO₂ emissions were estimated to exceed 27,550 million tons per year (USEPA 2006d). Replacement base-load power for the Mohave Generating Station would emit greenhouse gases that may be either greater or less than the Mohave Generating Station.

Under Alternative A, 11.9 million tons/year of CO₂ would be emitted from the Mohave Generating Station site. Under Alternative B or C, CO₂ emissions from the existing Mohave Generating Station site would not occur. However, CO₂ emissions likely would increase from other base-load generating stations in the region, the net effect of which may be either higher or lower than the Mohave Generating Station.

The net impact of CO₂ emissions from either Alternatives A, B, or C would not cause a significant impact on global climate change.

4.23.4 Noise and Vibration

The Mohave Generating Station is located within an industrial district and is subject to the corresponding Clark County Unified Development Code noise requirements at the property line. The most significant noise sources at the site are located within the power block area, about 0.5 mile from the closest property line. Therefore, noise attenuates significantly before it reaches the property line. The facility's baseline noise levels historically have been in compliance with Clark County noise requirements. The new air pollution control equipment would be installed adjacent to the existing power block and would include noise attenuation measures to reduce equipment noise levels. The proximity of the existing and new noise sources is anticipated to result in very little additional noise above existing levels at the property line. Construction noise levels would be temporary and limited to construction hours. Due to the distance to the nearest sensitive receptor, noise levels are not expected to be significantly greater than ambient.

Under Alternative A, future operations are anticipated to have an insignificant impact on ambient noise levels. Under Alternatives B or C, noise from the existing facility would not occur.

4.23.5 Social and Economic Conditions

If Alternative A is implemented and the Mohave Generating Station returns to service, the economic benefits of plant operations to Clark County, Nevada; Laughlin, Nevada; Mohave County, Arizona; and Bullhead City, Arizona would return to historic levels. In 2000, the most recent year for which information was readily available, Mohave Generating Station employed 340 workers (SCE 2004). The average salary for union-represented workers was in excess of \$66,561 per year. In comparison, the average per capita income for Laughlin, Bullhead City, and Clark County was \$30,624 (1997 data), \$28,405 (1990 data), and \$30,628 (1999 data) respectively. In 2000, Mohave Generating Station workers received more than \$22 million in salary and wages that were primarily expended in the local region and Mohave Generating Station purchased \$25 million in goods and services from local vendors and contractors in the tri-state area (Nevada, Arizona, and California).

The installation for the new air pollution control equipment would result in the creation of approximately 20 new jobs and additional goods and services would be procured in the local region to service the new pollution control equipment. Local construction jobs of up to 700 workers also would be created during the 3-year construction period.

4.23.6 Visual Resources

The Mohave Generating Station is located within an industrial district and has been part of the visual landscape since 1970. Therefore, the baseline character of the present view is as an industrial complex. Under Alternative A, the installation of the new air pollution control devices would expand the existing footprint of the facility and add more, visible structures, including sulfide dioxide scrubbers and silos. In addition, the existing stack would be removed and replaced with a new stack that would be slightly wider and higher. These structures would be placed adjacent to existing equipment and would blend into the existing industrial features. Therefore, the preferred alternative is expected to result in an insignificant impact on the visual character of the site and its surroundings.

4.23.7 Transportation

Under Alternative A, vehicle traffic to and from the Mohave Generating Station would resume at historic levels. Historically, vehicle traffic in the area did not adversely impact traffic patterns or road

maintenance. In addition, the installation of the new pollution controls is estimated to result in up to an additional 190 truck trips per week and vehicle traffic for 20 additional employees. During the peak construction period, more than 700 workers would be employed at the site. Traffic congestion during construction would be alleviated by planning shifts around peak traffic times, staggering vehicle trips, and selecting alternate travel routes. Impacts on local transportation from Alternative A would be insignificant.

4.23.8 Other Impacts

The Mohave Generating Station site is an existing industrial complex that previously has been disturbed. No additional undisturbed land would be required under Alternative A if the Mohave Generating Station returns to service. Therefore, potential impacts on landforms, topography, geology, mineral resources, soil resources, vegetation, fish and wildlife, land use, cultural resources, and recreation were deemed to be insignificant.

4.24 CUMULATIVE EFFECTS

Regulations prepared by the Council on Environmental Quality for implementing NEPA require Federal agencies to analyze and disclose the effects that result from incremental impact of an action “when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR 1508.7).

4.24.1 General

Air Quality. Table 4-50 summarizes recent, actual (reported) annual PM₁₀ emissions from several major and minor point sources located within or near the project study area. The “other sources” described in the table include the total PM₁₀ emissions from all identified permitted point sources with PM₁₀ emissions less than 10 tons per year. The historical background point source PM₁₀ emissions total 3,736 tons/year.

Current annual PM₁₀ emissions from the Kayenta mining operation were estimated at 1,154 tons per year. Adding the annual PM₁₀ emissions from the background point sources within the study area (3,736 tons per year) to the annual PM₁₀ emissions from the Kayenta mining operation (1,154 tons per year) results in total annual regional PM₁₀ point source emissions of 4,890 tons per year. It is important to note that the background sources listed are in northeast Arizona and northwest New Mexico; therefore, total PM₁₀ emissions in the broader study area are higher than the 4,890 tons per year value for this analysis.

The cumulative effects in the past included the operation of the Mohave Generating Station. According to SCE, the 2-year average emissions baseline (based on emissions during 2002 and 2001) for PM₁₀ emissions was 1,977 tons/year (SCE 2006). These impacts have been regulated under the jurisdiction of the Nevada Department of Environmental Protection, pursuant to applicable state regulations. Evaluation of the magnitude and extent of past or future Mohave Generating Station impacts are not the subject of this EIS. Presently, the scaled-back operations in the Black Mesa Complex and suspension of operations at the Mohave Generating Station have reduced the cumulative effects on air quality in the region, relative to past years. The criteria pollutant emissions for the Black Mesa Complex have been substantially reduced and the emissions from the Mohave Generating Station can be subtracted entirely from the inventory of emission sources. At the time of the EIS, there is no available quantitative modeling evaluation of the magnitude of these emission reductions on regional air quality.

Table 4-50 Background Point Source Annual PM₁₀ Emissions ¹

Facility Name	Company Name	Location	Year	PM ₁₀ Emissions (tons per year)
Navajo Generating Station ²	Salt River Project	Page, Arizona	2004	329
Mohave Generating Station ³	Southern California Edison Company	Laughlin, Nevada	2004	1,977
Cholla Generating Station	Arizona Power Service	Joseph City, Arizona	2003	731
Nelson Lime Plant	Chemical Lime Company	Peach Spring, Arizona	2003	374
Phoenix Cement	Phoenix Cement	Phoenix, Arizona	2003	126
Snowflake Pulp Mill	Abitibi Consolidated	Snowflake, Arizona	2004	58
Griffith Energy Project	Griffith Energy LLC	Kingman, Arizona	2004	58
El Paso Natural Gas Company - Williams Compressor Station	El Paso Corporation	Williams, Arizona	2004	15
American Woodmark Corporation	American Woodmark Corporation	Kingman, Arizona	2004	12
All Other Sources (annual PM ₁₀ emissions less than 10 tons)			Most recent year	56
Total Background Source PM₁₀ Emissions (tons per year)				3,736

NOTES: ¹ Emission data for sources are from Arizona Department of Environmental Quality unless noted otherwise.

² Emission data from South California Edison Company, personal communication with Gary Dudley, October 28, 2005.

³ Emission data from Navajo Generating Station, personal communication with Lee Shakespear on October 27, 2005.

Table 4-51 summarizes total PM₁₀ emissions from background point sources and the highest annual PM₁₀ emissions associated with each of the project alternatives, reflecting past, current and future impacts. It is important to note that during the 2006 to 2009 time period (current impacts), the Mohave Generating Station is not operating. Therefore, the total background point source PM₁₀ emissions value has been reduced by the historical baseline amount of 1,977 tons/year attributable to this point source. Furthermore, maximum PM₁₀ emissions from Mohave Generating Station will be lower than the historical baseline by 236 tons/year to 1,741 tons/year when the facility resumes operation in 2010. Consequently, the total background PM₁₀ emissions value from 2010 to 2026 will include 1,741 tons/year from Mohave Generating Station.

Table 4-51 also shows the magnitude of annual emissions increases (associated with pipeline construction and expanded operations of the Black Mesa mining operation) over current regional emissions levels (which include the current Kayenta mining operation). Note that the highest increase in annual project PM₁₀ emissions under Alternative A is approximately 14.8 percent of current regional emissions. Note that no PM₁₀ emissions increases over current regional emission levels would occur with Alternatives B and C, since only the current Kayenta mining operation would continue.

Table 4-51 Summary of Highest Annual PM₁₀ (tons per year) Increases Over Regional Point Source Emissions for All Three Alternatives

Period	Total Regional PM ₁₀ Emissions	Alternative A	Percent of Background Source Emissions	Alternative B	Percent of Background Source Emissions	Alternative C	Percent of Background Source Emissions
Prior to 2006 ¹	4,890	0	NA	0	NA	0	NA
2006-2009 ²	2,913	251	8.6	0	NA	0	NA
2010-2026 (or later) ³	4,653	690	14.8	0	NA	0	NA

NOTES: ¹ Emitting activities include operation of the Kayenta and Black Mesa mining operations, regional point sources (including Mohave Generating Station).

² Emitting activities include operation of the Kayenta mining operation at current production levels, regional point sources (except Mohave Generating Station) and construction of coal-slurry and water-supply pipelines. Black Mesa mining operation not operated during Mohave Generating Station outage (2006-2009).

³ Alternative A emitting activities include Black Mesa mining operation at increased production level (6.2 million tons per year), operation of Kayenta mining operation at current level and regional point sources (including Mohave Generating Station); Alternatives B and C: emitting activities include operation of Kayenta mining operation at current levels through 2026 (operation of Black Mesa mining operation does not resume).

As described in Section 4.6, refined air quality analyses performed for this EIS offer an indication of the contribution to cumulative effects from continued future operation of the Black Mesa Complex and the addition of the coal-washing plant as part of Alternative A. A key finding is that, based on overly conservative modeling (as described herein), discernable changes in air quality due to mining activities are predicted to be confined to the south of the Black Mesa Complex. This is predicted based on modeled winds. Although predicted concentrations above discernable levels (e.g., PSD significance thresholds) are predicted to occur for up to 100 km south of the Black Mesa Complex, there is little opportunity for the mining activity impacts to overlap with impacts from other sources in the region. This pattern would be largely unchanged from the level of impacts and the direction of impacts that have occurred during past operations of the Black Mesa Complex.

Cultural Resources. The cumulative impacts of culture change and deterioration, weathering, and erosion of the tangible aspects of cultural resources accumulate over time. Prior, ongoing, and future developments of various types also have degraded and destroyed cultural resources in the vicinity of the project, and will continue to do so. If the option of sizing the water pipeline to provide water to tribal communities as well as the Black Mesa Complex were implemented, the construction of the water-supply system and the development the water supplies might stimulate would lead to other impacts on cultural resources—perhaps as great or even greater than the proposed project. Although it is estimated that the proposed project might adversely affect approximately 100 or more cultural resources, thousands of cultural resources have been recorded within the region, and it is likely that hundreds of thousands remain to be recorded and evaluated. The impacts of the proposed project therefore are expected to represent only a minor increment to cumulative impacts on the cultural resources within the region. The exceptions where cumulative impacts are projected to be more substantial are lower Chevelon Creek and to a lesser extent lower Clear Creek, which are significant traditional Hopi cultural resources.

Recreation. Recreation areas exist throughout northern Arizona and provide opportunities for both developed and passive, dispersed recreational use. Although recreational use of the Black Mesa Complex is currently limited, once reclaimed, the area available for recreation could increase. Current and proposed development, particularly in the western portion of the project area, would most likely increase the demand for access to recreation areas and use of access roads.

Transportation. Arizona Department of Transportation (ADOT) plans to widen U.S. Highway 89 to four lanes (from highway Milepost 442 to Milepost 482), raise the median, and add three new interchanges with intermittent turn lanes. U.S. Highway 89 crosses the existing pipeline near CSP Milepost 78, within the area of improvements. Arizona Highway 64 (highway Milepost 185 to Milepost 235) is planned for additional paved shoulders, widening of some segments to four lanes, additional turn lanes, and construction of several passing lanes (ADOT 2004). Arizona Highway 64 crosses the existing pipeline near Milepost 123, an area identified for improvements.

In addition, ADOT is currently in the process of deciding on a corridor for the realignment of Arizona Highway 95. The alternative highway corridors are generally located east of Bullhead City and west of the Mount Nutt and Warm Springs wilderness areas from Arizona Highway 68 to I-40. The existing coal-slurry pipeline route would cross ADOT's current preferred highway corridor for the Arizona Highway 95 reroute near CSP Milepost 265.

The City of Kingman has approved a project to add a third lane to Gordon Drive. In addition, the existing pipeline may cross (near CSP Milepost 230) the proposed north-south road associated with interchange improvements at I-40 and Rattlesnake Wash.

The City of Kingman has indicated that there is a plan for a new traffic interchange on I-40 at Rattlesnake Wash (located in proximity to CSP Milepost 2 of the Kingman reroute). The north-south connecting road would also intersect the reroute at Milepost 2.

Social and Economic Conditions. Due to the existence of the Black Mesa Complex, mining drives the economy of the local area and makes the largest private-industry contribution to the revenue of the Hopi Tribe and Navajo Nation. The Mohave Generating Station has been and (under Alternative A) would be supplied completely by the Black Mesa mining operation, and the coal for the Navajo Generating Station has been and (under all alternatives) would continue to be supplied completely by the Kayenta mining operation. OSM's approval of the LOM revision to resume the Black Mesa mining operation would enable resumed operation of Mohave Generating Station for 2010-2026. A brief summary of the impacts of continued or discontinued operation of the Mohave Generating Station and continuation of the Navajo Generating Station follows.

The Mohave Generating Station operated from 1970-2005, and in recent years employed 305 people, had a \$22.2 million payroll, and made an overall contribution of about \$364 million to the region's economy. The direct economic impact of the generating station employment generally affected three communities—Laughlin, Bullhead City, and Mohave County. Since the station is located in Laughlin, certain benefits accrue to the Laughlin business community and directly to Nevada governments, such as the property tax revenues to the State, Clark County, and the Clark County School District, Southeast Region. Nearly two-thirds of the Mohave Generating Station's employees resided in Mohave County other than in Bullhead City (many in the Kingman area), while about one-quarter lived in Bullhead City, and fewer than 1 in 12 lived in Laughlin. The indirect economic activity such as jobs in businesses that supported the station similarly benefited Mohave County. It is expected that resumed operations at Mohave Generating Station would result largely in a reversal of the direct and indirect effects of the shutdown, with respect to employment and governmental revenue. If and when the station resumes operations, it will be equipped with new air-pollution control technology.

The suspension of operations at the Mohave Generating Station, Black Mesa mining operation, and associated facilities, may last only through 2009, if Alternative A is selected, or may become permanent. For the time period 2006-2009, the shutdown has a direct effect on the economy of the entire region, felt most severely in the local area on both reservations, and in Kingman and Laughlin.

Proposed construction activities at the Mohave Generating Station that are associated with the emission-control improvements do not require any Federal approvals. Many of the required activities, labor force, materials, and other components for the proposed construction project would be similar to those for the operation of the station. The construction activities could offset many of the adverse effects of the later portion of the station's shutdown period.

The Navajo Generating Station is usually considered as one element of the "Navajo Project," whose other components are the Kayenta mining operation and the Black Mesa and Lake Powell Railway. The Navajo Project's 483 employees at the mining operation are addressed elsewhere in this EIS. There are about 500 full-time employees in total between the Navajo Generating Station and the railway, who are employed by SRP, the special government district that operates the generating station. The Navajo Generating Station is a basic industry that, with tourism, drives the economy of Page. Of the 500 employees, more than 80 percent are Hopi or Navajo. While some live in the local area of the mines, others live in Page, LeChee, or other areas nearer to the generating station.

Under existing conditions, the Navajo Generating Station supplies a substantial portion of the total electric power supplied to communities in Arizona, Nevada, and southern California. The jobs at the "Navajo Project" are among the most numerous, stable, high-paying jobs for residents of Page and the Hopi and Navajo Reservations. The generating station and the Kayenta mining operation together are also minor direct contributors to the Flagstaff economy.

Under Alternative A, the resumption of operation of the facilities related to operation of Mohave Generating Station in 2010 would have a direct beneficial effect upon the economy of the entire region. The completion and operation of the C-aquifer water-supply system and a permanent road would have a direct beneficial effect upon economic development in the region and especially throughout the Hopi Reservation and in the western Navajo Reservation.

The long-term shutdown of the Black Mesa Complex operations and the Mohave Generating Station would have impacts on the entire region, especially Kayenta, Kingman, and Laughlin. Electric power generation planning at present (2006) takes into account the closure of the Mohave Generating Station when the Colorado River water allocation for the plant ends in 2026.

The Navajo Generating Station would continue to operate for the foreseeable future. The Navajo Generating Station would be fueled by Black Mesa Complex coal beyond 2026 provided that an additional LOM revision and associated plans, permits and contracts were put in place. When the Black Mesa Complex and the Navajo Generating Station would eventually shut down, major economic impacts on the Kayenta area would occur because of the cessation of the mining operation, and major economic impacts on the Page area would occur because of the shutdown of the Navajo Generating Station.

Environmental Justice. The Navajo Generating Station is a basic industry that, with tourism, drives the Page economy. Of the 500 employees of the generating station and the associated Black Mesa and Lake Powell Railway, more than 80 percent are Hopi or Navajo. While some live in the local area of the mines, others live in Page, LeChee, or other areas nearer to the station. The LeChee Chapter currently has one of the lowest proportions of persons living in poverty on the Navajo Reservation. Other western Navajo chapters, beyond the local area of the mining operations, such as Bodaway, Cameron, Coalmine Mesa, and Coppermine, have high poverty rates. The local area beyond Page outside the Navajo Reservation is very rural and has elevated rates of poverty. The industries in Page are the employment base for the region. Any decline in employment at the station would carry with it income effects upon those households that are at or near the top of the income range in the local area.

Laughlin, Nevada, the location of the Mohave Generating Station, has few residents with incomes under the poverty level. A majority of the employees of the station live in the Kingman, Arizona, area while some live in Bullhead City, Arizona. Generally, there are not high proportions of poverty-level residents in Kingman and Bullhead City, but there are a few census tracts in each area with high rates of poverty. The population in poverty experienced minor indirect and induced economic impacts when the station shut down. The local area surrounding the station has few minority residents.

Much of the region of influence is designated as a medically underserved area. That designation indicates that the number of primary care physicians per thousand population is low, while the proportion of persons in poverty, the proportion of elderly persons, and the infant mortality rate are high. According to the formula, the designation is applied to the entire counties of Apache and Navajo, the low-income population in Mohave County and Bullhead City, the Kingman Indian Health Service Area in Mohave County, and the Tuba City Indian Health Service area in Coconino County.

The mining operations and generating stations would adhere to occupational health and safety regulations, including onsite health facilities. They are located in areas, however, where the access to health care is limited. When and if any of the mining operations or stations cease operations and, therefore, a health care resource is lost, there is a minor direct influence on the former employees and a minor indirect influence on the area.

4.24.2 Specific to the Black Mesa Complex

The cumulative effects of coal surface mining on the Black Mesa Complex under all alternatives would increase acreage reconstructed with gentler slopes, smoother rolling hills, and less dense drainage patterns. Reclamation operations implemented under the approved reclamation plan (refer to Appendix A-1) reduces the degree of impacts from mining operations. In addition, under all alternatives, surface mining would increase the amount of permanent subsurface disturbance that would impact the lateral continuity and groundwater flow conditions of water-bearing sedimentary formations. The existing geologic sedimentary rocks and structures would be changed permanently to the mined depth of approximately 250 feet at the base of the Wepo Formation.

Since the beginning of mining operations and through 2005, the Peabody's mining operations have removed 377 million tons of coal from mining areas within the Black Mesa Complex. Under Alternative A, the mining operations would remove 170 million tons from the Kayenta mining operation and 105 million tons, from the Black Mesa mining operation, through 2026. This represents a total of 652 million tons of coal removed from the Black Mesa Complex. The Kayenta mining operation has already disturbed 13,529 acres, and the Black Mesa mining operation has disturbed 6,965 acres—acres that have been or are being reclaimed for productive use. Under Alternative A, 8,062 acres and 5,467 acres, respectively, would be progressively disturbed and subsequently reclaimed for productive use. Under Alternatives B and C, the Kayenta mining operation would disturb the same amount of acreage, while the Black Mesa mining operation would not resume, so would not disturb any more acreage.

Past (1996-2005), proposed, and reasonably foreseeable mining of coal in the Black Mesa Complex would result in disturbance of 42,832 acres of native vegetation under Alternative A and B and 28,556 acres under Alternative C. Although the areal extent of impacted acreage would be greatest under Alternative A, the intensity of impact when reclamation operations are conducted under the approved reclamation plan would be the same under all alternatives. The cumulative effects of coal surface mining on the soil resources of Black Mesa can be characterized as beneficial to neutral. The project would result in conversion of woodlands to grassland on Black Mesa, but it is likely that these areas were historically

woodlands. The quality of rangeland and wildlife habitat on the mesa is expected to improve with reclamation of disturbed areas under all alternatives.

A Cumulative Hydrologic Impact Analysis (CHIA) is required by OSM. The objective of the CHIA is to determine material damage to the hydrologic balance for the cumulative mining effects in the impact area. Currently, the CHIA is being updated by OSM and the 1989 CHIA concluded that there was no significant cumulative impacts on surface water at Moenkopi or Dinnebito Washes, and no significant surface-water impacts.

As described in Section 4.4, neither the mining activities and monitoring data collected at the Black Mesa Complex since 1989 nor the proposed LOM activities have resulted in change in the overall conclusion of the 1989 CHIA. There are no other coal mining activities within the area. Given the lack of dependable year-round surface water, there are no other surface water uses that would result in a greater cumulative impact on surface water resources than that of the Black Mesa Complex.

4.24.3 Specific to the Project Water Supply

4.24.3.1 C Aquifer Water-Supply System

Under Alternative A, groundwater from the C aquifer would be pumped to supply water for the coal-slurry pipeline and for Kayenta and Black Mesa mining operations and reclamation. In addition, there is historic, present and future projected pumpage from the C aquifer by both tribal and nontribal users.

Past and current pumpage has been estimated by various entities (ADWR 1994; Hart et al. 2002; USDA 1981). Future nonproject-related C-aquifer pumpage was estimated in the Western Navajo and Hopi Water Supply Needs, Alternatives and Impacts Study (HDR 2003). These sources were reviewed and updated by Reclamation’s C-aquifer Technical Advisory Group (TAG) (Reclamation 2005). The C-aquifer groundwater demand (pumpage) estimates produced by the TAG are considered the most up-to-date estimates available and were adopted for this study.

Although there was some water use prior to 1950 it was small compared to the total water budget, and for modeling purposes was considered to be zero (SSPA 2005). Estimated total nonproject pumpage increased from 95,492 to 120,079 af/yr over the 61-year (2000-2060) projection period. Estimated groundwater pumpage from 1950 to 2000 (past) and 2001 to 2060 (future), by major use, is given in Table 4-52.

Table 4-52 Estimated Nonproject C-Aquifer Pumpage, 1950 to 2060, in af/yr

Use	1950-2000	2000-2060
Irrigation	0-23,148	23,148-18,200
Industrial	0-50,382	50,382-63,000
Municipal	0-21,963	21,693-38,879
Total	0-95,492	95,492-120,079

SOURCE: S.S. Papadopoulos and Associates 2005

As can be seen, pumpage in the C aquifer has grown significantly since the 1950s, with the largest single use being industrial. Over 90 percent of industrial use is comprised of four major facilities as shown in Table 4-53.

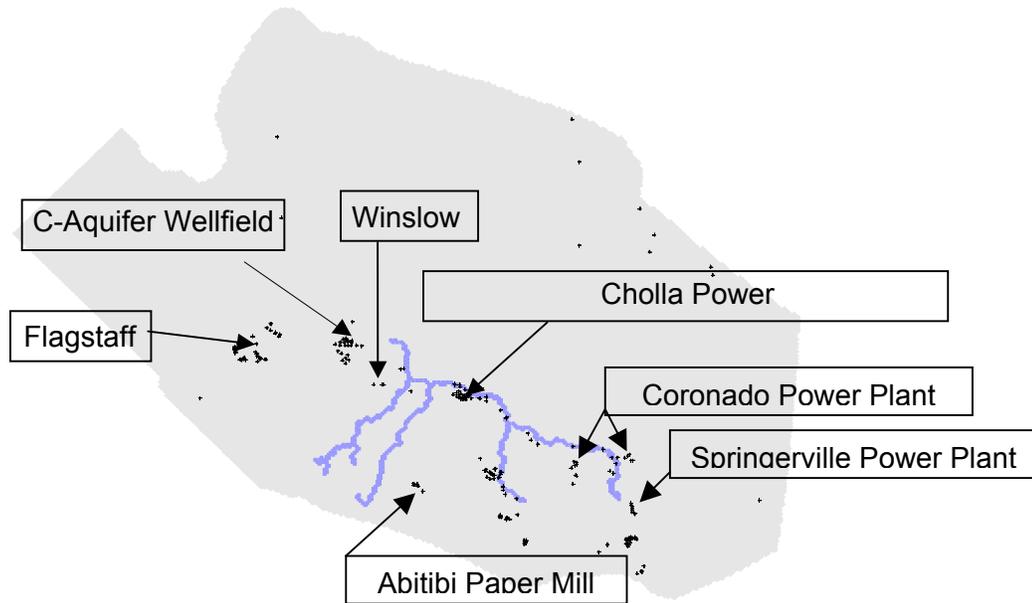
Table 4-53 Major Industrial Users

User	Estimated 2000 pumpage (acre-feet)
Cholla Power Plant	14,882
Coronado Power Plant	10,394
Springerville Power Plant	9,252
Abitibi Paper Mill	15,553

SOURCE: S.S. Papadopoulos and Associates 2005

Two of these facilities, the Cholla Power Plant and Abitibi Paper Mill, are located closest to the C-aquifer well field.

The TAG-estimated pumping rates were assigned to each of the nonproject pumping centers within the C-aquifer groundwater flow model to estimate the impact on aquifer water levels and streamflow depletion. As discussed in Appendix H, the SSPA and USGS models were used for assessment of impacts due to regional pumping. Location of pumping centers is shown on Figure 4-1.



SOURCE: S.S. Papadopoulos and Associates 2005

Figure 4-1 Pumping Centers

According to groundwater modeling, continued and increasing regional pumping of groundwater from the C aquifer is expected to cause widespread declines in groundwater elevations, especially near major pumping centers. In 2060 declines of 20 feet or more are predicted for areas near Silver Creek, along the Little Colorado River from Holbrook to Joseph City, and the upper Little Colorado River above St. Johns, while declines of 5 to 15 feet are predicted to occur in the area of lower Chevelon and Clear Creeks (SSPA 2005).

Model-predicted impact of nonproject and project pumping on stream base flow in lower Clear and Chevelon Creeks is shown in Figure 4-2 and Figure 4-3. Base flow in Lower Clear Creek is predicted to decline from about 4.2 cfs in 2000 to 3.2 cfs in 2060, or a decline of 1.0 cfs. The baseflow on lower Chevelon Creek declines from almost 3 cfs in 2000 to about 0.3 cfs in 2060, a reduction of more than

90 percent. The projected impact on lower Chevelon Creek base flow is due primarily to its proximity to the Cholla Power Plant/Holbrook/Agriculture pumping center (SSPA 2005).

The projected maximum impact on base flow due to project pumping is less than 3 percent of the impact due to nonproject pumpage. The impact on average annual streamflow is about 0.1 percent, as discussed in Section 4.4.1.4. Computer modeling indicates that although the proposed pumping of groundwater from the C aquifer for the project would have negligible effects on perennial reaches of lower Clear Creek and lower Chevelon Creek, cumulative impacts from other nonproject pumping will reduce base flows considerably. Base flow in Clear Creek is projected to decline by 20 to 25 percent between 2000 and 2060 (from 4.2 cfs to 3.2 cfs), and by about 90 percent in Chevelon Creek, from 3.0 cfs to 0.3cfs. These impacts are projected to result primarily from pumping for municipal, industrial, and agricultural uses in the vicinity of Holbrook and Joseph City (SSPA 2005).

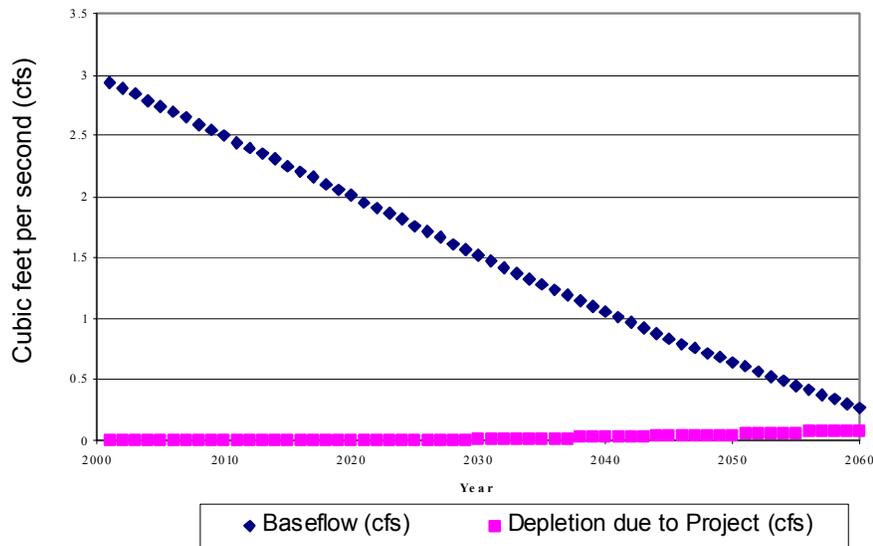


Figure 4-2 Lower Chevelon Creek Streamflow Depletion, 11,600 Acre-feet Per Year Project and Nonproject Pumpage

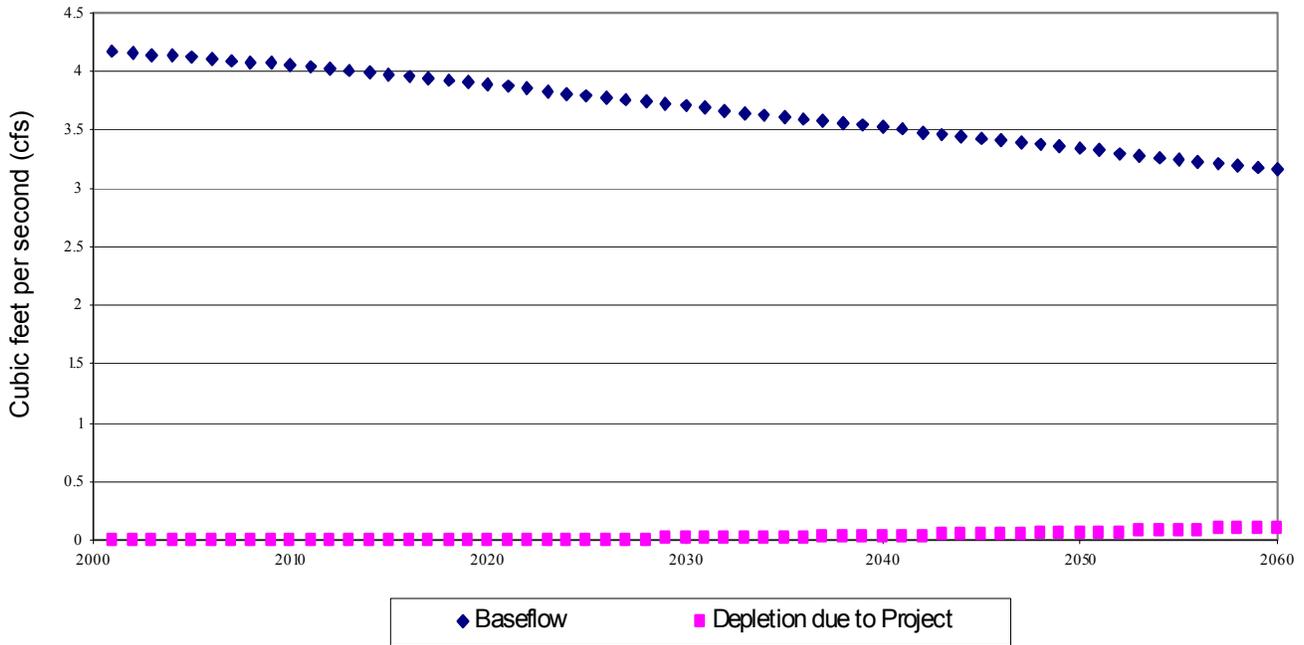


Figure 4-3 Lower Clear Creek Streamflow Depletion, 11,600 Acre-feet Per Year Project and Nonproject Pumpage

Increases in depth to groundwater beneath perennial stream segments would reduce the availability of water for riparian vegetation, making it more dependent on seasonal runoff. This is likely to cause decreases in the extent and density of riparian vegetation, where present in these stream segments. Native riparian cottonwood, willows, and other species are likely to be more adversely affected than tamarisk. Southwestern willow flycatchers could be affected by decrease in the extent, thinning of cover, and changes in composition in riparian vegetation, and by reductions in areas of surface water or saturated soils in breeding habitat.

Declines in groundwater elevations would result in reduced baseflow in streams occupied by the federally listed threatened Little Colorado spinedace and within areas designated as critical habitat. Diminution in baseflow would reduce or eliminate habitat for fish at a critical season, and surviving spinedace may be isolated in pools where they would be subject to increased competition and predation. Several other special-status fish species are similarly affected by cumulative loss of habitat and adverse interactions with introduced species, including the roundtail chub, Little Colorado sucker, and bluehead sucker.

The effect of nonproject pumping on water levels in the C-aquifer well field would be to increase the maximum drawdown from 58 to 68 feet, an increase of 10 feet. This increase in drawdown is due to the proximity of the nearest major pumping centers (Winslow, Cholla Power Plant, Holbrook and Joseph City agriculture) to the project well field (SSPA 2005). Modeling predicts that even with the additional drawdown from nonproject pumping, there would be a less than 10 percent reduction in aquifer thickness after 50 years.

4.24.3.2 N-Aquifer Water Supply

The agencies' preferred Alternative A assumes some continued use of N-aquifer water (average of 480 af/yr) for mine-related uses. The GeoTrans D- and N-aquifer groundwater flow model assessed the

impacts on aquifer water levels and discharge to streams and springs due to the Alternative A project uses as well as other nonproject (community) uses (GeoTrans 2006).

Municipal (community) and industrial (Peabody) N-aquifer annual usage from 1965 to 2003 as reported by the USGS is given in Table 4-54.

Table 4-54 Municipal and Industrial N-Aquifer Annual Usage from 1965-2003

Use	1965-2003 (af/yr)
Community	70 to 2,790
Peabody (started in 1968)	0 to 4,450
Total	70 to 7,240

SOURCE: U.S. Geological Survey 1985-2005

GeoTrans estimated the future community usage based on an assumed growth rate of 2.7 percent per year (GeoTrans 2005). On this basis, total community pumpage would increase from 2,790 acre-feet in 2003 to approximately 5,000 acre-feet in 2025.

As discussed in Section 4.4.1.5.2 and Table 4-54, modeling predicts that under Alternative A the water level in the closest community well (Forest Lakes NTUA #1) would rise by 94.8 feet in 2025. The rise due to reduced Peabody pumping is 109.3 feet; however, continued community pumping would result in a water-level decline (drawdown) between 2005 and 2025 of 14.4 feet at the Forest Lake NTUA Well #1. The predicted 2025 water level reflects drawdown that has occurred since mining began. Total water-level decline since 1955 (starting date in the model) through 2005 is estimated to be approximately 217 feet (GeoTrans 2006). Net decline in water level through 2025 is, therefore, estimated to be about 122 feet of which about 90 percent would be due to pre-2005 mine-related pumping. As noted above, Forest Lake NTUA #1 is the closest community well to the Peabody well field. Wells located farther from the well field would have less project-related drawdown and a lower percentage of total drawdown due to project pumpage. For example, Kykotsmovi PM 1 is predicted to have a total 2025 drawdown of 53 feet of which about 12 percent, or 7 feet, would be due to Peabody pumping (GeoTrans 2006; USGS 1985-2005).

Predicted 2025 reduction of groundwater discharge to streams is greatest at Begashibito Wash/Cow Springs (refer to Table 4-4), the closest point of stream/spring discharge to the Peabody well field (GeoTrans 2006). The total predicted 2005 to 2025 reduction in discharge is 15.6 af/yr, of which 13.6 af/yr is due to project pumping. Past mine-related pumpage is estimated to have reduced 2005 groundwater discharge at Begashibito Wash/Cow Springs by about 9 af/yr, for a total predicted project-related reduction of approximately 23 af/yr in 2025, a 1 percent reduction in premining groundwater discharge. As with wells, the further the point of discharge the less the reduction in discharge due to project pumping and the higher the percentage due to nonproject pumpage. For example at Pasture Canyon, near Tuba City, the predicted 2025 reduction in discharge is 96 af/yr, all of which is attributed to nonproject (community) pumping (GeoTrans 2006).

With the exception of Pasture Canyon, diminution in 2025 groundwater discharge from the N aquifer to streams/springs from all pumping (project and nonproject) is predicted to be less than 2 percent of the premining discharge. At Pasture Canyon the 2025 reduction is predicted to be 22 percent of the premining discharge, all of which would be attributed to community pumping. In all cases, stream/spring base flow diminution due to project pumping is less than 2 percent of premining groundwater discharge (GeoTrans 2006).

**CONSULTATION AND
COORDINATION**

5.0 CONSULTATION AND COORDINATION

5.1 INTRODUCTION

During the scoping process, and consultation and coordination throughout the preparation of this EIS, formal and informal efforts were made by the OSM to involve other Federal agencies, State and local governments, tribes, and the public. Consultation and coordination with Federal and intergovernmental agencies, organizations, American Indian tribes, and interested groups and individuals are important to (1) ensure that the most appropriate data have been gathered and employed for analyses and (2) ensure that agency and public sentiment and values are considered and incorporated into decision making.

The sections of this chapter describe the consultation and coordination efforts for this EIS including the formal consultation required, public participation activities, and public review of the Draft EIS.

5.2 CONSULTATION AND COORDINATION

Coordination and collaboration on the EIS were accomplished through written and telephone communication, meetings, and other cooperative efforts between OSM and interested Federal, State, and local government agencies, tribes, organizations, other interest groups, and the public.

5.2.1 Cooperating Agencies

As part of scoping, Federal, State, and local agencies, and American Indian tribes that may have an interest in the Black Mesa 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 American Indian 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, State, local, and tribal procedures; and (4) establishment of a mechanism for addressing intergovernmental issues.

In August 2004, OSM sent formal letters inviting 11 agencies to participate as cooperating agencies in the preparation of the Black Mesa Project EIS and received 9 positive responses. The Arizona State Land Department and the USACE, Los Angeles District, both responded to OSM that they would participate as reviewers of the EIS rather than as cooperating agencies in the preparation of the EIS. On November 15, 2005, the Hualapai Tribe requested cooperating agency status from OSM. OSM sent a formal letter acknowledging the Hualapai Tribe as a cooperating agency on November 30, 2005. The cooperating agencies include the following:

- Federal: Department of the Interior—Reclamation, BIA, BLM; USEPA; and Department of Agriculture—Forest Service.
- American Indian Tribes: Hopi Tribe, Hualapai Tribe, Navajo Nation.
- Local governments: City of Kingman, Mohave County.

The initial cooperating agencies' meeting was held on March 24, 2005 to discuss the status of the project, results of the scoping process, scope of the EIS, EIS and project schedules, future coordination, agency actions and decisions, alternatives to be considered and issues to be addressed in the EIS, and the criteria to be used to evaluate alternatives. On September 14, 2005, OSM met with the BLM in the Kingman Field Office to discuss the status of the project and, in particular, the 14-mile portion of the coal-slurry pipeline that crosses public land administered by BLM. Representatives of the Hualapai Tribe attended

the meeting. The cooperating agencies also held frequent (usually weekly) conference calls and met on May 17 and 18, 2006 to discuss the preliminary Draft EIS.

5.2.2 **Formal Consultation**

OSM and the cooperating agencies are required to prepare EISs in coordination with any studies or analyses required by the Fish and Wildlife Coordination Act (16 U.S.C. Sec 661 et seq. [16 U.S.C. 661]), Endangered Species Act of 1973 (16 U.S.C. Sec 1531 et seq. [16 U.S.C. 1531]), and the National Historic Preservation Act of 1966, as amended (16 U.S.C. Sec 470 et seq. [16 U.S.C. 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. Doing so would effectively facilitate the consultation processes. The following sections are summaries of the activities associated with the consultation processes to date for threatened and endangered species and cultural resources.

5.2.2.1 **Biological Resources**

In accordance with the Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq., formal consultation is required when the action agency (or agencies in this case) determines that the proposed action may affect a listed species or designated critical habitat. The consultation process determines whether the proposed action (1) is likely to jeopardize the continued existence of a listed species or destroy or adversely modify critical habitat; (2) begins with OSM’s written request and submittal of a completed biological assessment; and (3) concludes with the issuance of a biological opinion and incidental take statement from FWS.

In May 2005, URS Corporation (URS), on behalf of OSM, sent letters requesting lists of any federally listed, sensitive, endangered, and/or threatened species that may occur in the project area to the AGFD; BLM, Kingman Field Office; Forest Service, Kaibab National Forest; Hopi Tribe; Navajo Nation; Nevada National Heritage Program; FWS, Southern Nevada Field Office; and FWS, Arizona Ecological Services (a copy of the letter and list of recipients are in Appendix K). Responses and accompanying information received are summarized in Table 5-1.

**Table 5-1 Information Provided by Agency or Tribe
Regarding Listed Species in the Project Area**

Agency	Date of Response	Information Provided
AGFD	May 20, 2005	Special status species list
Forest Service, Kaibab National Forest	May 17, 2005	Forest Service sensitive species list
Navajo Nation	July 8, 2005	Endangered and sensitive species
Nevada National Heritage Program	July 17, 2005	Endangered, threatened, candidate and/or at risk plant and animal taxa
FWS, Southern Nevada Field Office	May 23, 2005	Federally listed species list
FWS, Arizona Ecological Services (courtesy copy to the Flagstaff field office)	July 12, 2005	Federally listed species list

Considerable efforts have been made by all participants to determine major issues and concerns and potential effects the project may have on federally listed species. At the suggestion of the cooperating agencies, a Biological Resources Subcommittee was formed soon after the cooperating agency meeting on March 24, 2005 to facilitate this process. The Biological Resources Subcommittee consists of representatives from OSM, BIA, BLM, Reclamation, USEPA, FWS, AGFD, Hopi Tribe, and Navajo Nation. The project applicants also participated in the Biological Resources Subcommittee. To date,

informal consultation has been ongoing. This process has helped (1) identify which species and habitats may be in the action area, (2) determine the effects the project action may have on listed species, (3) discuss ways the effects can be eliminated or reduced through project action modification, (4) discuss the need to enter into formal consultation, and (5) discuss ways the project action can help in the conservation of selected listed species. To date, several meetings of varied members of the Biological Resources Subcommittee have been held. Table 5-2 provides a summary of these meetings.

Table 5-2 Summary of Meetings Related to Federally Listed Species on the Black Mesa Project

Agency/Organization	Date	Topics Discussed
FWS, Reclamation, and URS (on behalf of OSM)	June 24, 2005	Initial organization of the Biological Resources Subcommittee.
OSM, FWS, Reclamation, BIA, AGFD, Hopi Tribe, Navajo Nation, Peabody, SCE, BMPI, and URS	July 26, 2005	Status of the project including biological resources studies, and coordination with the participants regarding the multi-agency Consultation Agreement.
OSM, Reclamation, BIA, Hopi Tribe, Navajo Nation, FWS, AGFD, SCE, SRP, and URS	September 21, 2005	Results of the groundwater and streamflow modeling, and potential impacts on native fish due to baseflow reductions of water as a result of pumping water from the C aquifer.
OSM, Reclamation, BIA, Hopi Tribe, Navajo Nation, AGFD, SCE, Salt River Project (SRP), and URS	September 27, 2005	Initial discussion about potential conservation opportunities for threatened and endangered species that may be affected by pumping water from the C aquifer.
OSM, Reclamation, BIA, Hopi Tribe, Navajo Nation, SCE, SRP, and URS	September 29, 2005	Status of the species analyses, status and schedule of the Biological Assessment, and further discussion on conservation opportunities for species potentially affected by C aquifer pumping (Little Colorado River spinedace, roundtail chub, and Chiricahua leopard frog).
OSM, FWS, Reclamation, BIA, AGFD, Hopi Tribe, Navajo Nation, SCE, SRP, and URS	December 14, 2005	Provide background on project and potential impacts, review current list of conservation measures developed, and discuss other potential conservation measures that may be implemented to offset project related impacts to special status fish species.
OSM, FWS, Reclamation, BIA, AGFD, Forest Service, Hopi Tribe, Navajo Nation, SCE, SRP, and URS	January 18 and 19, 2006	Provide background on project and potential impacts, review potential conservation measures for special status fish species on the Apache-Sitgreaves and Coconino National Forests, and obtain Forest Service input on proposed conservation measures and Forest Service process for implementing these measures.
OSM, FWS, Reclamation, BIA, AGFD, Forest Service, Hopi Tribe, Navajo Nation, SCE, SRP, and URS	February 8, 2006	Prioritize conservation measures that have been previously identified to assist the project proponents in identifying a proposal for consideration in the Biological Assessment and EIS.
FWS, Reclamation, BIA, AGFD, SCE, SRP, and URS	February 21, 2006	Review additional information provided by meeting participants on refining the short list of potential projects ranked at the last meeting. Add as much detail as possible to the proposed projects.

Agency/Organization	Date	Topics Discussed
OSM, FWS, Reclamation, BIA, ADWR, USDI/PPA, Forest Service, Hopi Tribe, Navajo Nation, SCE, SRP, and URS	May 17, 2006	Review previous considerations and recommendations. Review new facts and recommendations for proposed capital conservation projects (as described in the East Clear Creek Watershed Health Improvement Environmental Assessment) to offset impacts on listed native fish species.
OSM, FWS, BIA, Navajo Nation, SRP, and URS	October 18, 2006	Review agency comments on the draft Biological Assessment.

A Consultation Agreement was developed to outline the consultation process and products, actions, and schedule for the consultation under Section 7 of the ESA. The Consultation Participants are OSM, BIA, BLM, Forest Service, USEPA, and FWS. The Hopi Tribe, Navajo Nation, SRP (the Mohave Generating Station co-owners were represented previously by SCE), Peabody, and BMPI are participating through BIA and OSM as applicants. OSM distributed the Consultation Agreement to the Consultation Participants for signature on November 3, 2005. All signatures were obtained by October 3, 2006.

All data collected from the Federal agencies, the tribes, and State and local government agencies, as described in Table 5-1, have been incorporated into this EIS and the Biological Assessment.

In addition to the Biological Assessment, a Biological Evaluation has been prepared and submitted to (1) the Forest Service to address Forest Service sensitive and indicator species and migratory bird species and (2) the Navajo Nation to address Navajo Nation sensitive species.

5.2.2.2 Cultural Resources

Section 106 of the NHPA requires OSM 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 CFR 800) implement Section 106 and define a process for Federal agencies to use in consulting SHPOs, THPOs, and other interested parties as they assess the effects of their undertakings. Pursuant to those regulations, OSM initiated Section 106 consultations with the Navajo THPO and the Arizona and Nevada SHPOs in May 2005 (a copy of the letter and list of recipients are in Appendix K). Those consultations are ongoing, and will continue during post-EIS phases of project implementation.

OSM has coordinated closely with the Hopi Tribe and Navajo Nation about various aspects of the project, including potential impacts on cultural resources. The HCPO and the Navajo Nation Archaeology Department were retained to conduct inventories of archaeological and historical sites on their respective reservations, as well as studies of traditional cultural resources of significance to their respective communities. On May 20, 2005, OSM sent letters to 11 other tribes to provide them information about the project area and to ask if they wanted to participate in the Section 106 consultations (a copy of the letter and list of recipients are in Appendix K). The Hualapai Tribe indicated they not only wanted to participate in the Section 106 consultations, but also wanted to serve as a cooperating agency in the preparation of the EIS. Because of their concerns, the Hualapai Tribe Department of Cultural Resources was retained to inventory and assess effects on traditional Hualapai cultural resources. The Chemehuevi Tribe, Colorado River Indian Tribes, Havasupai Tribe, and Fort Mojave Tribe indicated they wanted to participate in the Section 106 consultations. The San Juan Southern Paiute Tribe has not decided but indicated they wanted to continue to receive information about the project. The Zuni Tribe also indicated

they wanted to continue to receive information about the project, but would defer to the Hopi Tribe and Navajo Nation regarding treatment of cultural resources and may opt to not participate in a Section 106 agreement. The Pahrump Paiute Tribe has not yet indicated if they want to participate. The Yavapai-Apache Nation, Yavapai-Prescott Indian Tribe, and Las Vegas Paiute Tribe indicated they have no concerns about the project and did not want to participate in the consultations.

Informational meetings were held on June 30, 2005 with representatives of the Navajo Nation; on July 1, 2005 with the Hopi Tribe; and on October 17, 2005 with the Hualapai Tribe to provide further information and discuss future coordination.

A Cultural Resources Subcommittee, with representatives of the lead and cooperating agencies, other involved Federal and State agencies, and project proponents was organized to coordinate compliance with Section 106, and other laws, regulations, and ordinances protecting cultural resources. The subcommittee members reviewed the cultural resources study plan and technical reports. A Cultural Resources Subcommittee meeting was held on January 10, 2006 to discuss the results of the cultural resources inventory and development of a Section 106 Programmatic Agreement.

On May 8, 2006, OSM sent a letter to the Hopi Tribe, Hualapai Tribe, and Navajo Nation requesting a government-to-government consultation meeting with each tribe. A meeting with the Hualapai Tribe was held on May 17, 2006 and with the Hopi Tribe on June 23, 2006.

5.3 PUBLIC PARTICIPATION

The public participation process for the EIS has been ongoing throughout the development of the EIS and will continue to the Record of Decision. In addition to formal public participation activities, informal contacts occur frequently with public land users, industry, and interested persons through meetings, field trips, telephone calls, electronic mail, and/or letters.

As required, OSM, in coordination with the cooperating agencies, conducted scoping in the early stages of preparing the EIS to encourage public participation and solicit public comments on the scope and significance of the proposed action (CEQ regulations, 40 CFR 1501.7). OSM initiated the scoping process in January 2005 by requesting comments to determine the scope of issues and concerns that need to be considered during the analyses conducted for the EIS.

5.3.1 Notice of Intent

OSM's Federal Register Notice of Intent, published on December 1, 2004 (Volume 69 Federal Register Pages 69949-69951 [69 FR 69949-69951]), marked the beginning of the scoping period for the Black Mesa Project EIS. The scoping period, required to be a minimum of 30 days, was announced as ending on January 21, 2005. OSM solicited comments from relevant agencies and the public and held eight scoping meetings in January 2005. At the request of the public, OSM extended the scoping period and held two additional scoping meetings in Forest Lake, Arizona, in February 2005. A second notice was published in the Federal Register on February 4, 2005 (70 FR 6036), announcing the additional meetings and the extension of the scoping period to March 4, 2005. Copies of the Federal Register notices are in Appendix L.

5.3.2 Newspaper and Radio Announcements

In December 2004 and February 2005, OSM issued news releases to local and regional newspapers to announce the project and to inform the public of the scoping meeting times and locations. The news releases were sent to The Navajo Times, Hopi Tutuveni, The Navajo-Hopi Observer, Arizona Daily Sun,

Gallup Independent, Mohave Valley Daily News, The Laughlin Nevada Times, Bullhead City Bee, The Kingman Daily Miner, The Winslow Mail, and Holbrook Tribune.

OSM also used paid radio announcements and newspaper advertisements to introduce the project and announce the times and locations of the scoping meetings. The radio announcements were aired in December 2004 and in January and February 2005; the newspaper advertisements were published in December 2004 and February 2005.

The paid radio announcements were aired on KUYI Hopi Radio 88.1 FM and on KTNN Radio AM 660 (Navajo Nation). The announcements on KUYI were made in Hopi followed by English twice a day on December 31, 2004, and on February 12, 14, and 16, 2005. The announcements on KTNN were made in Navajo followed by English twice a day on five consecutive days, December 29, 2004, through January 2, 2005; and on February 12, 14, and 16, 2005.

Table 5-3 lists the newspapers and the date of each paid advertisement.

Table 5-3 Newspapers and Dates of Publications

Publication	Date(s)
The Navajo Times	Thursday, December 16 and 23, 2004, and February 3, 2005
Hopi Tutuveni	Thursday, December 16, 2004 and Wednesday, February 2, 2005
The Navajo-Hopi Observer	Wednesday, December 15 and 22, 2004 and Thursday, February 3, 2005
Arizona Daily Sun	Wednesday, December 15 and 22, 2004
Gallup Independent	Wednesday, December 15 and 22, 2004
Mohave Valley Daily News	Wednesday, December 22 and 29, 2004
The Laughlin Nevada Times	Wednesday, December 22 and 29, 2004
Bullhead City Bee	Friday, December 24 and 31, 2004
The Kingman Daily Miner	Wednesday, December 22 and 29, 2004

5.3.3 Additional Public Notice

OSM created bulletin-board flyers to announce the scoping meetings and sent the flyers to the Hopi Office of Mining and Mineral Resources and the Navajo Minerals Department with the request that the flyers be posted in public places such as tribal offices, chapter houses, and grocery stores.

In addition, OSM developed a project Web site (<http://www.wrcc.osmre.gov/WR/BlackMesaEIS.htm>) for the Black Mesa Project. Information on the Web site includes public meeting announcements; descriptions of the project, EIS planning process, and the proposed project area; Black Mesa Project Scoping Summary Report; and transcripts of the public scoping meetings.

A project newsletter update was sent in September 2005 to all members of the public who chose to be on the project mailing list as well as project team members and other interested parties. The newsletter provided a summary of the project, including the steps of the EIS process and what would be happening next in the project. In addition, a summary of issues heard during scoping was included in the newsletter. Contact information for OSM was provided to allow interested parties to ask questions or request additional information.

Two more newsletters were sent in July and September 2006. The former newsletter notified the persons on the mail list that on June 19, 2006, SCE, majority owner of Mohave Generating Station, announced it

would not continue to pursue resumed operation of the power plant. Due to uncertainty about the future of the Black Mesa Project, OSM stated that it had suspended activities to publish the Draft EIS. The latter newsletter notified persons on the mailing list that OSM had resumed work on the EIS because SRP, a minority owner of the power plant, had requested OSM to do so because it was still assessing the situation and might reopen the power plant if it found additional partners.

5.4 PUBLIC SCOPING MEETINGS

OSM hosted 10 public scoping meetings, with a total of more than 720 in attendance, within a period that extended from January 3, 2005, through February 19, 2005. Attendance is shown in Table 5-4.

Table 5-4 Public Scoping Meeting Dates, Locations, Attendance, and Number of Speakers

Meeting Date	Meeting Location	Attendance	Number of Speakers
January 3, 2005	St. Michaels, Arizona	41	9
January 4, 2005	Forest Lake, Arizona	55+	25
January 4, 2005	Kayenta, Arizona	106	22
January 5, 2005	Kykotsmovi, Arizona	119	34
January 6, 2005	Leupp, Arizona	120	29
January 12, 2005	Kingman, Arizona	35	14
January 12, 2005	Laughlin, Nevada	38	20
January 13, 2005	Flagstaff, Arizona	130+	53
February 18, 2005	Forest Lake, Arizona	44	13
February 19, 2005	Forest Lake, Arizona	38	18
TOTAL		726+	237

Each of the 10 meetings began with a presentation of the project by OSM, followed by oral presentations by members of the public wanting to comment on the Black Mesa Project and the EIS process. Two project maps and a flow chart of the EIS process were displayed at each of the meetings.

A project fact sheet, comment forms, speaker cards, and mailing list cards were made available to the public at each scoping meeting. A Navajo interpreter was available at the meetings in St. Michaels, Forest Lake, Kayenta, Kykotsmovi, Leupp, and Flagstaff to translate oral comments. A court reporter was present at each meeting and the meeting transcripts became part of the official record.

Comment forms were provided to enable individual members of the public and agency representatives to (1) express interest in being added to the project mailing list; (2) provide comments regarding issues or concerns that they deem to be significant and that they feel should be addressed in the EIS, and why; (3) provide suggestions regarding reasonable changes and/or additions to the proposed project that they feel should be made to reduce the environmental impacts (including mitigation measures not in the proposal that they feel should be carried out) and why; and (4) submit any other comments or questions regarding the overall project. OSM invited participants to submit comments in formats other than the comment forms, such as letters, facsimiles, and electronic mail messages submitted to OSM.

5.4.1 Comments Received During Scoping

Comments received during the scoping period were analyzed and documented in the Black Mesa Project Scoping Summary Report issued in April 2005. By the end of the scoping comment period, OSM had received 351 written or electronically mailed submissions and 237 statements made by speakers at public meetings. In addition to these, more than 2,000 form letters regarding the LOM revision were received. Specific environmental issues and where they are addressed in this Draft EIS are listed in Table 1-1.

5.4.2 Review of the Draft EIS

This Draft EIS will be distributed for review to the agencies, organizations, and individuals listed in Section 5.5. Also, to promote an understanding of the project among Hopi and Navajo native-language speakers, an audio-visual version of the Executive Summary in English, Hopi, and Navajo languages has been produced on DVD for distribution to libraries and other public offices, Hopi villages, and Navajo Chapter houses.

Comments on the Draft EIS may be submitted orally or in writing at the scheduled public meetings or in writing by letter or electronic mail to OSM (as instructed in the letter to readers at the beginning of this document). To ensure consideration in the Final EIS, all written comments must be received by the date and time announced by OSM in the Federal Register. The public meetings will be held on the Hopi, Hualapai, and Navajo Indian Reservations; in Mohave, Navajo, and Coconino Counties, Arizona; and in Clark County, Nevada. Dates and addresses of these meetings will be announced in the Federal Register, advertised in the local news media, and listed on the OSM Website: www.wrcc.osmre.gov/WR/BlackMesaEIS.htm. During the meetings, information will be displayed to explain the environmental process and the document. Oral comments will be transcribed for consideration in the Final EIS. Native language translators will be available at meetings on the Reservations.

5.5 DISTRIBUTION AND REVIEW OF THE DRAFT EIS

The following agencies, organizations, and individuals were notified that the Draft EIS will be available in paper copy, on compact disk (CD), and on the project web site. Some have requested and will receive a copy of the Draft EIS for review and comment. The Final EIS will be sent to those who request a copy or provide comments on the Draft EIS.

FEDERAL

Department of Agriculture

Forest Service, Kaibab National Forest, Williams,
Arizona
Soil Conservation Service, Phoenix, Arizona

Department of the Army

U.S. Army Corps of Engineers, Los Angeles District,
Regulatory Branch, Arizona Section, Tucson,
Arizona

Department of the Interior

Bureau of Indian Affairs
Trust Services, Washington, DC
Navajo Regional Office, Gallup, New Mexico
Navajo Regional Forester's Office, Ft. Defiance,
Arizona
Western Regional Office, Phoenix, Arizona
Hopi Agency
Environmental Services, Reston, Virginia
Bureau of Land Management
Washington, DC Office
Arizona State Office, Phoenix, Arizona
Kingman Field Office, Kingman, Arizona
Bureau of Reclamation
Washington, DC Office
Phoenix Regional Office, Arizona
Denver, Colorado Office
Minerals Management Service
National Park Service

Natural Resources Library
Office of Environmental Policy and Compliance
Headquarters, Washington, DC
Denver Region, Denver, Colorado
Office of Policy Analysis, Washington, DC
Office of the Solicitor
Rocky Mountain Region, Lakewood, Colorado
Office of Surface Mining
Headquarters, Washington, DC
Western Regional Coordinating Center, Denver,
Colorado
U.S. Fish and Wildlife Service
Southwest Region 2, Albuquerque, New Mexico
Arizona Ecological Services Field Office,
Phoenix, Arizona
Flagstaff Sub-Office, Flagstaff, Arizona
Division of Environmental Quality, Arlington,
Virginia
U.S. Geological Survey
Flagstaff, Arizona Office
Reston, Virginia Office

U.S. Environmental Protection Agency

Washington, DC
Region 9, San Francisco, California

Federal Legislators

Senator John McCain
Senator Jon Kyle

Congressman Richard Renzi
Congressman Trent Franks

STATE

State of Arizona

Governor Janet Napolitano
Arizona Department of Environmental Quality
Arizona Economic Development Division
Arizona Game and Fish Department
Arizona Department of Health Services
Arizona Department of Mines and Mineral Resources
Arizona Department of Transportation
Arizona Department of Water Resources
Arizona Soil Conservation State Office
Arizona State Historic Preservation Officer
Arizona State Land Department
Arizona Department of Public Safety
Arizona State Parks

State Legislators

Representative Tom Boone, District 4
Representative Jack Brown, District 5
Representative Judy Burges, District 4
Representative Trish Groe, District 3
Representative Ann Kirkpatrick, District 2
Representative Albert Tom, District 2
Representative Bill Konopnicki, District 5
Representative Lucy Mason, District 1
Representative Nancy McLain, District 3
Representative Tom O'Halleran, District 1
Senator Albert Hale, District 2
Senator Jake Flake, District 5
Senator Ken Bennett, District 1
Senator Ron Gould, District 3

State of Nevada

Nevada State Clearinghouse

Tribal Governments

The Hopi Tribe, Kykotsmovi, Arizona
Chairman, The Hopi Tribe
Cultural Preservation Office
Department of Natural Resources
Environmental Protection Office
Office of Mining and Mineral Resources
Office of Realty Services
Hopi Villages
Upper Moenkopi Village
Lower Moenkopi Village
Village of Bacavi
Village of Hotevilla
Kykotsmovi Village
Sipaulovi Village
Mishongnovi Village
Shungopovi Village

First Mesa Consolidated Villages
(Tewa, Walpi, Sichomovi)
Ywehloopahki (Spider Mound Village)
Outside council – Arnold and Porter, Denver,
Colorado
The Navajo Nation, Window Rock, Arizona
President, Navajo Nation
Department of Justice
Minerals Department, Surface Mining Program
Environmental Protection Agency
Water Resources Department, Fort Defiance,
Arizona
Navajo Chapters
Alamo Chapter
Aneth Chapter
Baca/Prewitt Chapter
Becenti Chapter
Beclabito Chapter
Birdsprings Chapter
Black Mesa Chapter
Blue Gap/Tachee Chapter
Bodaway-Gap Chapter
Breadsprings Chapter
Burnham Chapter
Cameron Chapter
Casamero Lake Chapter
Chichiltah Chapter
Chilchinbeto Chapter
Chinle Chapter
Churchrock Chapter
Coalmine Canyon Chapter
Coppermine Chapter
Cornfields Chapter
Counselor Chapter
Cove Chapter
Coyote Canyon Chapter
Crownpoint Chapter
Crystal Chapter
Dennehotso Chapter
Dilkon Chapter
Forest Lake Chapter
Fort Defiance Chapter
Gadii ahi (Cudeii) Chapter
Ganado Chapter
Greasewood Springs Chapter
Hardrock Chapter
Hogback Chapter
Houck Chapter
Huerfano Chapter
Indian Wells Chapter
Inscription House Chapter
Iyanbito Chapter
Jeddito Chapter
Kaibeto Chapter
Kayenta Chapter

Kinlichee Chapter
 Klagetoh Chapter
 Lake Valley Chapter
 LeChee Chapter
 Leupp Chapter
 Little Water Chapter
 Low Mountain Chapter
 Lukachukai Chapter
 Lupton Chapter
 Manuelito Chapter
 Mariano Lake Chapter
 Mexican Springs Chapter
 Mexican Water Chapter
 Nageezi Chapter
 Nahata Dzill Chapter
 Nahodishgish Chapter
 Naschitti Chapter
 Navajo Mountain Chapter
 Nazlini Chapter
 Nenahnezad Chapter
 Newcomb Chapter
 Oak Springs Chapter
 Ojo Encino Chapter
 Oljato Chapter
 Pinedale Chapter
 Piñon Chapter
 Pueblo Pintado Chapter
 Ramah Chapter
 Red Lake #18 Chapter
 Red Mesa Chapter
 Red Rock Chapter
 Red Valley Chapter
 Rock Point Chapter
 Rock Springs Chapter
 Rough Rock Chapter
 Round Rock Chapter
 San Juan Chapter
 Sanostee Chapter
 Sawmill Chapter
 Sheepsprings Chapter
 Shiprock Chapter
 Shonto Chapter
 Smith Lake Chapter
 St. Michael Chapter
 Standing Rock Chapter
 Steamboat Chapter
 Sweetwater Chapter
 Tecnospos Chapter
 Teesto Chapter
 Thoreau Chapter
 Toadlena/Two Grey Hills Chapter
 Toh Nanees Dizi Chapter
 Tohajiilee Chapter
 Tohatchi Chapter
 Tolani Lake Chapter

Tonalea Chapter
 Torreon Chapter
 Tsaille/Wheatfields Chapter
 Tsayatoh Chapter
 Tselani/Cottonwood Chapter
 Tuba City Chapter
 Twin Lakes Chapter
 Upper Fruitland Chapter
 Whippoorwill Chapter
 Whitecone Chapter
 Whitehorse Lake Chapter
 Whiterock Chapter
 Wide Ruins Chapter

Zuni Tribe, Governor Arlen Quetawki
 Hualapai Tribe, Peach Springs, Arizona
 San Juan Southern Paiute Tribe, Tuba City, Arizona
 Pahrump Paiute Tribe, Pahrump, Nevada

Local Governments

Clark County, Nevada, Board of Supervisors
 Coconino County, Arizona, Board of Supervisors
 Mohave County, Arizona, Board of Supervisors
 Mohave County, Arizona, County Manager's Office
 Navajo County, Arizona, Board of Supervisors
 San Bernardino County, California, Board of Supervisors
 Yavapai County, Arizona, Board of Supervisors
 Development and Community Services,
 Apache County, Arizona
 City of Bullhead City, Arizona, City Manager Tim Ernster
 City of Flagstaff, Arizona, Mayor Joseph Donaldson
 City of Holbrook, Arizona, Mayor Brian Smithson
 City of Kingman, Arizona, Mayor Lester Byram
 City of Williams, Arizona, City Manager Dennis Wells
 City of Winslow, Arizona, Mayor Allen Affeldt
 Town of Laughlin, Town Manager Jackie Brady

Project Applicants

Peabody Western Coal Company
 Salt River Project
 Black Mesa Pipeline, Inc.

Private Corporations/Organizations

Southern California Edison Company
 Northern Arizona University, Flagstaff, Arizona
 University of California, Berkeley, California
 Laughlin Community College, Laughlin, Nevada
 United Mine Workers Association, Kayenta, Arizona
 InterTribal Council of Arizona
 Sierra Club, Flagstaff, Arizona
 Western Navajo Farm Board, Tuba City, Arizona
 Moyes Storey Law Offices, Phoenix, Arizona
 Navajo-Hopi Services, Flagstaff, Arizona
 Federal Laboratory for Technology, Prescott, Arizona
 Hopi Black Mesa Trust, Polacca, Arizona

Honor the Earth, Minneapolis, Minnesota
 Natural Resources Defense Council, Santa Monica, California
 Brown & Brown Law Offices, Pinetop, Arizona
 Western States Alliance, Golden Valley, Arizona
 Black Mesa RV Board, Leupp, Arizona
 Utility Workers Union of America, Kingman, Arizona
 John Franklin Squibb Enterprises, Needles, California
 Black Mesa Water Coalition, Flagstaff, Arizona
 Coal River Mountain Watch, Whitesville, West Virginia
 People of Black Mesa, Kayenta, Arizona
 Black Mesa Trust, Flagstaff, Arizona
 Ethnobotanical Research Association, Flagstaff, Arizona
 Kayenta Family Health Care, Kayenta, Arizona
 Arizona Water Group, Flagstaff, Arizona
 Southeastern Native American Alliance West, Long Beach, California
 Bluewater Network, San Francisco, California
 Fullerton College, Whittier, California
 Voice of the People, Hotevilla, Arizona
 Mohave County Public Land Use Committee, Kingman, Arizona
 ResVet' Mobile Services, Polacca, Arizona
 Navajo Tribal Utility Authority, Fort Defiance, Arizona
 Biome, Ecological & Wildlife Research, Flagstaff, Arizona
 ERO Resources Corporation, Denver, Colorado
 Intrinsic, Flagstaff, Arizona

Individuals

Adam Fromhoff, Flagstaff, Arizona
 Alexander Osif, Kayenta, Arizona
 Allen Martin, Page, Arizona
 Amanda Johnson, Flagstaff, Arizona
 Andrea Hartley, Flagstaff, Arizona
 Andrew Lewis, Polacca, Arizona
 Anna Rondon, Gallup, New Mexico
 Anne-claire Wilton, Kykotsmovi, Arizona
 Annie Herrera, Kayenta, Arizona
 Arnold Luna, Kayenta, Arizona
 Ben Hoisington, Fort Defiance, Arizona
 Betsy Mahoney, Spearfish, South Dakota
 Beve Beath, Kayenta, Arizona
 Billy Arizona, Tuba City, Arizona
 Bilta Begay, Kayenta, Arizona
 Brenna Two Bears, Flagstaff, Arizona
 Britta Jebens, Hamburg, Arizona
 Bucky Preston, Polacca, Arizona
 C. Jason Arnold, Kingman, Arizona
 Calvin Kescoli, Kayenta, Arizona
 Carl Wood, Cherry Valley, California
 Carla Ann Jishie, Piñon, Arizona
 Carolyn Johnson, Denver, Colorado

Charles Freteluco, Kingman, Arizona
 Chris Bailey, Kayenta, Arizona
 Clarissa Barnes, Dickson, Tennessee
 Clayson Benally, Flagstaff, Arizona
 Crystal Lechino, Flagstaff, Arizona
 Dan and Lorriane Herder, Kykotsmovi, Arizona
 Daniel Peaches, Kayenta, Arizona
 David Yazzie, Kayenta, Arizona
 Dawn Kish, Flagstaff, Arizona
 Debra and Richard Csenge, Topsham, Maine
 Delores Greyeyes, Kayenta, Arizona
 Denise Gresh, Milton, Pennsylvania
 Dorothy and Ken Lamm, Flagstaff, Arizona
 Ed Seaton, Kayenta, Arizona
 Elsie Benally, Kayenta, Arizona
 Elwood Saganey, Kayenta, Arizona
 Esther Lake, Kayenta, Arizona
 Faith Wilcox, Westport, Maine
 Fern Benally, Shonto, Arizona
 Francis Billy Tsosie, Kayenta, Arizona
 Francis Tso, Flagstaff, Arizona
 Fred Dexter, Boulder City, Nevada
 Garret Rosenblatt, Flagstaff, Arizona
 Gary Killen, Bullhead City, Arizona
 Gilbert Dayzie, Shiprock, New Mexico
 Glen Manygoats, Flagstaff, Arizona
 Glenn Roehl, Bullhead City, Arizona
 Glenna C. Begay, Forest Lake, Arizona
 Gregory Hill, Winterhaven, California
 Gregory Schultz, Laughlin, Nevada
 Harry Yazzie, Tuba City, Arizona
 Helena Begay, Forest Lake, Arizona
 Henry Yazzie, Chinle, Arizona
 Herb and Rose Yazzie, Kayenta, Arizona
 Howard Todecheene, Kayenta, Arizona
 Jacobo Marcus, Flagstaff, Arizona
 Jacobo Marcus, Kykotsmovi, Arizona
 Janet Behrens, Laughlin, Nevada
 Jeanette Chee, Leupp, Arizona
 Jeremiah Kerley, Cameron, Arizona
 Jesse Lewis, Laughlin, Nevada
 Jessica Fisher, Flagstaff, Arizona
 Jim Panik, Laughlin, Nevada
 Jim Schlenvogt, Flagstaff, Arizona
 Jim Thompson, Kingman, Arizona
 Joanne Finch, Munds Park, Arizona
 Joe Holgate, Shonto, Arizona
 John Ford, Dolan Springs, Arizona
 John Neville, Sedona, Arizona
 Julia Bonds, Rock Creek, West Virginia
 Karene Bennett, Sedona, Arizona
 Kee Herbert Begay, Kayenta, Arizona
 Kee Nez, Piñon, Arizona
 Ken Batte, St. Michaels, Arizona
 Kent Walker, Leupp, Arizona

Kia Mudge, Polacca, Arizona
Kim Dougherty, Dickson, Tennessee
Kimberly Horner, Flagstaff, Arizona
Kitty Farmer, Santa Fe, New Mexico
Kristin Huisinga, Flagstaff, Arizona
Larry Nockidinah, Tuba City, Arizona
Larry Wood, Flagstaff, Arizona
Laura Chee, Leupp, Arizona
Lee Nez, Tuba City, Arizona
Lena Smith, Shonto, Arizona
Leonard Bailey, Kayenta, Arizona
Leonard Selestewa, Flagstaff, Arizona
Leonard Talaswana, Second Mesa, Arizona
Leroy Kewanimpteur, Hotevilla, Arizona
Leta Tsosie Williams, Kayenta, Arizona
Linda Willie, Leupp, Arizona
Lisa Pascopella, Berkeley, California
Lisa Rayner, Flagstaff, Arizona
Lorraine Flood, Leupp, Arizona
Lorraine Katenay, Tuba City, Arizona
Louis Cerny, Gaithersburg, Maryland
Louise McCabe, Leupp, Arizona
Lucinda Wilson, Window Rock, Arizona
Lucretia Black, Leupp, Arizona
Lucy Tabaha, St. Michaels, Arizona
Mae Pulinos, Kayenta, Arizona
Marie Douglas, Chino Valley, Arizona
Marie Justice, Page, Arizona
Marilyn Chischillie, Page, Arizona
Marilyn Michael, Phoenix, Arizona
Marilyn Tewa, Second Mesa, Arizona
Martha Young, Kayenta, Arizona
Marty Bronston, Kayenta, Arizona
Marvin Van Houten, Flagstaff, Arizona
Mary Croft, Casa Grande, Arizona
Mary Helgeson, Snowflake, Arizona
Mike Hindriksen, Laughlin, Nevada
Milton and Lillie Johnson, Kayenta, Arizona
Milton Lake, Kayenta, Arizona
Mitch Smith, Fort Mohave, Arizona
Nicole Horseherder, Kykotsmovi, Arizona
Norman and Daniel Benally, Kayenta, Arizona
Oscar Doctor, Leupp, Arizona
Pam Powell, Flagstaff, Arizona
Paul Carlson, Laughlin, Nevada
Paul Clark, Kayenta, Arizona
Paul Moss, White Bear Lake, Minnesota
Peter Jeschke, Montecito, California
Randy Livinggood, Bullhead City, Arizona
Raymond Yellowman, Tuba City, Arizona
Regina Lane, Page, Arizona
Renate Domnick, Hamburg, Arizona
Robert Begay, Tuba City, Arizona
Robert Paton, Piedmont, California
Roberta Franklin, Leupp, Arizona

Roberto Nutlouis, Piñon, Arizona
Robin and Frances Markham, Pleasant Hill, Tennessee
Roger Parrish, Kayenta, Arizona
Ron and Joyce Reid, Flagstaff, Arizona
Roy Begody, Tuba City, Arizona
Roy Gilman, Kayenta, Arizona
Roy Tutt, Kayenta, Arizona
Salina Begay, Kayenta, Arizona
Sallie Loman, Laughlin, Nevada
Sandy Jesus, Window Rock, Arizona
Sarah Issac, Kykotsmovi, Arizona
Sarah Jane White, Shiprock, New Mexico
Scott Canty, Flagstaff, Arizona
Sean Grant, Scottsdale, Arizona
Serena Calnimpewa, Kykotsmovi, Arizona
Simon Crank, Kayenta, Arizona
Star School, Flagstaff, Arizona
Steve Mietz, Flagstaff, Arizona
Tahnee Brown, Piñon, Arizona
Thomas and Edith Welty, Flagstaff, Arizona
Thomas Yellowhair, Kayenta, Arizona
Thorson Kewenvoyouma, Tuba City, Arizona
Timothy Mose, Piñon, Arizona
Tom Deschene, Kayenta, Arizona
Tonya and Ray Garcia, Flagstaff, Arizona
Vernon Masayesva, Flagstaff, Arizona
Vince Nelson, Mohave Valley, Arizona
Wahleah and Gloria Johns, Pinon, Arizona
Wilton Johnson, Window Rock, Arizona
Woody Katenay, Tuba City, Arizona

Libraries

Navajo Nation Library System
Gallup Public Library
Hopi Public Library
Tuba City Public Library
Page Public Library
Winslow Public Library
Holbrook Public Library
Flagstaff City-Coconino County Public Library
Kingman Library
Laughlin Library
Bullhead Library

**PREPARERS AND
CONTRIBUTORS**

6.0 PREPARERS AND CONTRIBUTORS

Name/Title	Project Responsibility	Education
Lead Agency		
Office of Surface Mining Reclamation and Enforcement		
Pete Rutledge, Manager, Program Support Division, Western Region	Management, Oversight	Engineer of Mines Degree
Richard Holbrook, Manager, Southwest Branch, Program Support Division, Western Region	Management, Oversight	BA, Environmental Biology
Dennis Winterringer, Senior Environmental Protection Specialist	EIS Project Leader	MS, Wildlife Management BS, Fisheries and Wildlife Biology
Paul Clark, Hydrologist	Water Resources	MS, Hydrogeology BA, Geology
Jerry Gavette, Soil Scientist (CPSS/CPSC)	Mine Team Leader	MS, Agriculture-Soils BS, Agriculture Production and Management
Foster Kirby, Archaeologist	Cultural Resources	MA, Archaeology BA, Archaeology BA, Anthropology
Robert Postle, Ecologist	Mine Team Leader	MS, Land Rehabilitation BA, Environmental Biology
Cooperating Agencies		
Bureau of Indian Affairs		
Amy Heuslein, Regional Environmental Protection Officer, Western Regional Office, Environmental Quality Services	Management, Oversight, NEPA, Biological Resources	BS, Wildlife Biology
Garry Cantley, Regional Archaeologist, Western Regional Office, Environmental Quality Services	Cultural Resources	MA, Archaeology BA, Anthropology
Omar Bradley, Acting Regional Director Navajo Regional Office	Management, Oversight	MBA BS, University Services
Jonathan Martin, Natural Resources Officer	Biological Resources, NEPA	MS, Forest Management BS, Forest Management
Don Simonis, Natural Resources Officer/Regional Archaeologist	Cultural Resources	MA, Anthropology BA, Anthropology
Raymond Roessel, Western Regional Office, Division of Natural Resources, Hydrologist	Water Resources	MS, Hydrology BA, Geology
Stan Webb, Western Regional Office, Real Estate Services	Real Estate Services	BS, Biology JD, MPA
Jeff Loman, Washington D.C. Chief, Natural Resources Division Washington, D.C.	Trust Services	Senior Fellows MS, Hazardous Materials Management BA, Speech Education
Bureau of Land Management		
Moon Hom	Mining Engineer	BS, Mining Engineering
Rebecca Peck	Biological Resources	BS, Wildlife Management
Craig Johnson	Cultural Resources	MA, Anthropology BA, Psychology, Anthropology
Bruce Asbjorn	Wilderness, Visual Resources, Recreation	BS, Range Forest Management
Don McClure	Environmental Resources	MS, Range Management

Name/Title	Project Responsibility	Education
Paul Hobbs	Soils	BS, Soil Science
Jerica Richardson	Cultural Resources	BA, Anthropology
Josey Elefritz	Geographic Information Systems	Liberal Studies
Janna Paronto	Lands	Paralegal Certificate, Lands Academy
Ruben Sanchez	Management, Oversight	BS, Range Management
Wayne King	Management, Oversight	BS, Natural Resources Management
Michael Taylor	Management, Oversight	BS, Wildlife Science
Gregg Simmons	Planning, NEPA Program Lead	BS, Forest Management
Bureau of Reclamation		
Bruce Ellis	Management, Oversight	BA, Anthropology
Sandra Eto	NEPA Specialist	BA, Sociology
Kevin Black, Sr.	C Aquifer Water-Supply Study Manager	BS, Business Management
Henry Messing	Biological Resources	MS, Biology BS, Biology
Jon Czaplicki	Cultural Resources	MA, Anthropology BA, Anthropology
Rob Clarkson	Native Fish Biologist	MS, Zoology BS, Fisheries Management
City of Kingman		
Rob Owen	Special Projects Administrator	BS, Urban Planning
Hopi Tribe		
Scott Canty	Office of General Counsel	Attorney, Hopi Tribe
Harris Sherman	Outside Council	JD BA, History
Arnold Taylor	Natural Resources	BS, Agriculture
Leigh Kuwanwisiwma	Cultural Resources	BS, Accounting
Michael Yeatts	Cultural Resources	MA, Anthropology BS, Chemistry
Lanell Poseyesva	Cultural Resources	BA, Anthropology
Stewart Koyiyumtewa	Cultural Resources	BA, Anthropology
Lee Wayne Lomayestewa	Cultural Resources	Member of 7 Traditional Hopi Societies
Joelynn Roberson	Project Management	MPA, Public Administration BS, Political Science
Norman Honie	Mining and Mineral Resources	AA, Animal Husbandry Certificates of Applied Science in Range Management and Drafting Certificates in Mining and Mineral Property Management
Nat Nutongla	Water Resources	BS, Physical Geography
Sharon Lopez	Wetlands, Floodplains	MS, Environmental Science and Policy BS, Fresh Water Studies
Steven Lomadofkie	Geology, Minerals	
Robert Adams	Soils, Vegetation	BA, Mechanical Engineering
Priscilla Pavatea	Soils, Biological Resources	BS, Animal Health BS, Animal Health Science
Donna Anderson	Biological Resources	MS, Wildlife and Fisheries Science BS, Wildlife and Fisheries Science
Clayton Honyumtewa	Land Use	Courses: Land Management and Natural Resources

Name/Title	Project Responsibility	Education
Davis Pescusa	Lands and Realty	BA, Business Administration
Robert Charley	Realty and Right-of-Way	
Clay Hamilton	Real Estate Services	Training, Cultural Resources
Micah Lomaomvaya	Visual Resources, Socioeconomics	BA, Anthropology
Gina Mullen	Geographic Information Systems	MS, Environmental Science and Policy BS, Geology
Navajo Nation		
John Stucker, Senior Mining Engineer, Minerals Department – Surface Mining Program	Project Management, Geology, Minerals, Soils	PE, BS, Mining Engineering
Arvin Trujillo, Executive Director, Navajo Nation Division of Natural Resources	Project Management	MS, Mineral Processing BS, Chemistry
Stanley Pollock, Assistant Attorney General	Legal	JD MGS
John Leeper	Water Resources	PE, PhD, Civil Engineering MS, Civil Engineering BS, Civil Engineering
Jason John	Water Resources	MS, Geohydrology BS, Geohydrology
Robert Kirk	Water Resources	BS, Geography
David Mikesic, Zoologist, Natural Heritage Program, Department Fish and Wildlife	Biological Resources	MS, Zoology BA, Biology – Terrestrial Ecology
Alan Downer, Director, Navajo Nation Historic Preservation Department	Cultural Resources	PhD, Applied Anthropology MS, Anthropological Archeology BS, Geology
Ron Maldonado	Cultural Resources	BS, Anthropology
Charlene Nelson	Air Resources	MS, Environmental Engineer BS, Health Science
Eugenia Quintana	Air Resources	MS, Community and Regional Planning, Natural and Environmental Planning BUS, University Services
Ray Benally, Director, Navajo Nation Water Resources Department	Water Resources	PE, RLS, BS, Engineering MBA
Tom Morris, Senior Environmental Specialist	Wetlands, Floodplains	BS, Agriculture AAS, Environmental Technology
Lawrence Begay	Senior Reclamation Specialist	BS, Microbiology and Chemistry
Judy Willetto	Vegetation, Grazing	AA, Animal Science
Rita Whitehorse-Larsen, Wildlife Biologist	Biological Resources	BS, Environmental Resources – Range and Wildlife Management
Howard Draper	Land Use and Realty	BS, Geography Regional Development
Martin Begaye	Visual Resources	BS, Anthropology
Trib Chroudahary	Socioeconomics	MS, Economics BS, Economics
Rachelle Silver, GIS Analyst	Geographic Information Systems	AAS, Microcomputer Operations
Mohave County		
Nick Hont	Liaison	PE, BS, Civil Engineering

Name/Title	Project Responsibility	Education
U.S. Environmental Protection Agency		
Jeanne Geselbracht	NEPA Specialist	MA, Geography BA, Geography
Jason Brush	Clean Water Act 404 and 401	MA, Anthropology
John Tinger	Clean Water Act NPDES Permits	BS, Civil Engineering
USDI Fish and Wildlife Service		
Steve Spangle, Regional Supervisor	Management, Fish and Wildlife	BS, Wildlife Management
Brenda Smith, Assistant Field Supervisor	Management, Fish and Wildlife	MS, Wildlife and Fisheries Science BS, Wildlife Biology
John Nystedt	Fish and Wildlife	BS, Zoology, Wildlife Science
Shaula Hedwall	Fish and Wildlife	MS, Natural Resource Sciences, Wildlife Ecology emphasis BS, Forestry, Wildlife Ecology emphasis
USDA Forest Service – Kaibab National Forest		
Tom Mutz	Lands and Minerals	BS, Forest Watershed Management BS, Psychology
John Hanson	Cultural Resources	PhD, Archaeology MA, Anthropology BA, Anthropology
Other Participating Agencies		
Arizona Game and Fish Department		
Rebecca Davidson, Habitat Branch	Project Evaluation Coordinator	BS, Environmental Science
Julie Meka, Nongame Branch, Native Fish Program	Fish and Wildlife	MS, Fisheries Science BS, Biology
Mike Lopez, Region I, Fisheries Program	Fish and Wildlife	BS, Biology
USDI Office of Policy Analysis		
Kim Magraw, Program Analyst	Coordination, Project Review	MS, Ecology BA, Biology
USDI Office of Environmental Policy and Compliance		
Vijai Rai, Leader, Natural Resource Management Team	NEPA Guidance, Oversight, Project Review	PhD, Geology MS, Geology
Robert Stewart, Regional Environmental Officer	NEPA Guidance, Oversight, Project Review	MA, History AB, History
USDI Office of the Solicitor		
Robert D. Comer, Regional Solicitor	Departmental Oversight, EIS Review	BA, Environmental Biology and Conservation Master of Forest Science JD
Project Proponents		
Southern California Edison Company		
Daniel Pearson	Biological Resources and Overall NEPA Review	MS, Biological Sciences BS, Biology
Gary Dudley	Project Environmental Coordination	MS, Mechanical Engineering BS, Engineering
Bob Goodson	Project Environmental Coordination	BA, Geography
Michelle Nuttall	C-Aquifer Project Manager, Oversight	BA, Biology
Tom Taylor	Cultural Resources	MA, Anthropology BA, Anthropology

Name/Title	Project Responsibility	Education
Paul Phelan	Engineering Management Oversight	BS, Mechanical Engineering BS, Metallurgical Engineering
Larry Johnson	Project Manager, Engineering and Technical Services	PE, BS, Mechanical Engineering
Brian Watts	Project Engineering and Technical Services	PE, BS, Engineering
Steve Weaver	Project Engineering and Technical Services	PE, BS, Mechanical Engineering
Black Mesa Pipeline, Inc.		
Fred Rimington, President	Management, Oversight	MBA BS, Business Administration
Ruth Jensen, Environmental Specialist	Environmental Review	BS, Chemical Engineering
Peabody Western Coal Company		
Brian Dunfee, Director, Environmental Services	Project Oversight	MS, Range Ecology BS, Wildlife Biology
Gary Wendt, Supervisor, Environmental Program	Permit Coordinator	BS, Soil Science
Randy Lehn, Manager, Mine Engineering and Services	Engineering Oversight	BS, Civil Engineering
John Cochran	Hydrology, Air, and Meteorology	BS, Hydrology
Vern Pfannenstiel	Reclamation, Vegetation, and Wildlife	BS, Range Ecology
Salt River Project		
Randy Dietrich	Management, Oversight	MBA MS, Electrical Engineering BS, Electrical Engineering
Ray Hedrick	Environmental Review	MS, Wildlife Management BS, Wildlife Management
Chuck Paradzick	Biological Resources	MS, Natural Science BS, Wildlife Conservation Biology
Rick Anduze	Cultural Resources	25+ years archaeology experience
Consultants		
URS Team		
Cindy Smith, Manager, Environmental Planning	Project Manager	BS, Liberal Arts and Sciences
Randy Simpson, Senior Environmental Planner	Deputy Project Manager	BLA, Landscape Architecture BS, Environmental Design
Sandra Weir, Senior Environmental Planner	Socioeconomics, Environmental Justice, Project Management	MS, Geography BS, Geography
Cary Roberts, Environmental Planner	Project Coordination	MS, Environmental Management BS, Ecology and Evolutionary Biology
Bob Farmer, PhD, Practice Leader, Air Quality Services	Air Quality	PhD, Chemical Engineering MS, Chemical Engineering BS, Chemical Engineering
Bob Estes	Air Quality	BS, Environmental Science and Biology
Barbara Sprungl, Senior Air Quality Engineer	Air Quality	MBA, Business Administration BS, Chemical Engineering
Mark Murphy, PhD, Hydrologist	Water, Geology, Paleontology, Soils	PhD, Geology MS, Geology BS, Earth Science

Name/Title	Project Responsibility	Education
Brad Norling, Senior Biologist	Biological Resources	MS, Zoology and Physiology BS, Wildlife Biology
Danny Rakestraw, Senior Biologist	Biological Resources	MS, Wildlife Ecology BS, Wildlife Ecology
Barbara Garrison, Senior Biologist	Biological Resources	BS, Wildlife and Fisheries Science
Jeff Dawson, Senior Biologist	Biological Resources	MS, Botany BS, Biology
Jaime Wood, Environmental Planner	Land Use, Recreation, Transportation	MS, Environmental Planning BS, Environmental Studies BS, Geography, Environmental Resource Management
Ron Rypinski	Railroad Specialist	AA, Business Administration
Jennifer Pyne, Environmental Planner	Socioeconomics, Environmental Justice	MEP, Environmental Planning BA, Politics
Scott Stapp, Environmental Planner, Acoustics Specialist	Noise and Vibration	MS, Biology BA, Biology
Ross Dorothy, Environmental Planner	Visual Resources	BAS, Computer Visualization Technology
A.E. (Gene) Rogge, PhD, Manager, Cultural Resources	Cultural Resources	PhD, Anthropology MA, Anthropology BA, Anthropology
Debra Duerr, Senior Environmental Planner	Public Involvement	BA, Urban Planning
Richard Stuhan, GIS Analyst	Geographic Information Systems	BS, Applied Geography/ Geographic Information Management/Remote Sensing
Glenn Emanuel, Application Developer	Information Technology	BS, Management Information Systems
Mitch Meek, Graphic Artist	Graphics	BFA, Graphic Design
John Qoyawayma, Graphic Artist	Graphics	Technical courses in CAD, graphic design
Wendy Gabriel, Writer/Editor	Editing, Document Production	MA, Environmental Planning BA, Psychology
Mark Brown, Project Administrator	Project Administration	BS, Journalism
Anthropological Research LLC		
T.J. Ferguson	Cultural Resources	PhD, Anthropology MCRP, Community and Regional Planning MA, Anthropology BA, Social Science
Chip Colwell-Chanthaphonh	Cultural Resources	PhD, Anthropology MA, Anthropology BA, Anthropology
Circa Cultural Consulting		
Peter Bungart	Cultural Resources	MA, Anthropology
Anne Raney	Cultural Resources	MA, Anthropology
ERO Resources (Consultant to SRP)		
Craig Sommers	Water Resources	MS, Water Resource Economics BS, Soil and Water Science
Navajo Nation Archaeology Department		
Robert Begay, Manager	Cultural Resources	MA, Anthropology BS, Psychology
Davina Twobears	Cultural Resources	MA, Anthropology BA, Anthropology

Name/Title	Project Responsibility	Education
Kimberly C. Spurr	Cultural Resources	MA, Anthropology BA, Anthropology
Stewart A. Deats	Cultural Resources	M Ed, Education BA, Anthropology and Geology
Harriett K. Sandoval	Cultural Resources	BA, Anthropology
Hualapai Tribe		
Loretta Jackson-Kelly, Tribal Historic Preservation Officer	Cultural Resources	Associate Degree in Applied Science
Jana Tschopp	Cultural Resources	MA, Anthropology
Sharon Wilder	Cultural Resources	Hualapai Tribal Member
Southwest Ground Water Consultants		
Bill Greenslade	Water Resources	MS, Hydrology BS, Geological Engineering
SWCA		
Rich Valdez	Fish Biologist	PhD, Fisheries Ecology MS, Fisheries BS, Wildlife Management

Disclaimer Statement

National Environmental Policy Act (NEPA) Disclosure Statement Black Mesa Environmental Impact Statement

The President's Council on Environmental Quality (CEQ) regulations at 40 CFR 1506.5(c) require that consultants preparing an environmental impact statement (EIS) execute a disclaimer specifying they have no financial or other interest in the outcome of the project. The term "financial interest or other interest in the outcome of the project" for the purposes of this disclosure is defined in the March 23, 1981, guidance "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 FR 19026-18038 at Questions 17a and b.

"Financial or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)" 46 FR 18026 at 18031.

In accordance with these requirements, URS Corporation has prepared this EIS on behalf of the Office of Surface Mining Reclamation and Enforcement and the cooperating agencies and declares no financial or other interest in the outcome of the Black Mesa Project.

Certified by:



Cindy L. Smith, Vice President/Project Manager
URS Corporation



November 2006

REFERENCES



7.0 REFERENCES

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http://www.workforce.az.gov/admin/uploadedPublications/1193_Navajo03.xls.
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GLOSSARY



GLOSSARY

Acre-foot: The volume (as of irrigation water) that would cover 1 acre to a depth of 1 foot (43,560 cubic feet).

Action: In the context of the National Environmental Policy Act (NEPA), describes actions proposed to meet a specific purpose and need and that may have effects on the environment, which are potentially subject to Federal control and responsibility. Federal actions generally fall into the categories of adoption of official policy, formal plans, and programs; or approval of specific projects. For this document, the term action applies to a specific project.

Aesthetic quality: A perception of the beauty of a natural or cultural landscape.

Aggradation: The deposition of sediment by running water, as in the channel of a stream.

Air quality: A measure of the health-related and visual characteristics of the air, often derived from quantitative measurements of the concentrations of specific injurious or contaminating substances.

Air quality classes: Classifications established under the Prevention of Significant Deterioration portion of the Clean Air Act that limit the amount of air pollution considered significant within an area. Class I applies to areas where almost any change in air quality would be significant, Class II applies to areas where the deterioration normally accompanying moderate, well-controlled growth would be permitted, and Class III applies to areas where industrial deterioration generally would be allowed.

Alluvium: A general term for clay, silt, sand, gravel, or similar consolidated material deposited during comparatively recent geologic time by a stream or other body of running water in the bed of the stream, river, or floodplain, or as a cone or fan at the base of a mountain slope.

Alternative: Any one of a number of options for a project.

Alternative energy: Renewable energy sources such as wind, flowing water, solar energy, and biomass, which create less environmental damage and pollution than fossil fuels, and offer an alternative to nonrenewable resources.

Ambient. Of the environment surrounding a body, encompassing on all sides. Most commonly applied to air quality and noise.

American Indian tribe (or tribe): Any American Indian group in the conterminous United States that the Secretary of the Interior recognizes as possessing tribal status (listed periodically in the Federal Register).

Ancillary road: Any road not classified as a primary road.

Animal unit month: The amount of forage necessary to sustain one cow and one calf (e.g., a 1,000-pound cow and calf) for a period of one month.

Annual (ecology): A plant that completes its development in one year or one season and then dies.

Aquatic: Growing or living in or near the water.

Aquifer: A water-bearing rock unit (unconsolidated or bedrock) that will yield water in a usable quantity to a well or spring.

Aquitard: Refers to any layer in an aquifer or aquifer system that is much less permeable than the aquifers themselves, but not impermeable.

Archaeological site: A discrete location that provides physical evidence of past human use.

Archaeology: the scientific study of the life and culture of past, especially ancient, peoples, as by excavation of ancient cities, relics, artifacts, etc.

Archival: Pertaining to or contained in documents or records that preserve information about an event or individual.

Area of Critical Environmental Concern: A Bureau of Land Management (BLM) designation pertaining to areas where specific management attention is needed to protect and prevent irreparable damage to important historical, cultural, and scenic values, fish or wildlife resources, or other natural systems or processes, or to protect human life and safety from natural hazards.

Arroyo: A dry gully, or a stream in a dry region.

Artifact: Any object showing human workmanship or modification, especially from a prehistoric or historic culture.

Ash: The residue that remains when something is burned. Also, one component of coal; generally, high ash-content coal is considered to be low-grade.

Assessment: The act of evaluating and interpreting data and information for a defined purpose.

Attainment area (air): Designation of a geographical area by the U.S. Environmental Protection Agency (USEPA) where the air quality is deemed to be better than the National Ambient Air Quality Standards (NAAQS). This designation is based on the measured ambient criteria pollution data available for the geographic area. Areas where the measured ambient criteria pollution data are worse than the NAAQS are identified as nonattainment. An area can be designated as unclassified when there are insufficient ambient criteria pollutant data for the USEPA to form a basis for attainment status. An area can be in attainment for some pollutants but not others.

Backfill: The fill, often mine waste or rock, that replaces the void left from where a rock or ore has been removed. Also, the material used to fill in a trench in the groundbed (i.e., pipeline trench). The composition of the backfill varies based on the soil type being used and the component being covered.

Background (visual): That portion of the visual landscape lying from the outer limit of the middleground to infinity. Color and texture are subdued in this area, and visual sensitivity analysis here is primarily concerned with the two-dimensional shape of landforms against the sky.

Baghouse: An air pollution control device containing a large fabric bag, usually made of glass fibers, used to eliminate intermediate and large (greater than 20 PM [particulate matter] in diameter) particles. This device operates like the bag of an electric vacuum cleaner, passing the air and smaller particles while entrapping the larger ones.

Base flow: The contribution of stream discharge from groundwater seeping into the stream.

Baseline: The existing conditions against which impacts of the proposed action and its alternatives can be compared.

Basin: A depressed area having no surface outlet (topographic basin); a physiographic feature or subsurface structure that is capable of collecting, storing, or discharging water by reason of its shape and the characteristics of its confining material (water); a depression in the earth's surface, the lowest part often filled by a lake or pond (lake basin); a part of a river or canal widened (drainage, river, stream basin).

Best management practices: A suite of techniques that guide, or may be applied to, management actions to aid in achieving desired outcomes and help to protect the environmental resources by avoiding or minimizing impacts of an action.

Big game: Large species of wildlife that are hunted (such as elk, deer, pronghorn antelope).

Biological assessment: Information prepared by, or under the direction of, a Federal agency to determine whether a proposed action is likely to (1) adversely affect listed species or designated critical habitat; (2) jeopardize the continued existence of species that are proposed for listing; or (3) adversely modify proposed critical habitat.

Biological opinion: A document that is the product of formal consultation, stating the opinion of the U.S. Fish and Wildlife Service (FWS) on whether or not a Federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

Black Mesa Complex: Comprises two separate mining operations surface coal-mining operation—the Kayenta mining operation and the Black Mesa mining operation—on Black Mesa in Navajo County, Arizona. The Black Mesa Complex is located on contiguous coal leases within the boundaries of the Hopi and Navajo Indian Reservations.

Boiler: Any device used to burn coal fuel to heat water for generating steam.

Butte: A steep hill standing alone in a plain.

Candidate species: A plant or animal species not yet officially listed as threatened or endangered, but which is undergoing status review by the FWS.

Capital cost: The total investment needed to complete a project and bring it to a commercially operable status. The cost of construction of a new plant. The expenditures for the purchase or acquisition of existing facilities.

Carbon dioxide: An atmospheric gas composed of one carbon and two oxygen atoms. Carbon dioxide results from the combustion of organic matter if sufficient amounts of oxygen are present. Liquid carbon dioxide is a good solvent for many organic compounds (for example, it is used to remove caffeine from coffee).

Centrifuge: An apparatus consisting essentially of a compartment spun about a central axis to separate contained materials of different specific gravities, or to separate colloidal particles suspended in a liquid. In the case of this project, the centrifuge would remove water from the slurry.

Chapter (Navajo): Navajo unit of local government; nearly all Navajo land is assigned to chapters. There are 110 Chapters on the Navajo Reservation.

Clean Air Act of 1990: Federal legislation governing air pollution. The Clean Air Act established NAAQS for carbon monoxide, nitrogen oxide, ozone, particulate matter, sulfur dioxide, and lead. Prevention of Significant Deterioration classifications define the allowable increased levels of air quality deterioration above legally established levels and include the following:

Class I – minimal additional deterioration in air quality (certain national parks and wilderness areas)

Class II – moderate additional deterioration in air quality (most lands)

Class III – greater deterioration for planned maximum growth (industrial areas)

Clean Water Act of 1987: National environmental law enforced by the USEPA that regulates water pollution.

Cliff dwelling: A rock and adobe dwelling built on sheltered ledges in the sides of a cliff; cliff dwellings are ruins that represent the abandoned homes of ancient cultures.

Coal: A fossil fuel extracted from the ground by deep mining. It is a readily combustible black or brownish-black sedimentary rock composed primarily of carbon and hydrocarbons along with other elements including sulfur. Coal is formed from plant remains that have been compacted, hardened, chemically altered, and metamorphosed by heat and pressure over geologic time. It is primarily used as a solid fuel to produce heat through combustion and is the most common source of electricity generation worldwide.

Coal resource area: An area of high potential for unmined coal.

Coal washing: The process of separating undesirable materials from coal based on differences in densities. For example, pyritic sulfur, or sulfur combined with iron, is heavier and sinks in water; coal is lighter and floats.

Collection area: Geographic location or specific area in which native plants that have cultural significance to the Hopi and Navajo people are collected for use as food and medicine, in rituals, and other uses such as for tools, construction, and baskets.

Commercial area: A land use zoning term used to describe or designate areas in which business facilities, rather than residential uses, are concentrated.

Compaction: Process by which the volume or thickness of rock is reduced due to pressure from overlying layers of sediment.

Conduit: A pipe, usually made of metal, ceramic, or plastic, that protects buried cables or wires.

Consent decree: A legal document, approved by a judge, that formalizes an agreement reached between USEPA and potentially responsible parties through which potentially responsible parties will conduct all or part of a cleanup action at a Superfund site; cease or correct actions or processes that are polluting the environment; or otherwise comply with USEPA initiated regulatory enforcement actions to resolve the contamination at the Superfund site involved. The consent decree describes the actions potentially responsible parties will take and may be subject to a public comment period.

Construction, operation, and maintenance plan (COMP): A detailed plan depicting engineering, access, construction, environmentally sensitive areas, and reclamation that is prepared prior to construction and operation.

Contrast rating: A method of determining the extent of visual impact for an existing or proposed activity that would modify any landscape feature (land and water form, vegetation, and structures).

Conveyor: An apparatus for moving material from one point to another in a continuous fashion. This is accomplished with an endless (that is, looped) procession of hooks, buckets, or wide rubber belt, etc. In the case of this project, a conveyor moves coal from the Kayenta mining operation to the area where the coal is loaded onto the Black Mesa and Lake Powell Railroad, which transports the coal to the Navajo Generating Station.

Cooperating agency: Assists the lead Federal agency in developing an environmental assessment or environmental impact statement. The Council on Environmental Quality regulations implementing NEPA define a cooperating agency as any agency that has jurisdiction by law or special expertise for proposals covered by NEPA (40 CFR 1501.6). Any Federal, state, or local government jurisdiction with such qualification may become a cooperating agency by agreement with the lead agency.

Corridor: As discussed in this document, a wide strip of land within which a proposed linear facility (e.g., pipeline, transmission line) could be located.

Cost/benefit ratio: The number that results from a quantitative evaluation of the costs which would have incurred by implementing an environmental regulation versus the overall benefits to society of the proposed action.

Council on Environmental Quality (CEQ): An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews Federal programs for their effort on environmental studies, and advises the President on environmental matters.

Criteria: Standards on which a judgment or decision can be based.

Cubic foot/feet per second (cfs): As a rate of stream flow, a cubic foot of water passing a reference section in one second of time. One cfs flowing for 24 hours will yield 7.983 acre-feet of water.

Cultural resources: Remains of human activity, occupation, or endeavor as reflected in districts, sites, buildings, objects, artifacts, ruins, works of art, architecture, and natural features important in human events.

Cumulative effect (or impact): The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions. Cumulative impacts are evaluated as part of the environmental impact statement (EIS), and may include consideration of additive or interactive effects regardless of what agency or person undertakes the other actions.

Decibel: A unit for expressing the relative intensity of sounds on a logarithmic scale from zero for the average least perceptible sound to about 130 for the average level at which sound causes pain to humans. For traffic and industrial noise measurements, the A-weighted decibel, a frequency-weighted noise unit, is widely used. The A-weighted decibel scale corresponds approximately to the frequency response of the human ear and thus correlates well with loudness.

Degradation: The wearing down or away, and general lowering or reducing, of the earth's surface by the processes of weathering and erosion.

Diné Bikeyah: The traditional land of the Navajo covers parts of northeastern Arizona, northwestern New Mexico, southeastern Utah, and southwestern Colorado between four sacred mountains (Mount Hesperus, Blanca Peak, Mount Taylor, and the San Francisco Peaks).

Discharge: Outflow of surface water in a stream or canal (water). Discharge from an industrial facility that may contain pollutants harmful to fish or animals if it is released into nearby water bodies usually requires a permit issued by the USEPA and is monitored.

Distance zone: A visibility threshold distance where visual perception changes. They usually are defined as foreground, middleground, and background.

Diversion: A channel, embankment, or other manmade structure constructed to divert water from one area to another; the process of using these structures to move water.

Drainage: The natural or artificial removal of surface water and groundwater from a given area. Many agricultural soils need drainage to improve production or to manage water supplies.

Drawdown: The decrease in elevation of the water surface in a well, the local water table or the pressure head on an artesian well due to extraction of groundwater or decrease in recharge to the aquifer.

Easement: A right afforded a person, agency, or organization to make limited use of another's real property for access or other purposes.

Ecology: The relationship between living organisms and their environment.

Ecosystem: A complex system composed of a community of plants and animals, and that system's chemical and physical environment.

Effect (or impact): A modification of the existing environment as it presently exists, caused by an action (such as construction or operation of facilities). An effect may be direct, indirect, or cumulative. The terms effect and impact are synonymous under the NEPA. A direct effect is caused by an action and occurs at the same time and same place (40 CFR 1508.8(a)). An indirect effect is caused by the action later in time or farther removed in distance, but 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.

Emission: Effluent discharged into the atmosphere, usually specified by mass per unit time, and considered when analyzing air quality.

Endangered species: A plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are rarely identified by the Secretary of the Interior in accordance with the Endangered Species Act (ESA) of 1973.

Endangered Species Act of 1973: Provides a means whereby the ecosystems upon which threatened and endangered species depend may be conserved and to provide a program for the conservation of such threatened and endangered species. The ESA requires all Federal agencies to seek to conserve threatened and endangered species, use applicable authorities in furtherance of the purposes of the ESA, and avoid jeopardizing the continued existence of any species that is listed or proposed for listing as threatened and endangered or destroying or adversely modifying its designated or proposed critical habitat. The FWS is responsible for administration of this act.

Energy conservation: A means of saving energy.

Environment: The surrounding conditions, influences, or forces that affect or modify an organism or an ecological community and ultimately determine its form and survival.

Environmental impact statement (EIS): A document prepared to analyze the impacts on the environment of a proposed action and released to the public for review and comment. An EIS must meet the requirements of NEPA, CEQ, and the directives of the agency responsible for the proposed action.

Environmental justice: 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 group 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 (see Executive Order 12898).

Ephemeral range: A rangeland that does not consistently produce enough forage to sustain a livestock operation but may briefly produce unusual volumes of forage that may be utilized by livestock.

Ephemeral stream: A stream that flows only in direct response to precipitation in the immediate watershed or in response to the melting of a cover of snow and ice and has a channel bottom that is always above the local water table.

Erosion: The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as “gravitation creep.”

Extirpation: To destroy completely.

Extraction: The act of extracting or drawing a substance out of the earth (e.g., mining).

Federal Register: Published by the Office of the Federal Register, National Archives and Records Administration, the Federal Register is the official daily publication for rules, proposed rules, and notices of Federal agencies and organizations, as well as executive orders and other presidential documents.

Floodplain: That portion of a river or stream valley, adjacent to a river channel, that is built of sediments and is inundated with water when the stream overflows its banks.

Foreground: The visible area from a viewpoint or use area out to a distance of 0.5 mile. The ability to perceive detail in a landscape is greatest in this zone.

Fossil: Any remains, trace, or imprint of a plant or animal that has been preserved by natural process in the earth’s crust since some past geologic time.

Game management unit: A land management classification used by the Arizona Game and Fish Department to assist in managing hunting, such as hunting seasons allowed and number of permits to be issued for specific species, within the State of Arizona.

Geochemistry: The study of the chemical components of the earth’s crust and mantle. Geochemistry is applied to mining exploration to detect sites that indicate abnormal concentrations of either the elements being sought or of their more readily detected associate elements. Depending on circumstance, geochemical exploration samples soils, rock, and lake and stream sediments.

Geographic information system: A system of computer hardware, software, data, people and applications that capture, store, edit, analyze, and graphically display a potentially wide array of geospatial information.

Geologic formation: A rock unit distinguished from adjacent deposits by some common character, such as its composition, origin, or the type of fossil associated with the unit.

Geology: The science that relates to the earth, the rocks of which it is composed, and the changes that the earth has undergone or is undergoing.

Geothermal resource: Heat found in rocks and fluids at various depths that can be extracted by drilling or pumping for use as an energy source. This heat may be residual heat, friction heat, or a result of radioactive decay.

Global warming: An increase in the average temperature of the earth's atmosphere and oceans. The term also is used to describe the theory that increasing temperatures are the result of a strengthening greenhouse effect caused primarily by manmade increases in carbon dioxide and other greenhouse gases.

Gray water: Any nonsewage water that is nonpotable because it has been used in some way; for example, water from sinks, bathtubs, showers, or laundry operations. It may be recycled for toilet and outside water uses including irrigation.

Greenhouse gas: A component of the atmosphere that contributes to the greenhouse effect, or the process by which an atmosphere warms a planet. The major natural greenhouse gases are water vapor, carbon dioxide, and ozone. Minor greenhouse gases include methane, nitrous oxide, sulfur hexafluoride, and chlorofluorocarbons.

Groundwater: Subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated.

Grubbing: To dig up and remove all plants (roots and stems or trunk) in order to clear the land.

Gypsum: A soft white mineral, the most common sulfate mineral.

Habitat: A specific set of physical conditions in a geographic area(s) that surrounds a single species, group of species, or large community. In wildlife management, the major components of habitat are food, water, cover, and living space.

Halite: A white and colorless mineral, sodium chloride or rock salt.

Historic property: Any prehistoric or historical 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 artifacts, records, and remains that are related to and located within such properties; the term also includes properties of traditional religious and cultural importance to an American Indian tribe or Native Hawaiian organization and that meet the National Register criteria.

Hydrology: The study of the movement, distribution, and quality of water throughout the earth, addresses both the hydrologic cycle and water resources.

Impact (or effect): A modification of the existing environment as it presently exists, caused by an action (such as construction or operation of facilities). An impact may be direct, indirect, or cumulative. The terms effect and impact are synonymous under NEPA.

Impoundment: A closed basin, naturally formed or artificially built, which is dammed or excavated for the retention of water, sediment, or waste.

Indian Lands Program: The program's emphasis is addressing environmental impacts on Indian lands that are not currently addressed by other programs. The Office of Surface Mining Reclamation and Enforcement (OSM) is the regulatory authority for coal-mining operations that occur on Indian lands in the western United States. As such, OSM is responsible for the review and decisions on all applications to conduct mining operations and, if a mining permit is issued, OSM is responsible for inspection of the mines to ensure that the public and the environment are protected. Ultimately, OSM is responsible for ensuring that mining operations are fully reclaimed before the lands are returned to the tribes.

Indirect effect (or impact): Secondary effects that occur in locations other than the initial action or later in time, but that are caused by the proposed action.

Indurated rock: Hardened or cemented sedimentary rock.

Industrial area: A land use zoning term used to describe or designate areas in which heavy industry is concentrated or allowed.

Infrastructure: The facilities, services, and equipment needed for a community or facility to function, such as and including roads, sewers, water lines, and electric lines.

Initial Program: A transitional program designed by Congress to implement the requirements of the Surface Mining Control and Reclamation Act of 1977, established as a nationwide program to protect society and the environment from the adverse effects of surface coal-mining operations and to assist the states in developing and implementing a program to achieve the purposes of the Act. The Initial Program took effect six months after the enactment of the Act and created a dual inspection and enforcement role for OSM and the states in ensuring compliance with certain key provisions of the Act at all surface-coal-mining and reclamation operations. The Initial Program was to be replaced by a permanent state regulatory program as approved by the Secretary of the Interior based on findings that the program provisions met the purposes of the Act and the state had the capability of carrying them out; or, where a state did not submit an application for a state program, upon promulgation and implementation of a Federal program.

Intermittent: A river or stream that flows for a period of time, usually seasonally during rainy periods, and stops during dry periods. In arid regions, dry periods may be interrupted by occasional flash floods from brief but intense rain storms.

Invasive species: Describes a large number of nonnative plant species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Issue: Describes the relationship between actions (proposed, connected, cumulative, similar) and environmental (natural, cultural, and socioeconomic) resources. Issues may be questions, concerns, problems, or other relationships, including beneficial ones. Issues do not predict the degree or intensity of harm the action might cause, but simply alert the reader as to what the environmental problems might be. The NEPA document should address issues identified through interaction with agencies and/or the public, and/or through resource studies.

Labor force: All persons 16 years of age or over who are either employed or unemployed and actively looking for a job.

Land use plan: A plan or document developed by a government entity, which outlines specific functions, uses, or management-related activities of an area, and may be identified in combination when joint or seasonal uses occur and may include land used for support facilities that are an integral part of the use.

Landform: A term used to describe the many land surfaces that exist as a result of geologic activity and weathering (e.g., plateaus, mountains, plains, and valleys).

Landscape: An area composed of interacting ecosystems that are repeated because of geology, landform, soils, climate, biota, and human influences throughout the area. Landscapes are generally of a size, shape, and pattern, which are determined by interacting ecosystems.

Landscape character: Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique.

Lawsuit: A civil action brought before a court in which the party commencing the action, the plaintiff, seeks a legal remedy. If the plaintiff is successful, judgment will be given in the plaintiff's favor, and a range of court orders may be issued to enforce a right, impose a penalty, award damages, impose an injunction to prevent an act or compel an act, or to obtain a declaratory judgment to prevent future legal disputes.

Lease: An authorization or contract by which one party (lessor) conveys the use of property to another (lessee) in return for rental payments. In cases of resource production, lessees pay royalties to the lessor in addition to rental payments.

Life of mine: The estimated time period within which a mine is expected to operate, which also is the duration for which a permit is issued. The adjective "life-of-mine (LOM)" is used with "plan" or "permit." Relevant Federal or state agencies have the authority to approve a modification of a LOM permit or a transfer of a LOM permit from one company to another.

Lifestyle: A way of living based on identifiable patterns of behavior based on an individual's choice, and influenced by the individual's personal characteristics, their social interactions, socioeconomic and environmental factors, and cultural, ethnic, or religious background.

Locomotive: A railway vehicle that provides the motive power for a train and has no payload capacity of its own; its sole purpose is to move the train along the tracks.

Management indicator species: Designated by the U.S. Forest Service, these species are selected because their population changes are believed to indicate the effects of management activities.

Megawatt: A unit for measuring power equal to one million watts. The productive capacity of electrical generators is measured in megawatts.

Mesa: An isolated, nearly level land mass, formed on nearly horizontal rocks, standing above the surrounding country and bounded with steep sides.

Methane: A colorless, nonpoisonous, flammable gas created by anaerobic decomposition of organic compounds. A major component of natural gas used in the home.

Methanol: An alcohol that can be used as an alternative fuel or as a gasoline additive. It is less volatile than gasoline; when blended with gasoline it lowers the carbon monoxide emissions but increases hydrocarbon emissions. Used as pure fuel, its emissions are less ozone-forming than those from gasoline. Poisonous to humans and animals if ingested.

Mineral resources: Any inorganic or organic substance occurring naturally in the earth that has a consistent and distinctive set of physical properties. Examples of mineral resources include coal, nickel, gold, silver, and copper.

Mitigation: The abatement or reduction of an impact on the environment by (1) avoiding a certain action or parts of an action, (2) employing certain construction measures to limit the degree of impact, (3) restoring an area to preconstruction conditions, (4) preserving or maintaining an area throughout the life of a project, (5) replacing or providing substitute resources to the environment, or (6) gathering data (e.g., archaeological or paleontological) prior to disturbance.

National Ambient Air Quality Standards: The allowable concentrations of air pollutants in the air specified by the Federal government. The air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public welfare) from any unknown or expected adverse effects of air pollutants.

National Environmental Policy Act of 1969: Our nation's basic charter for protection of the environment. It establishes policy, sets goals, and provides means for carrying out the policy. In accordance with NEPA, all Federal agencies must prepare a written statement on the environmental impacts of a proposed action. The provisions to ensure that Federal agencies act according to the letter and spirit of NEPA are in the CEQ regulations for implementing NEPA (43 CFR 1500-1508).

National Register of Historic Places. A listing, maintained by the Secretary of the Interior, of districts, sites, buildings, structures, and objects worthy of preservation. To be eligible a property must normally be at least 50 years old, unless it has exceptional significance, and have national, State, or local significance in American history, architecture, archaeology, engineering, or culture; and possess integrity of location, design, setting, material, workmanship, feeling, and association; and (a) be associated with events that have made a significant contribution to the broad patterns of history, (b) be associated with the lives of persons significant in our past, or (c) embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction; or (d) have yielded, or may be likely to yield, information important to prehistory or history.

Noise: Loud, unpleasant, unexpected, or undesired sound that disrupts or interferes with normal human activities.

Noxious weed: Nonnative plant species that negatively impact crops, native plant communities, and/or management of natural or agricultural systems. Noxious weeds are officially designated by a number of states (including Arizona and Nevada) and Federal agencies.

Operating cost: The expense of maintaining property or a facility (e.g., paying property taxes, wages, utilities, supplies, and insurance); it does not include depreciation or the cost of financing or income taxes.

Perennial stream: A stream or that part of a stream that flows continuously during all of the calendar year as a result of groundwater discharge or surface runoff.

Pipeline: A continuous pipe conduit for transporting fluids such as natural gas and/or supplemental gaseous fuels, oil, or water from one point to another, usually from a point in or beyond the producing field or processing plant to another pipeline or to points of use. Pipelines require associated equipment as valves, compressor stations or booster pumps, communications systems, and meters.

Plateau: In geology and earth science, a plateau is an area of high land, usually consisting of relatively flat open country if the uplift was recent in geologic history. Plateaus, like mesas and buttes, are formed when land has been uplifted by tectonic activity and then eroded by wind or water.

Prime farmland: A special category of highly productive cropland that is recognized and described by the U.S. Department of Agriculture's Soil Conservation Service and receives special protection under the Surface Mining Law of 1977.

Public land: Land or interest in land owned by the United States and administered through the Secretary of the Interior through the BLM without regard to how the United States acquired ownership, except lands on the Outer Continental Shelf, and land held in trust for the benefit of American Indians, Aleuts, and Eskimos.

Pump station: Mechanical device installed in sewer or water system or other liquid-carrying pipelines to move the liquids to a higher level so gravity can assist with moving the liquid across long distances.

Range: A large, open area of land over which livestock can wander and graze.

Raptor: A bird of prey.

Rare: A plant or animal restricted in distribution. May be locally abundant in a limited area or few in number over a wide area.

Recharge: Replenishment of a groundwater reservoir (aquifer) by the addition of water, through either natural or artificial means.

Reclaimed water: Treated, recycled wastewater not safe for consumption. Also known as nonpotable water. Reclaimed water is often used for irrigation and other nonconsumptive purposes.

Reclamation: Restoration of land disturbed by natural or human activity (e.g., mining, pipeline construction) to original contour, use, or condition. Also describes the return of land to alternative uses that may, under certain circumstances, be different from those prior to disturbance.

Recontouring: Return a surface to or near to its original form through some type of action such as grading.

Record of Decision: A document separate from, but associated with, an EIS that publicly and officially discloses the responsible official's decision on a proposed action.

Recreation Opportunity Spectrum: The Recreation Opportunity Spectrum (ROS) provides a framework that allows forest managers to plan for and provide a variety of recreational environments. It allows managers to describe and provide a range of recreational opportunities from highly developed areas (Urban, Rural, Roaded Natural, Roaded Modified) to areas with little or no development (Semi-Primitive

Motorized and Nonmotorized, Primitive). Attributes typically considered in describing the setting are size, scenic quality, type and degree of access, remoteness, level of development, social encounters, and the amount of onsite management. By providing and maintaining this spectrum of recreational settings and opportunities, a broad segment of the public can find quality recreational opportunities for a variety of recreational activities and experiences, now and in the future. Change in a national forest's mix of ROS classes affect the recreational opportunities offered (USDA, USFS 1986).

Refuse: Nonliquid, nonsoluble materials ranging from municipal garbage to industrial wastes that contain complex and sometimes hazardous substances. Refuse also includes sewage sludge, agricultural refuse, demolition wastes, and mining residues. Also referred to as solid waste. In the case of this project, refuse refers to the waste that would remain after coal washing.

Reservation: Land set aside to achieve a particular land use or conservation objective. For the purposes of this document, reservation refers to those lands managed by an American Indian tribe under the U.S. Department of the Interior's Bureau of Indian Affairs. The reservation land is Federal territory held in trust for tribes. The American Indian tribes have limited national sovereignty.

Retention pond: Wastewater pond, or retention area, in which floating wastes are skimmed off and settled solids are removed for disposal before the water leaves the permit area. Also called a sediment pond.

Revegetation: The re-establishment and development of self-sustaining plant cover. On disturbed sites, this normally requires human assistance such as reseeding.

Right-of-way: Land authorized to be used or occupied for the construction, operation, maintenance, and termination of a project, such as a road or utility.

Riparian: Referring or relating to areas adjacent to water or influenced by free water associated with streams or rivers on geologic surfaces occupying the lowest position of a watershed. Pertaining to, living or situated on banks of rivers, streams, or other body of water. Normally used to refer to the plants of all types that grow along, around, or in wet areas.

Rolling stock: Rail-borne railroad equipment such as locomotives, freight cars, passenger cars, and maintenance-of-way work cars that can be assembled into a train.

Royalty: A percentage of value of the resource production of a facility or project paid in the instance of a leasing situation, from a lessee to a lessor. Terms of royalties are determined in and outlined within the lease.

Rural: Sparsely settled places away from the influence of large cities and towns. Such areas are distinct from more intensively settled urban and suburban areas, and also from unsettled lands such as outback or wilderness. People tend to live in villages, on farms, and in other isolated houses on large plots of land.

Salinity: A measure of the amount of dissolved salts given a volume of water.

Scoping: The process open to the public early in the preparation of an EIS for determining the scope of issues related to a proposed action and identifying significant issues to be addressed in an EIS.

Screen: An initial assessment performed with few data and many assumptions to identify alternatives that should be evaluated more carefully.

Scrubber: Any of several forms of chemical/physical devices that remove sulfur compounds formed during coal combustion. These devices, technically known as flue gas desulfurization systems, combine the sulfur in gaseous emissions with another chemical medium to form inert “sludge,” which must then be removed for disposal. Scrubbers are used as air pollution control devices to trap pollutants in emissions.

Sediment: Solid fragmental material, either mineral or organic, that is transported or deposited by air, water, gravity, or ice.

Sediment pond: Wastewater pond, or retention area, in which floating wastes are skimmed off and settled solids are removed for disposal before the water leaves the permit area.

Sedimentation: The result when soil or mineral is transported by moving water, wind, gravity, or glaciers and deposited in streams or other bodies of water, or on land. Also, letting solids settle out of wastewater by gravity during treatment.

Seismicity: The geographic and historical distribution of earthquakes.

Sensitive receptor: In terms of noise, people or animals that may hear a noise or be sensitive to increased noise levels within their range of hearing.

Sensitivity: The state of being readily affected by the actions of external influence.

Significant (impact): “Significant” has been used in this document to describe any impact that would cause a substantial adverse change or stress to one or more environmental resources.

Sinkhole: A depression in the earth’s surface caused by dissolving of underlying limestone, salt, or gypsum. Sinkholes also form from human activity, such as the collapse of abandoned mines, due to water main breaks in urban areas, or from the overpumping and extraction of groundwater and subsurface fluids.

Slurry: In the case of this project, the slurry is a mixture of 50 percent water and 50 percent finely ground coal. The coal from the Black Mesa Mine is transported in this slurry mixture via pipeline to the Mohave Generating Station.

Special status species: Wildlife and plant species either federally listed or proposed for listing as endangered or threatened; state-listed; or priority species of concern to Federal agencies or tribes.

Spoil: The dirt or rock removed from its original location through excavation as in strip-mining, trenching, dredging, or construction.

Spur: A road, pipeline, or rail line that diverges from its primary path or route (i.e., a larger arterial or pipeline) to serve a specific area or connect to another road, pipeline, or rail line.

Storage coefficient: The volume of water the aquifer releases from or takes into storage per unit of surface area of the aquifer per unit decline or rise of head.

Subsidence: The lowering of the land-surface elevation from changes that take place underground. Common causes of land subsidence from human activity are pumping water, oil, and gas from underground reservoirs; dissolution of limestone aquifers (sinkholes); collapse of underground mines; drainage of organic soils; and initial wetting of dry soils (hydrocompaction).

Substation: A facility with a collection of equipment for the purpose of raising, lowering, and regulating the voltage of electricity.

Suburban area: Inhabited districts located either on the outer rim or outside the official limits of a city. Although suburbs may be located within city limits, the density of habitation is usually lower than in an inner city area and there is generally a transportation system(s) that allows commuting into more densely populated areas with higher levels of commerce.

Surface Mining Control and Reclamation Act: Requires mine operators to minimize disturbances and adverse effects on fish, wildlife, and related environmental values, and to restore land and water resources.

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.

Terrain: Used to describe the geophysiographic characteristics of land in terms of elevation, slope, and orientation.

Thoroughfare: A public road from one place to another.

Threatened or Endangered Species: Animal or plant species that are listed under the Federal Endangered Species Act of 1973, as amended (federally listed), or under similar state laws (state-listed).

Total dissolved solids: A term that describes the quantity of dissolved material in a sample of water.

Total maximum daily load: An estimate of the total quantity of pollutants (from all sources: point, nonpoint, and natural) that may be allowed into waters without exceeding applicable water-quality criteria.

Traditional cultural lifeway/resources: Resources that are significant for retention and transmission of traditional cultures. Biological resources that could have traditional cultural significance include plants collected for food, medicine, ceremonies, and other traditional uses, as well as raptors (e.g., eagles and hawks) collected for ceremonial uses. Other natural resources that could have traditional cultural significance include minerals or clay deposits and sources of surface water or shallow groundwater pumped for traditional purposes.

Traditional cultural properties/landscape features: These named places (landscape features) comprise the cultural landscape that provides the context for evaluating specific traditional cultural properties.

Trans-basin: Trans-basinal diversion of water is the change in location of a water use, by conveyance of that water, between water bodies not normally in hydrologic communication. This can be either an underground or aboveground water body. Because water is generally adjudicated by the courts, this use can only occur if judicial or administrative (Arizona Department of Water Resources) approval has been obtained.

Transition zone: The area between two discrete environmental areas, and thus containing elements of each. For example, the transition zone between an upland piñon forest and a lowland desert scrub environment.

Transmissivity: The rate at which water is transmitted through a unit width of the aquifer under a unit hydraulic gradient.

Tribal Council: A group of officials elected by tribal members to govern tribal affairs in accordance with a tribal constitution adopted pursuant to the Indian Reorganization Act of 1934.

Tribe: Any Indian tribe, band, group, or community having a governing body recognized by the Secretary of Interior.

Tutsqwa: The Hopi heartland, encompasses much of northeastern Arizona.

Undertaking: A project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; those requiring a Federal permit, license, or approval; and those subject to State or local regulation administered pursuant to a delegation or approval of a Federal agency.

Unit train: A long train of between 60 and 150 or more hopper cars, carrying only coal between a single mine and destination.

Urban: An area where there is an increased density of human-created structures in comparison to the areas surrounding it. Urban areas are frequently referred to as cities or towns. The U.S. Census Bureau defines an urbanized area as: “Core census block groups or blocks that have a population density of at least 1,000 people per square mile and (386 per square kilometer) and surrounding census blocks that have an overall density of at least 500 people per square mile (193 per square kilometer).”

Vegetation communities: Species of plants that commonly live together in the same region or ecotone.

Viewer sensitivity: A measure of the degree of concern about change in the visual character of a landscape. It is determined by assessing the types of viewers, land uses on lands facing a project, numbers of viewers, duration of time spent looking at a view, and influence of adjacent land use on the view.

Village (Hopi): The Hopi unit of local government, but much Hopi land is not assigned to a village and is administered at the tribal level.

Visibility: The distance to which an observer can distinguish objects from their background. The determinants of visibility include the characteristics of the target object (shape, size, color, pattern), the angle and intensity of sunlight, the observer’s eyesight, and any screening present between the viewer and the object (i.e., vegetation, landform, even pollution such as regional haze).

Visual resource management classes: Categories assigned to public lands based on scenic quality, sensitivity level, and distance zones. There are four classes, each of which has an objective that prescribes the amount of change allowed in the characteristic landscape.

Volt: The potential difference across a conductor when a current of one ampere dissipates one watt of power. Electrical potential difference can be thought of as the ability to move electrical charge through a resistance. In essence, the volt measures how much kinetic energy each electron carries. Between two points in an electric field, such as exists in an electrical circuit, the potential difference is equal to the difference in their electrical potentials. This difference is proportional to the electrostatic force that tends to push electrons or other charge-carriers from one point to the other. Potential difference, electrical potential, and electromotive force are measured in volts, leading to the commonly used term “voltage.”

Waters of the United States: All waters that are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce including adjacent wetlands and tributaries to water

of the United States; and all waters by which the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce.

Watershed: All land and water within the confines of a drainage divide.

Well field: Area containing one or more wells that produce usable amounts of water or oil.

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 soil conditions. Examples of wetlands include marshes, shallow swamps, lakeshores, bogs, muskegs, wet meadows, estuaries, and riparian areas.

Wilderness, Wilderness Area: An area formally designated by Congress as part of the National Wilderness Preservation System.

Xeroriparian: Riparian refers or relates to areas adjacent to water or influenced by free water associated with streams or rivers on geologic surfaces occupying the lowest position of a watershed. Pertaining to, living, or situated on, the banks of rivers and streams. "Xeroriparian" refers to being situated on dry washes (ephemeral streams).

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APPENDIX A



Appendix A

- A-1 Black Mesa Complex: Mining and Reclamation Procedures**
- A-2 Coal-Slurry Pipeline: Typical Pipeline Construction, Operation, and Maintenance**
- A-3 C Aquifer Water-Supply System: Typical Well Field and Pipeline Construction, Operation, and Maintenance**

Appendix A-1
Black Mesa Complex:
Mining and Reclamation Procedures

Appendix A-1 Black Mesa Complex: Mining and Reclamation Procedures

GENERAL

Authorization to Mine

Peabody Western Coal Company (Peabody) has been mining coal in two separate surface-mining operations on Black Mesa, within Navajo County, Arizona, since the 1970s. Mining takes place within the Black Mesa Complex, which is located on contiguous coal leases within the boundaries of the Hopi and Navajo Indian Reservations. The Kayenta mining operation and the Black Mesa mining operation have been in operation since 1973 and 1970, respectively. The Kayenta mining operation operates under an Office of Surface Mining Reclamation and Enforcement (OSM) Permanent Program Permit AZ-0001D, originally issued on July 6, 1990. Permit AZ-0001D is renewable at 5-year intervals and currently authorizes mining operations in coal resource areas N-09, N-10, N-99, J-19, and J-21, which, combined, contain enough coal to sustain the Kayenta mining operation through 2026 at the current production rate of 8.5 million tons of coal per year. Permit AZ-0001D has been renewed on three occasions: July 6, 1995; July 6, 2000; and July 6, 2005. The Black Mesa mining operation currently is authorized to operate under an OSM initial regulatory program (30 Code of Federal Regulations [CFR] Subchapter B Part 710) while the decision on the operations' Permanent Program Permit application remains in administrative delay pursuant to 30 CFR 750.11(c) Subchapter E.

Peabody filed a major permit revision application with OSM on February 17, 2004, seeking an extension of the life of mining through at least 2026 for both the Kayenta and Black Mesa mining operations and attendant changes to various other components of Peabody's Mining and Reclamation Plans. If Alternative A of the Black Mesa Project Environmental Impact Statement is implemented, the OSM Director (or designee), in consultation with the Bureau of Indian Affairs (BIA) and the Hopi Tribe and Navajo Nation [30 CFR 750.6(d)], would approve Peabody's permit application and issue a Federal permit to conduct surface coal mining and reclamation operations at the Black Mesa Complex with conditions necessary to meet the requirements of the Surface Mining Control and Reclamation Act (SMCRA) and all other applicable Federal laws. The Federal permit to mine coal would be renewable at 5-year intervals for the extended life of the mines. The Bureau of Land Management (BLM) Arizona State Director (or designee) would approve the proposed life-of-mine plan. Authority for OSM and BLM to take these actions is found in 30 CFR 750.6(a) and 25 CFR Chapter I, respectively. Responsibilities for consultation with BIA are defined under 30 CFR 750.6 and 25 CFR Part 216. In order for Peabody to continue surface-coal-mining and reclamation operations beyond the currently authorized timeframes, all approvals listed under the proposed action must be obtained.

Coal Mining Leases

The Black Mesa Complex comprises approximately 24,858 acres of land where the surface and mineral interests are held exclusively by the Navajo Nation ("N" designated coal resource areas) and approximately 40,000 acres of land in the former Hopi and Navajo Joint Minerals Ownership Lease Area ("J" designated coal resource areas) (Map A-1). The tribes have joint and equal interests in the minerals that underlie the former Joint Use Area; however, the surface has been partitioned. The portion of the leasehold that lies in the former Joint Use Area consists of approximately 6,137 acres partitioned to the Hopi Tribe and 33,863 acres partitioned to the Navajo Nation. The coal-mining leases with the Hopi Tribe and Navajo Nation, shown on Map A-1, provide that Peabody may produce up to 290 million tons from the exclusive Navajo Lease Areas (Contract 14-20-0603-8580 originally executed on February 1, 1964) and up to 380 million tons from the Hopi and Navajo Joint Minerals Ownership Lease Area (Contracts 14-20-0603-9910 and 14-20-0450-5743 originally executed on June 6, 1966) for a combined total of

670 million tons. While the specified leased coal tonnages are certain, the assignment of coal parcels to a particular buyer of the coal may change, depending upon customer demand and coal-quality needs.

The coal-mining leases also provide Peabody rights to prospect, mine, and strip leased lands for coal and kindred products, including other minerals, except for oil and gas, as may be found. Peabody also is given the right to construct support facilities such as buildings, pipelines, tanks, plants, and other support structures; make excavations, openings, stockpiles, dumps, ditches, drains, roads, spur tracks, transmission lines, and other improvements; and to place machinery and other equipment and fixtures and do all other things upon the leased lands necessary for the efficient operation of mining. Peabody may occupy that portion of the leased lands as is necessary to carry on mining operations, including right of ingress and egress, and may develop and use water for the mining operations.

Rights-of-Way and Easements

There are several existing grants of rights-of-way and easements allowing Peabody access and use of lands outside the existing coal lease areas. A grant of right-of-way and easement for an overland conveyor and coal-loading site was issued to the Navajo Generating Station project participants by the Secretary of the Interior with the approval of the Navajo Nation on December 10, 1969, that was ultimately transferred to Peabody. A grant of right-of-way and easement for two parcels of land providing access for utilities, haul roads, maintenance roads, sediment-control ponds, and a rock-borrow area was approved by the Navajo Nation and BIA on August 19 and 28, 1996, respectively. A grant of right-of-way for an electrical transmission line was issued by the BIA with the consent of the Navajo Nation on September 9, 1984.

Peabody would obtain a separate and additional off-lease right-of-way to construct a coal-haul road as a support facility for continued Kayenta and Black Mesa mining operations (Chapter 2, Map 2-1).

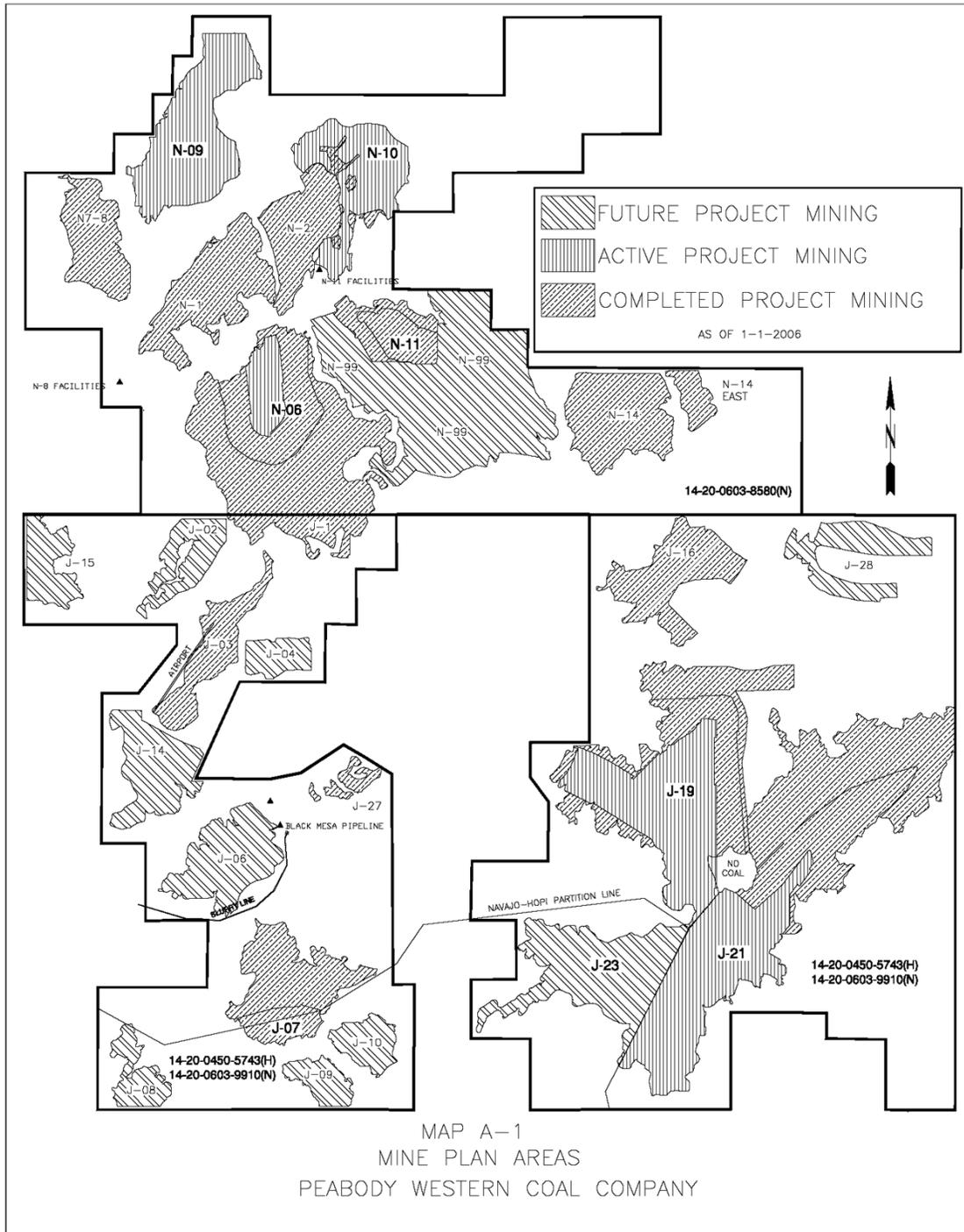
Coal-Supply Agreements

Peabody has a coal-supply agreement with the Navajo Generating Station participants containing a term ending in mid-2011, and a coal-supply agreement with the Mohave Generating Station participants that ended on December 31, 2005. Peabody presently is engaged in negotiations with the participants in both projects to extend the terms of the coal-supply agreements.

The future project mining areas within the Black Mesa Complex are shown on Map A-1. Approximately 829 million tons of potentially economical coal reserves are available within the Black Mesa Complex. On January 1, 2005, approximately 367 million of the 670 million tons currently under lease had been sold.

Coal Resource Protection

Peabody must conduct coal-mining activities in a manner that conserves and protects the coal resource in accordance with 25 CFR Subchapter I. The BLM provides inspection and enforcement to ensure protection and conservation of the coal reserve, and also is responsible for independently verifying Peabody's coal production. Coal mining on Black Mesa is a complicated process involving extraction of nonconcentrated, multiple coal seams having varying overburden depths and innerburden thicknesses. The coal seams split, change to burned coal, and pinch out in very short distances. The complicated nature of the coal-seam geology has resulted in the selection and application of equipment providing highly efficient and effective coal removal. Auxiliary equipment has been carefully matched to primary excavators and their capabilities to ensure maximum coal recovery while maintaining environmental integrity.



MINE FACILITIES

This section contains a description of the existing and proposed facilities that do and would support the Kayenta and Black Mesa mining operations, respectively. These facilities include water-control facilities, transportation facilities, and other support facilities.

Water-Control Facilities

Sediment- and Water-Control Facility Plan

Peabody must design, construct, and maintain appropriate sediment-control measures including sediment ponds, diversions, culverts, and other sediment- and water-control structures in accordance with 30 CFR 816.45 in order to prevent, to the extent possible, additional contributions of sediment to stream flow or to runoff outside the permit area due to mining activity, and to minimize erosion. Sediment-control measures include practices used within and adjacent to the mining-disturbance areas. Sediment-control measures consist of the use of proper mining and reclamation methods and sediment-control practices, singly or in combination. Sediment-control methods may include, but are not limited to, the following:

- Disturbing the smallest practicable area at any one time during the mining and construction operation;
- Stabilizing graded material to promote a reduction in the rate and volume of runoff;
- Retaining sediment within disturbed area;
- Diverting runoff away from disturbance areas, including stockpiles, back slopes, and material storage;
- Diverting runoff through disturbed areas using stabilized earth channels, culverts, or pipes so as to prevent, to the extent possible, additional contributions of sediment to stream flow or to runoff outside the permit area;
- Using straw dikes, silt fences, small V-ditches, riprap, mulches, check dams, ripping, contour furrowing, vegetative sediment filters, small depressions, sediment traps, and other measures that would reduce overland flow velocity, reduce runoff volume, or trap sediment; and
- Treating traffic areas with water or dust suppression to reduce the potential for wind and water erosion.

Siltation structures or sedimentation ponds are used primarily for controlling sediment from all disturbed areas, except those permitted areas exempted by the requirements of these regulations. Other alternative sediment-control methods may be used in conjunction with the siltation structures or, in the case of the permitted areas that are exempt (i.e., roads), they may be used individually.

Sediment Ponds and Impoundments

Temporary Sedimentation Ponds

Peabody constructs sedimentation ponds to control runoff and sediment from disturbed areas pursuant to 30 CFR 816.46, 816.47, 816.49, and 816.56. Sediment ponds generally are recognized in the coal-mining industry as the best available control technology to prevent, to the extent possible, additional contributions of suspended solids sediment to stream flow or runoff outside the permit area due to mining disturbance. All surface drainage from the disturbed areas passes through a siltation structure before leaving the permit area, except in certain small areas that are exempt from these regulations. In the exempt areas, alternative sediment-control methods are used to eliminate additional contributions of

sediment off the permit area. Most of the sediment ponds are designed to be temporary, and are reclaimed when they are no longer needed to treat runoff from disturbed areas. Certain temporary ponds may be proposed for permanent retention in the post-mining landscape, but must be upgraded to meet permanent impoundment regulatory requirements.

At the end of 2004, 153 sedimentation structures existed in the permit areas. Seventy-three temporary sedimentation structures have been removed and reclaimed or are approved for removal and reclamation by the regulatory authority. Peabody proposes to construct an additional 112 sedimentation ponds over the life of the mines. Again, many of these will be reclaimed during the life-of-mine timeframe when they are no longer needed to control runoff and sediment from the disturbed areas.

Sedimentation ponds and impoundments are designed to comply with the requirements of 30 CFR 780.11, 780.12, 780.25, 816.46, 816.47, 816.49, and 816.56, and other applicable regulations.

Permanent Impoundments

Fifty-one water sources consisting of three categories of impoundments determined to be needed to provide water for wildlife and livestock have been or are being proposed to exist permanently after mining is completed. These categories include pre-SMCRA internal impoundments, existing and proposed post-SMCRA internal impoundments, and existing and proposed water-control structures (sediment ponds). Nineteen permanent internal impoundments currently exist that are available for wildlife and livestock use as a part of the post-mining landscape. One additional internal permanent impoundment is being proposed for consideration in the permit application (J-19-RB). It would be located in the J-19 coal resource area. In addition, Peabody is proposing 31 existing or proposed temporary sediment-control structures as permanent impoundments. These include 9 existing Mine Safety and Health Administration structures, 20 existing sediment-control structures, and 2 proposed sediment-control structures. Being multi-purpose structures, these structures are used for sediment control during the life of the mine and reclamation operations and would be converted to permanent structures prior to final bond release.

Mine Safety and Health Administration-Size Impoundment Structures

Peabody uses 11 existing structures that meet the criteria of 30 CFR 77.216(a). Two structures would be temporary and 9 structures would be permanent. The primary purpose of these structures, except for the Kayenta Mine Fresh-Water Pond, is to control sediment from disturbed mining areas. The Kayenta Mine Fresh-Water Pond's purpose is to hold groundwater pumped from nearby Navajo-aquifer wells used for dust suppression.

Topsoil Stockpiles

Where prompt replacement of topsoil recovered ahead of mining disturbances is infeasible, numerous topsoil stockpiles are developed throughout the mine areas to store topsoil pursuant to 30 CFR 780.14(b)(5) and 816.22(c) until it is needed for revegetation operations. Stockpiled topsoil remains in place from less than 3 months to more than 10 years, depending on the location with respect to revegetation operations and the revegetation schedule. Stockpile dimensions, slopes, and volumes vary based on total salvage volumes, the configuration of the location site, and proximity to access roads. Using best management practices, stockpiles are placed on a stable site protected from wind and water erosion, and are not disturbed until required for redistribution.

Transportation Facilities

There are four types of roadways inside or crossing Peabody's permit area: primary roads, ancillary roads, non-mining-related roads (i.e., public roads and private roads), and pit ramps or routes of travel that are within the mining and spoil grading areas.

Primary and ancillary roads are located, designed, constructed, used, maintained, and reclaimed in accordance with the regulations and performance standards set forth under 30 CFR 816.150 and 816.151. Appropriate regulatory approval must be obtained for mine-related road crossings of stream buffer zones prior to construction of these crossings.

Within the primary and ancillary road classifications there are five sizes of roads based on use and traffic volume. There are three typical sizes of primary roads: (1) haul roads and mine-vehicle roads; (2) coal-haulage, mine-vehicle, and dragline-deadheading roads; and (3) mine-access roads. Two types of ancillary roads are used by lighter duty vehicles on a less frequent basis to access remote mine-facility sites, such as environmental monitoring sites; the first type is typically a two-lane road where an all-weather road is required to access remote sites, and the second type is usually a single-lane road that follows the natural topography (typically less frequently used than the first type).

All roads used or built by Peabody on or after December 16, 1977 will be reclaimed, unless they have been approved by the regulatory authority as a part of the post-mining land use plan. Because of the size and nature of Peabody's mining activities, very few of the roads in the latter category will be reclaimed until the end of mining activities on the entire leasehold. Exceptions include roads in the immediate vicinity of pits and ramps, which are created in the spoil and reclaimed as the general reclamation activities progress within a specific coal resource area.

Support Facilities

Support facilities include but are not limited to the following: mine buildings, offices and shops, bath houses, storage silos and cap magazines, coal-loading facilities, coal-crushing and -sizing facilities, coal-storage areas, equipment storage areas, water diversions and culverts, sheds constructed on permanent foundations and greater than 100 square feet in size, utilities, permanent fuel-storage and -tank farms, environmental monitoring sites, wells, and railroad and surface-conveyor systems (refer to Chapter 2, Map 2-2). New support facilities would be approved by OSM prior to construction regardless of their location. All disturbances for construction of facilities to support mining operations are contained within a designated disturbance area. Maintenance of all facilities and reclamation of temporary facilities is in accordance with the approved mining plan.

Coal-Washing Facility

As described in Chapter 2, if Alternative A of the Black Mesa Project is approved and implemented, Peabody would need to construct and operate a coal-washing facility at the Black Mesa mining operation in order to meet future coal-quality requirements of the Mohave Generating Station. The purpose of the coal-washing facility is to remove out-of-seam rock and mineral impurities commonly referred to as refuse from the coal, which results in less ash when the coal is burned. The coal-washing facility would be integrated into the existing Black Mesa coal-preparation facilities and thus would result in changes to both the facilities and the method of operation of the facilities. This section describes the coal-washing process, the changes that would be needed to integrate the coal-washing facility into the coal-preparation process at the Black Mesa mining operation, the effect the changes would have on potential fugitive dust emissions, and refuse disposal. No changes are proposed at the Kayenta mining operation coal-preparation facilities.

Coal-Washing Process

A coal-cleaning process would sort the coal as mined, sorting some to refuse and some to clean coal. This cleaning process would be accomplished using water-based technologies that use differences in specific gravity, so the chemical constituents of the individual particles would not be changed.

The coal-washing facility would consist of two parallel 600-ton-per-hour modules. Each module would consist of two cleaning circuits each consisting of heavy media cyclones (for coarse coals) and spiral concentrators (for fine coals). All raw coal greater than 1 millimeter (mm) in size would be segregated via vibrating screens and processed in large diameter heavy media cyclones. A heavy media process uses a finely ground (minus 0.044 mm) magnetite that is mixed with water to produce a medium of the desired specific gravity to separate the coal from the rock. The coal is mixed with the medium and pumped into the heavy media cyclones. The magnetite then is recovered from both the clean coal and refuse streams using drain and rinse screens in combination with magnetic separators, for reuse within the coarse coal circuit. Emissions from the storage and use of magnetite, prior to its becoming mixed with water, would be controlled with a baghouse.

The minus 1 mm fine raw coal is further segregated at 0.15 mm, with the use of classifying cyclones, so that a nominal 1-mm by 0.15-mm raw coal is produced and processed in spiral concentrators. The raw coal from the classifying cyclone, already mixed with water, is fed onto the spiral concentrators. Centrifugal force from the natural flow within the unit produces a specific gravity separation so that the coal can be separated from the refuse. All raw coal smaller than 0.15 mm segregated in the classifying cyclone circuit would not be beneficiated, but instead would be recovered as refuse.

Future Preparation Process and Facilities

The Black Mesa mining operation's preparation facilities would require changes in configuration and certain methods of operation to meet coal-quality requirements of the Mohave Generating Station, accommodate the coal-washing facility, and to reduce overall fugitive dust emissions. Primary changes from past operations would include: (1) increased hours of operation to accommodate growth in demand for coal at the Mohave Generating Station; (2) changes in the configuration and management of run-of-mine and clean coal stockpiles to achieve a more uniform product; (3) the like-kind replacement of the primary crusher; (4) removal of a pre-existing screen and secondary crusher; (5) modification of the coal-stacking and reclaiming systems; (6) addition of the coal-washing facility; (7) addition of the refuse-handling system; and (8) addition of new coal-quality sampling systems. Some relocation of conveyor belts also would be needed to accommodate the coal-washing facility. Figure A-1 provides a general flow diagram of the future coal preparation process.

As in the past operation, coal would be transported from one or more pits in off-road, bottom-dump or end-dump trucks to the coal preparation facility such that approximately 6.35 million raw tons would be produced. It would be dumped in one of three locations; the truck dump hopper, the run-of-mine stockpile, or a small off-specification oxidized coal stockpile. The run-of-mine stockpile would have separate zones for high- and low-ash coal. Coal would be recovered from the off-specification coal stockpile using a loader and trucks for transport to the truck dump hopper. Coal from the run-of-mine stockpile would be pushed to the truck dump hopper using rubber-tired dozers.

All coal passing the truck dump hopper is fed to the primary crusher where it would be crushed to a 2-inch minus size. Coal would leave the primary crusher via conveyor, would be sampled for quality, and would be transferred back to the run-of-mine stockpile into separate zones of high- and low-ash crushed coal by way of two new stacker tubes installed inside the footprint of the stockpile. The previous screen and secondary crusher would be eliminated.

From the crushed coal management zones in the run-of-mine stockpile, coal would be blended onto a new sub-grade reclaim conveyor belt for transport to the coal-washing facility. Track dozers would be employed for pile maintenance and reclamation of coal from the crushed coal zones of the run-of-mine stockpile. Total maximum feed to the coal-washing facility would be approximately 6.35 million tons annually. Approximately 950,000 tons (maximum) of refuse would be generated, conveyed to the refuse bin and loaded in trucks for disposal. This material would be wetted thoroughly as a result of the coal-cleaning process, and would not generate appreciable fugitive dust emissions.

Clean coal would be produced at an annual rate of approximately 5.4 million tons. This clean, thoroughly wetted product would be carried by conveyor to the clean-coal storage transfer point. Along the way a new two-stage sampling system would remove a small portion of the coal for quality analysis. The coal then would be conveyed either directly to the pre-existing live-storage facility or the clean-coal stockpile.

Coal conveyed to the clean-coal stockpile would be distributed based on quality among three new stacker tubes that would be installed within the existing footprint of the stockpile. A new sub-grade reclaim system would be installed and track dozers would continue to be used on the pile for maintenance and coal recovery purposes. The previously existing coal-reclaim system from the pile would be retained so the coal may be processed through the live-storage facility or delivered directly to the conveyors to the coal-slurry preparation facility.

There would be no changes to the remaining conveyor and sampling facilities that would convey clean coal from the mine to the neighboring coal-slurry preparation facility.

Potential Fugitive Dust Emission

The changes proposed at the Black Mesa mining operation's coal-preparation facilities have been designed to result in an overall net reduction in fugitive dust emissions from the facilities (Table A-1). The planned reduction in the number of coal stockpiles and elimination of the screening and secondary crushing processes more than offset the increase in emissions resulting from increased coal blending activities. While the emission estimates in Table A-1 are made on an uncontrolled basis for the purpose of assessing the worst case potential to emit, the facilities would be constructed and operated with emission controls. These controls include watering coal in the pit(s) during loading to reduce emissions when the coal is dumped at the stockpiles or hopper, deployment of water sprays at key process locations (e.g., the truck dump hopper, primary crusher, conveyor transfer points, stackers), partial or complete enclosure of key emission points (crusher, transfer points), and watering of coal stockpile aprons and haul roads.

Table A-1 Coal-Washing Facility Project Emission Changes

Emission Sources	Potential To Emit (tons/yr PM ₁₀) ¹		
	Increases	Decreases	Net Change
Crushers	7.66	6.19	+ 1.47
Screens	0.00	21.24	-21.24
Transfer points	0.24	0.29	- 0.05
Dozers/Loaders on coal stockpiles	17.2	1.30	+ 15.9
Unpaved haul roads	0.00	6.16	- 6.16
Wind erosion on coal stockpiles	32.37	29.51	+ 2.86
Baghouses	0.72	0.00	+ 0.75
Total	58.22	64.69	- 6.47

SOURCE: McVehil-Monnett Associates, Inc. 2006

NOTES: ¹Potential To Emit is calculated on an uncontrolled basis (no credit is taken for dust-control practices).

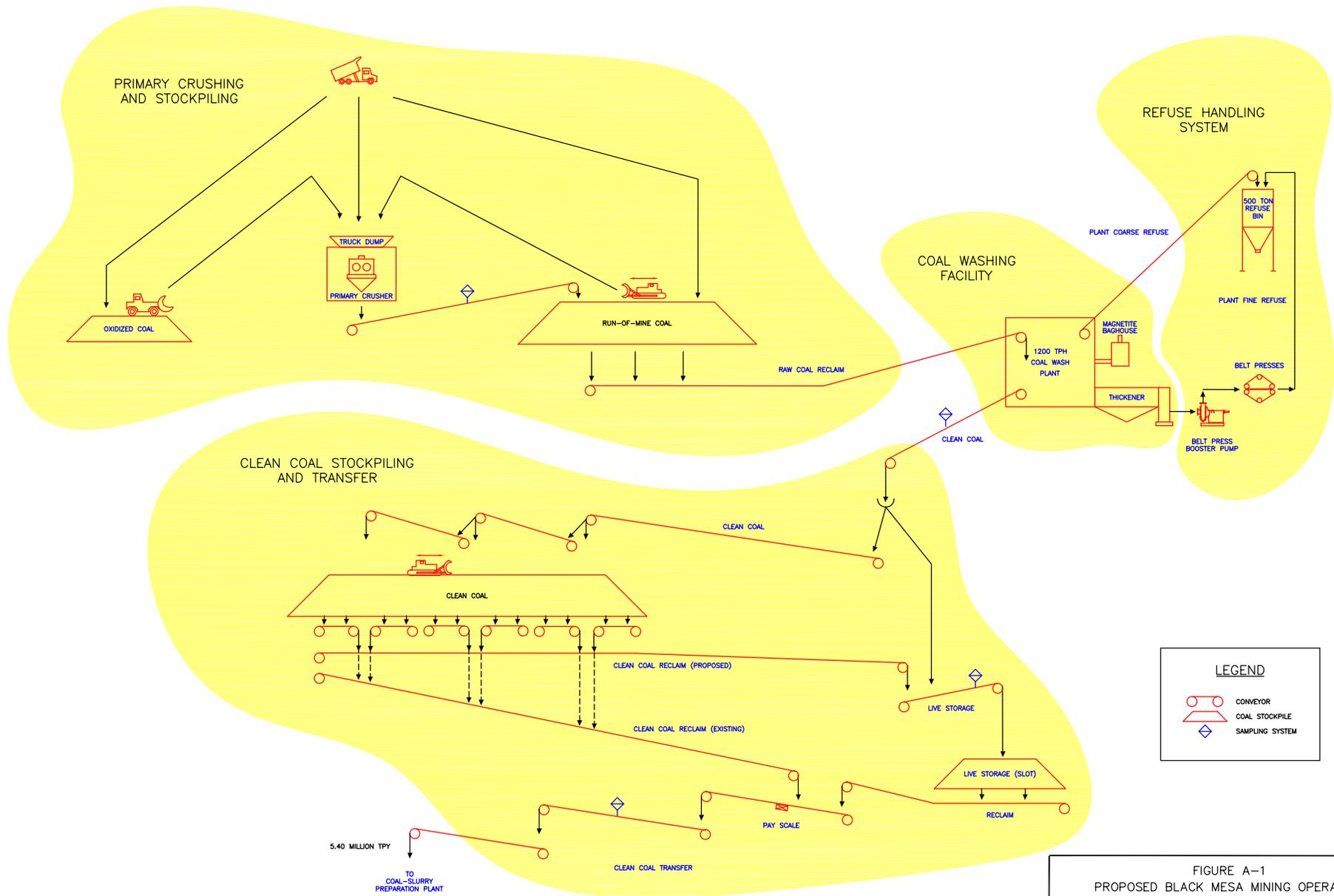


FIGURE A-1
PROPOSED BLACK MESA MINING OPERATION
COAL-PREPARATION FACILITIES LAYOUT

Refuse Disposal

The coal-washing facility would remove a maximum of about 950,000 tons per year of refuse, which would be returned to the mine pits for disposal. Prior to disposal, coarse refuse from the coarse refuse hopper would be mixed with the fine refuse (particle size less than 0.15 mm) exiting the coal-washing facility. The fine refuse would be dewatered prior to disposal using belt presses. The water would be cycled back to the coal-washing facility for reuse. No refuse piles or coal-mine-waste impoundments are proposed.

Peabody conducted a modeling study to determine the environmental consequences of disposing of refuse in the pits. The modeling study relied on leachate tests on waste material collected from coal core samples to provide chemical data, because actual coal-washing facility refuse material would not be available until operations resume at the Black Mesa mining operation. A degree of uncertainty was introduced to the study results because the coal core samples were not expected to have the same physical characteristics as the actual refuse material and were not subjected to a washing process.

As a result, Peabody would develop and submit for regulatory approval a refuse sampling and disposal plan that would be incorporated into the mining permit. The plan would be implemented when the coal-washing facility begins operating. The plan would consist of periodic sampling of refuse based upon the source (pit and seam) of run-of-mine coal being processed to ensure that a representative cross-section of the refuse material is sampled. Samples would be analyzed for an appropriate array of chemical constituents (including trace elements). The analytical data results would be compared to the chemical data assessed in the modeling study. If the analytical results from coal wash refuse samples exceed concentrations from the initial core samples, new model simulations would be conducted using the new data and the same models would be used to predict impacts in the study. If the coal-washing facility refuse sample data and model results do not deviate from the study data and model results, the refuse would be disposed of in the pits (N-06 and J-23) using standard practices currently outlined in the permit application. If the data and model results deviate significantly from the study and indicate the potential for greater impacts, Peabody would implement special refuse-disposal procedures such as placing the refuse in pit areas over preconstructed liners consisting of compacted clay spoil and capping the refuse with compacted clay spoils, or mixing the refuse with greater volumes of specially handled spoil having chemical characteristics suitable for diluting or neutralizing the refuse. Locations where special disposal procedures were implemented would be surveyed and recorded. Following final grading and reseeded, a downgradient spoil monitoring well would be installed and monitoring of water levels and chemistry would be conducted at frequencies and for parameters as described in the plan and approved by OSM to confirm that the special disposal procedures were effective.

Well Fields

No new well fields are proposed in the current permit application.

COAL MINING

This section contains a description of the mining methods, equipment, and coal production rates proposed by Peabody for the Kayenta and Black Mesa mining operations through the remaining life of the mines.

Peabody proposes to mine approximately 170.0 million tons of coal through the Kayenta mining operation between 2006 and 2026—approximately 8.5 million tons per year—for shipment by the Salt River Project Agriculture Improvement and Power District (SRP) to the Navajo Generating Station, using the Black Mesa and Lake Powell Railroad.

Peabody also proposes to mine approximately 105 million tons of coal through the Black Mesa mining operation between 2009 and 2026—approximately 6.2 million tons per year. This coal would be processed and transported by Black Mesa Pipeline, Inc. (BMPI) from Black Mesa to the Mohave Generating Station in Laughlin, Nevada, by way of the coal-slurry pipeline.

Mining Methods and Equipment

The Kayenta and Black Mesa mining operations practice a conventional form of strip mining called “area mining” wherein the overburden above the uppermost coal seam and the innerburdens or partings between the lower coal seams are removed in parallel strips across the coalfield until the area is mined. The overburden and partings are disposed of behind the active pit in previously mined pits where the bottom seam has been completely removed.

Clearing and Grubbing

Immediately prior to topsoil removal the area to be mined is cleared of large vegetation consisting primarily of piñon and juniper trees to facilitate topsoil recovery. The vegetation debris removed is placed at locations that would not interfere with mining operations. A majority of this material is made available to local residents as firewood and the remainder is either piled at the edges of the mining area to provide cover and nesting habitat for wildlife or buried in the pit during mining operations.

Topsoil Removal

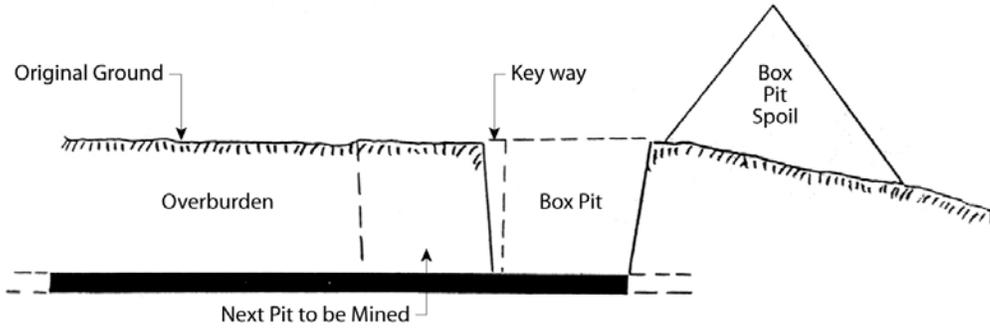
All suitable topsoil is removed from disturbed areas prior to initiating mining or mining-related activities. Prior to the start of removal operations, the proper salvage depth is staked or otherwise identified under the supervision of a soil scientist or other qualified person. Salvage-depth information must be adhered to by equipment operators. Topsoil material is removed throughout the year, weather permitting in 1,000- to 2,000-foot-long by 300-foot-wide sections. It is removed using scrapers or other earth-moving equipment and either hauled directly to recontoured areas for redistribution or transported to topsoil storage areas (stockpiles) located throughout the mine area for storage prior to eventual redistribution. Topsoil materials are removed up to 1,500 to 2,000 feet in advance of the active mining operation (i.e., active pit highwall) for safety and resource protection reasons.

Peabody implements dust control measures for topsoil stripping and redistribution operations. The cut of the topsoil removal areas and the ingress and egress routes to this area are included in watering operations. The ingress and egress routes to the topsoil lay-down area, where the final grading has occurred, also are watered. To reduce compaction, the lay-down area generally is not watered. Similarly, topsoil removal operations that place salvaged soil in stockpiles include watering as described above and often on the stockpile itself. Additional watering operations are conducted in the access routes to and from the equipment parking lot and the equipment parking and support areas.

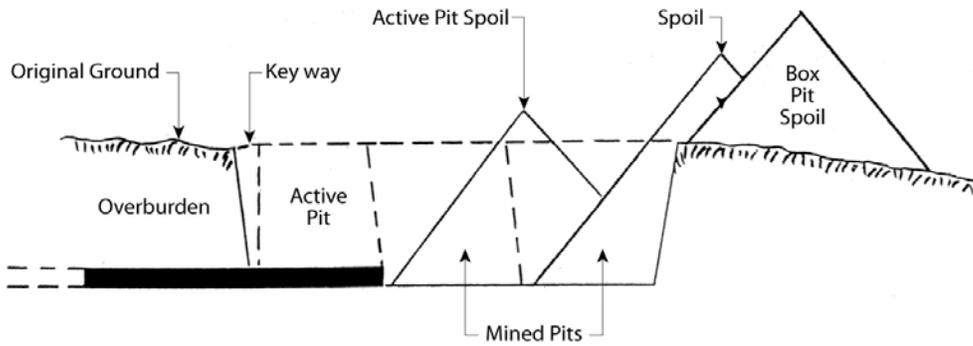
Overburden Removal

After being drilled and blasted, overburden material covering the shallowest coal seam is removed. The overburden is placed in piles in the previously mined pit along the side of the current cut using draglines and auxiliary excavating equipment. This process is repeated in sequential fashion as the pit advances into the coalfield (Figures A-2 and A-3).

INITIAL BOX PIT (End Cut Method)



SUBSEQUENT PITS



Note: Not to Scale

Figure A-2
Typical Pit Cross Sections

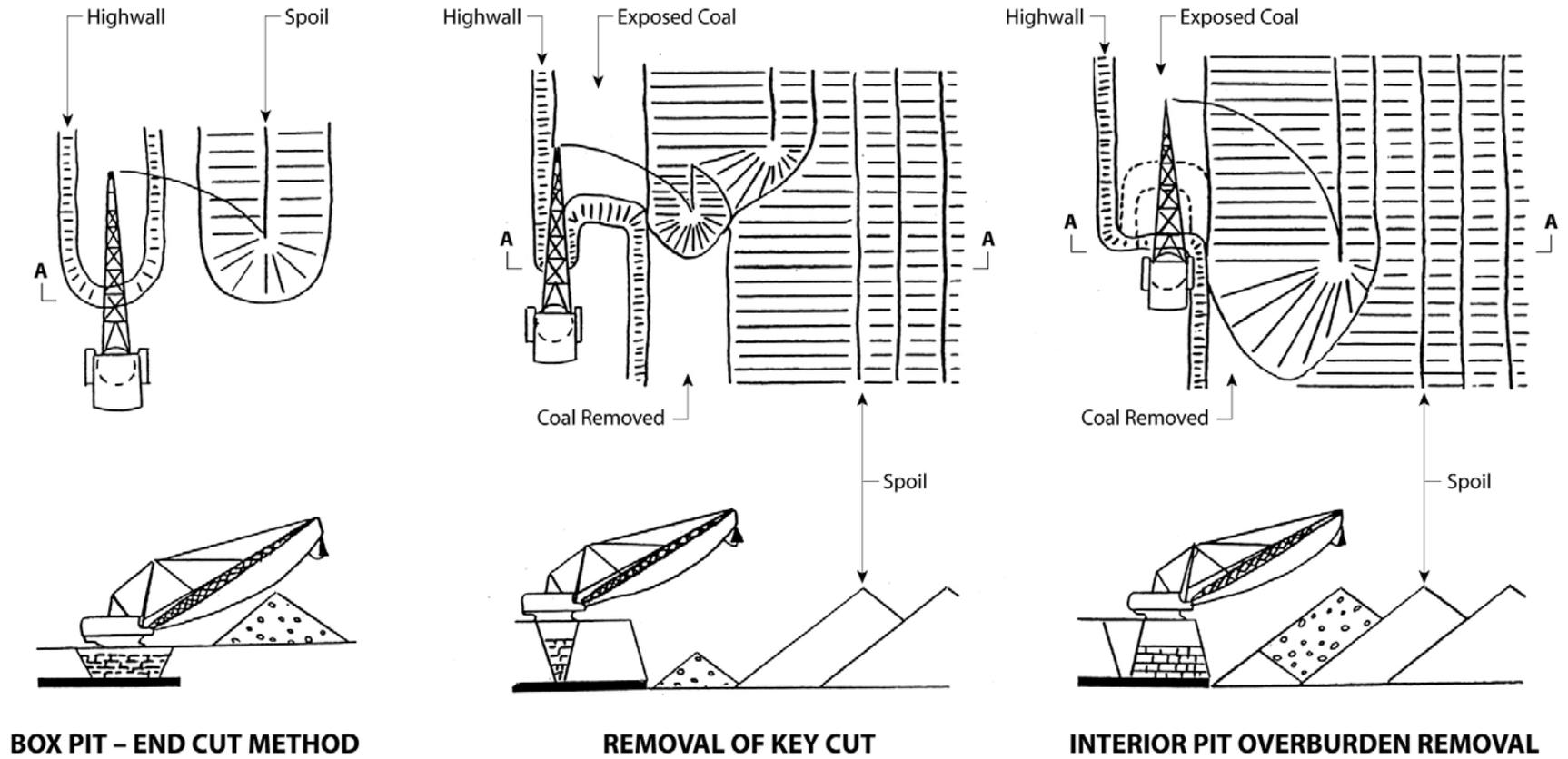


Figure A-3

Typical Pit Cross Section Showing Initial Box Pit and Subsequent Pits

Overburden and spoil material that would be used as topsoil supplements is identified and removed in much the same manner as topsoil material. Topsoil supplements may be handled throughout the year. Topsoil supplements are not stockpiled and therefore are hauled directly to recontoured areas for redistribution.

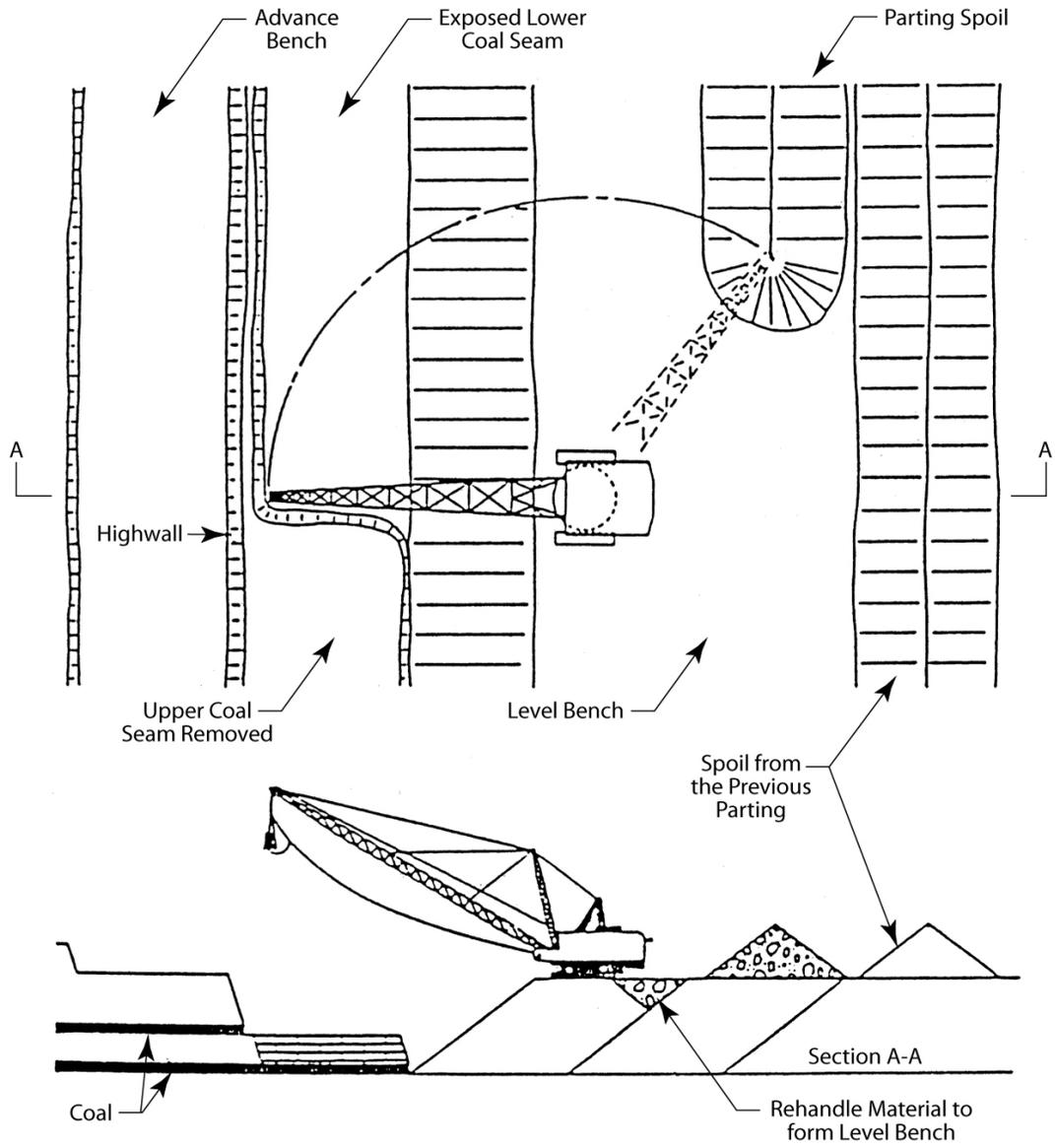
Draglines are also the primary excavators of partings or innerburdens (material between the coal seams) as thickness and field conditions indicate. Partings may vary in thickness from 6 inches to more than 50 feet in the lateral distance of one cut. After being drilled and blasted, partings are removed and placed within or along side the cut by draglines, backhoes, bulldozers, and/or truck and backhoe combinations, according to the operational requirements of each pit. Equipment such as trucks and backhoes or loaders and scrapers also may be used to assist with overburden or parting removal. When trucks and backhoes or scrapers are used, excavated material remains in the cut or pit area. A bulldozer is continually assigned to each dragline to perform bench leveling, access road preparation, trailing cable relocation, and miscellaneous duties.

The overburden excavation process begins with the digging of a narrow slot, or key cut, down to the coal seam to establish the highwall (refer to Figure A-3). The location of the key cut and the spoil establishes the width of the pit. The dragline is positioned above the area to be excavated and in line with the direction the cut is progressing. The dragline bucket is lowered to the material to be excavated, drawn toward the dragline, lifted, and swung to the side, at which point it dumps or spoils the excavated material into a previously mined cut or along the side of the cut onto unmined ground. This process is repeated until the entire area in front of the dragline has been excavated. The dragline then is repositioned and begins another key cut and starts the process again. This procedure is followed until the operational limits of the machine are achieved or pit boundaries are reached. At this point, the dragline “walks,” or deadheads, to where the next cut is to begin. The entire process starts again with each successive cut being excavated parallel to the previously mined cut and continues until excavation activities are complete within the pit.

Based on geological conditions and the mix of excavation equipment on Black Mesa, Peabody has defined the maximum recovery depth to be 180 feet. In some conditions, it may be economical to extend the maximum recovery depth to approximately 220 feet; however, this is evaluated by Peabody’s engineering department on a case-by-case basis.

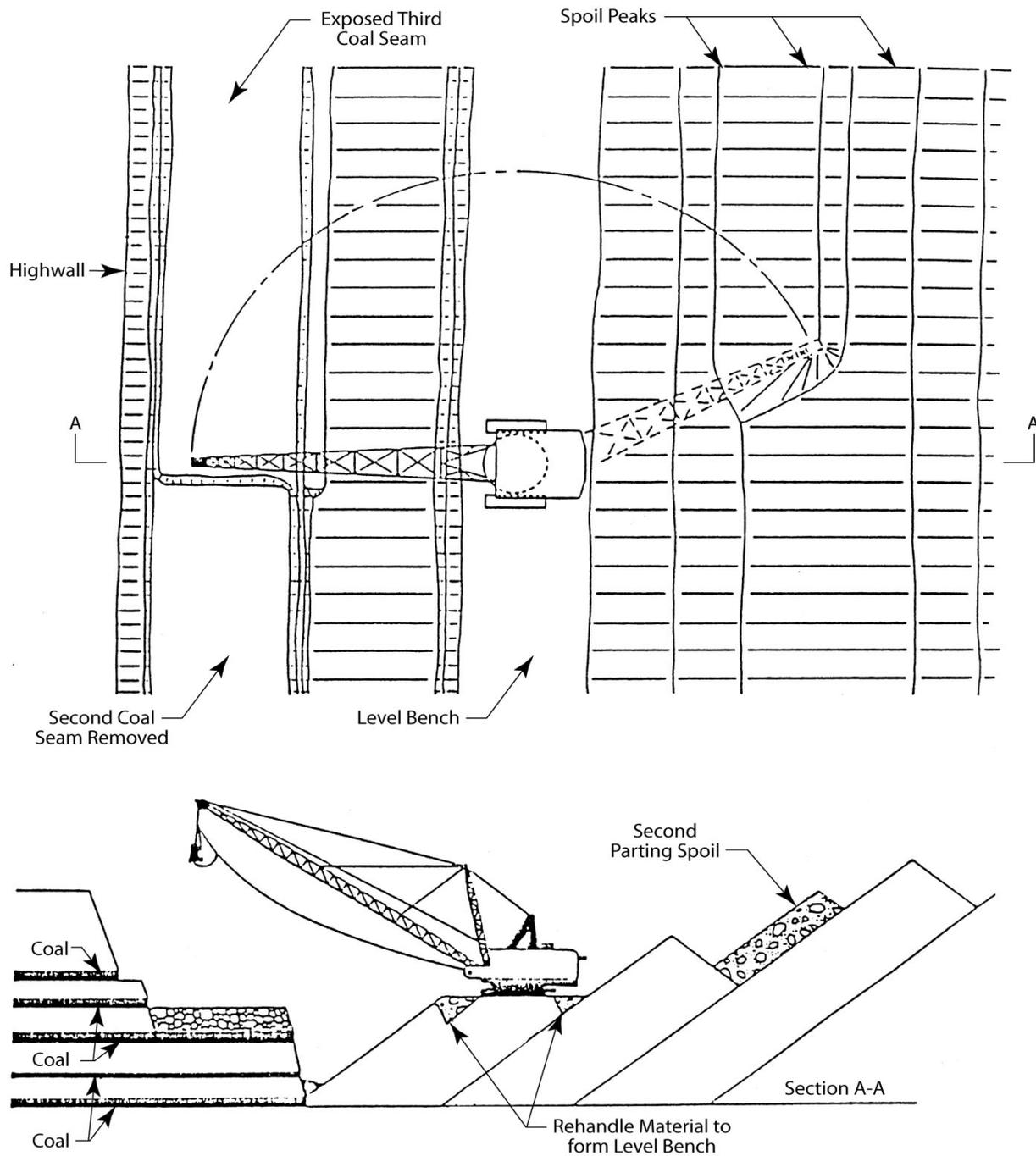
An alternative to the highwall-side overburden excavation process is to level a bench on the spoil side and position the dragline on the spoil side to excavate the overburden and pull back the spoil over the coal seam (Figures A-4 and A-5). The main advantage of this method is to enable the dragline, which has limited operating radius to handle overburden covers of greater depth than would normally be contemplated. Other advantages of this overburden excavation process include better coal recovery in deeper overburden, reduced auxiliary equipment required for overburden excavation, increased spoil stability, reduced material rehandle, and maintaining an adequate pit width. The disadvantages include the need to prepare a spoil-side bench, sequencing the spoil-side benching operation with the pit operations, and increased dragline cycle times.

Typically, at the Kayenta and Black Mesa mining operations, in deeper overburden, the upper coal seams may be uncovered on the highwall side and the lower seams uncovered on the spoil side. The positioning of the overburden removal equipment would be determined pit-by-pit to allow the most efficient coal recovery.



PLAN AND CROSS-SECTIONAL VIEW

**Figure A-4
Spoil-Side Overburden Stripping**



PLAN AND CROSS-SECTIONAL VIEW

Figure A-5
Spoil-Side Overburden Stripping

The selection of parting removal equipment is dependent upon the operational requirements within each pit. A dragline generally removes partings in excess of 15 feet; however, it may occasionally remove partings as thin as 5 feet. Backhoes and front-end loaders are used to remove partings that range in thickness from 3 to 15 feet. Occasionally, end-dump trucks are used in conjunction with a backhoe or front-end loader to remove partings within a pit. Bulldozers may remove partings that are less than 3 feet thick by first ripping the parting and afterwards pushing it off the coal seam to be removed.

Once the overburden or parting has been removed from above the coal seam, any remaining overburden material is cleared from the top of the coal seam using rubber-tired or track-type dozers.

The coal seam then is drilled and blasted using the same procedures that are followed to fragment overburden and partings. Rubber-tired front-end loaders and backhoes primarily are used to load the coal into haulage trucks for transportation to preparation areas. Backhoes are used in areas where thicker coal seams are to be loaded and mobility of the loader is not a prime consideration.

Haulage from pits to preparation areas is accomplished by bottom-dump trucks ranging in capacity from 150 to 250 tons. Occasionally, 150-ton end-dump trucks or smaller equipment also may be used. Haulage trucks are routed to pits as necessary to meet production and coal-quality requirements.

Backfilling

When all of the coal has been removed from the pit, overburden from the next parallel cut would be placed in the initial pit for backfilling. This would produce, in effect, an advancing pit that would continue until all the coal has been removed from the given coal resource area.

RECLAMATION

Surface Stabilization

Peabody has developed a plan in the permit application for establishing a reclaimed landscape that would minimize erosion and support post-mining land uses. Under this plan, factors such as hill slope gradient and length, soil properties, surface-soil mechanical manipulation techniques, site characteristics, and revegetation practices are evaluated using prescribed criteria to design the surface form, soil placement, and drainage plan. The Revised Universal Soil Loss Equation is applied to evaluate the effectiveness of the surface stabilization practices and determine the need for, and spacing of, gradient terraces on steeper slopes. Gradient terraces and down drains, in conjunction with surface protection and erosion control techniques, may be used when necessary to maintain landscape stability. With this plan, soil losses are predicted to be less than soil losses in pre-mining conditions.

Post-Mining Land Uses

The primary historical land use in the area has been livestock grazing—primarily sheep and goats. In recent years, the numbers of cattle and horses have increased. Other land uses include agriculture (primarily dry-land corn production), gathering of plant materials (for cultural, medicinal, and edible purposes), commercial trapping, various forms of outdoor recreation, and preservation of wildlife habitat. Reclamation efforts at the mine are directed toward restoring the land to be used for livestock grazing, wildlife habitat, and cultural plant use.

Post-Mining Topography

Backfilling and grading operations are designed to produce a diverse topography similar to the original landform, as discussed above regarding the surface stabilization plan. Material, including highwalls,

would be graded to slopes of 3h:1v or less. Rough-grading operations would be performed by bulldozers, scrapers, and occasionally, draglines. Bulldozers and scrapers are used for final grading.

Mine-Soil Reconstruction

Topsoil and topsoil-supplement redistribution operations ensure the replacement of a minimum of 4 feet of suitable plant growth media for revegetation, of which a minimum of 9 to 12 inches would be topsoil. Graded spoils determined to be suitable as a rooting medium would be covered by a minimum of 9 to 12 inches of topsoil. Graded spoils determined to be unsuitable are covered with a minimum of 4 feet of suitable material (overburden and/or topsoil). Redistribution of plant-growth media is accomplished whenever weather and soil moisture conditions permit, using scrapers, bulldozers, front-end loaders, backhoes, and end-dumps, and miscellaneous support equipment (road graders, water trucks, and farm tractors). This material is obtained from topsoil storage piles or hauled directly from topsoil material removal areas and supplemental sources (highwalls and spoil banks). Scoria or red rock that is suitable for plant growth is used in localized areas for reclamation of cultural plants, woody plants, and wildlife habitat.

Mine spoils are scarified prior to or immediately after topsoil material is distributed, to increase adhesion at the interface between the respective materials and relieve compaction. After redistribution operations are complete, contour furrows are installed perpendicular to the slope, using an offset disk unit with 36-inch disks. Revegetation treatments such as seeding, mulching, and erosion repair are all conducted on the contour to reduce the potential for downslope water flow.

Revegetation Plan

General

The revegetation plan has been developed to meet the requirements of 30 CFR 816.95, 816.97, 816.111, 816.113, 816.114, 816.116, and 816.133. Following topsoil replacement, surface mechanical manipulations, and seedbed preparation, revegetation is completed using a combination of applied seed mixes, mulching, and seedling planting programs. The best technologically available practices are used to accomplish all revegetation activities. The Rangeland Seed Mix, the primary seed mix used for revegetation, is composed of a minimum of 21 species, including warm and cool season grasses, forbs, and shrubs. The predominantly native seed mix is designed to meet the requirements of the above-cited regulations and meet nutritional requirements for livestock and wildlife. The Rangeland Seed Mix is split into drilled and broadcast components based on seedbed ecology needs of the seeded species and physical seed characteristics. Specialized seeding equipment is used to seed both components at the proper depths in one pass to reduce equipment traffic on the reclaimed surface. Several additional seed mixes are used in revegetating drainages or establishing wildlife habitat and sites for re-establishing cultural plants. The primary seeding season is from May to September, with a secondary seeding season available during spring and fall when ground conditions permit equipment operations.

Immediately following seeding of topsoiled areas, a native grass hay mulch is applied at 2 tons per acre and crimped. Native grass hay is more effective than straw and does not establish volunteer crops. Sites established with suitable plant growth substrates such as red rock or scoria are not mulched because of rough surface configuration and high coarse-fragment content. Following revegetation activities, the reclaimed areas are fenced to exclude livestock and are monitored for establishment.

Cultural Plant, Woodland, and Wildlife Habitat Revegetation

Peabody has developed and implemented a cultural plant restoration program on select reclaimed areas that also serves to reestablish woodland and wildlife habitat. Sites of one to several acres are prepared on north-facing slopes using red rock (scoria) suitable plant growth substrates. These sites are developed to simulate native site requirements of the target species. The sites contain numerous planting microsites due to roughened conditions created during substrate replacement operations. Plant materials are developed from local native seed collections with some regional sourcing as needed to ensure that plants are adapted to environmental conditions at the site and are capable of regeneration. Seedlings from these sources are grown in nurseries specializing in native plants. Specialized nursery cultural practices for the species being grown are used to develop these native plant materials. All seedlings receive mycorrhizal fungi applications for enhanced survivability and growth following planting. This ecological approach considers plant adaptations and symbiotic relationships common to plants in the arid Southwest. Seedlings are specially handled following greenhouse operations and are hand planted in a random distribution in the microsites present in the planting areas. More than 50 grass, forb, shrub, and tree cultural plant species are commonly included in this program.

Piñon/juniper woodland sites are re-established as a part of the cultural plant restoration program. Seedlings of piñon pine, Utah juniper, and to a lesser extent Gambel oak, are included in these planting efforts. Planted tree densities are 250 to 350 stems per acre and the minimum established density is 75 trees per acre. Live piñon transplants from salvage of 3- to 5-foot-tall trees in grubbing areas ahead of mining are transplanted annually to complement tree seedling planting. Approximately 200 trees are transplanted to select reclaimed sites annually during the winter dormant season.

Revegetation practices to restore wildlife habitat include the overall rangeland-seeding program, cultural plant and piñon/juniper woodland restoration, and additional woody species plantings around ponds and small depressions. The revegetation program is designed to establish diverse vegetation capable of meeting wildlife nutritional needs and other habitat factors such as cover or nesting. High-density shrub areas (greater than 800 stems per acre) are interspersed within the reclaimed landscape. Cultural plant/woodland/wildlife habitat sites also are interspersed within the reclaimed landscape. These features combine to increase edge and habitat diversity.

Revegetation Success

Revegetation success standards and their evaluation are structured to meet the criteria of 30 CFR 816.111 and 816.116. Standards are based on a combination of native reference areas and approved technical standards that reflect environmental site conditions, ecological considerations, and post-mining land uses. The criteria for evaluation follow both 30 CFR 816 requirements and other Federal guidelines and address the parameters of cover, production, woody density, and diversity.

Revegetated areas are included in an annual vegetation monitoring program to identify any needed remedial action, document trend and vegetation performance of reclaimed areas, contribute to the database for revegetation success evaluations, and provide data for implementation of post-mining land uses. The vegetation monitoring data are used to establish grazing levels in an approved grazing management program designed to enhance vegetation community characteristics and demonstrate achievable post-mining land uses.

Protection of Fish and Wildlife, and Related Environmental Values

General

Peabody's plan for protection of fish, wildlife, and related environmental values addresses the requirements of 30 CFR 816.97. The previous discussion under Revegetation Plan addresses re-establishment, mitigation, and enhancement of vegetative habit features and needs. Various sections of the approved permits address operations conducted to minimize hazards to raptors from electric power lines and how to design, locate, and operate roads and facilities that avoid or minimize impacts on wildlife and permit passage.

Nonvegetative wildlife-habitat-enhancement-or-replacement features include linear rock features and rock structures established at 1 acre per 100 acres with specified design criteria in the AZ-0001 and AZ-0001D permits. Raptor perches are established at a density of 1 acre per 400 acres. The perches are constructed based on the most appropriate technologically sound design criteria at the time of installation. Permanent impoundments and their numbers have been discussed previously in this appendix. These impoundments significantly enhance habitat, establish wetland vegetation, and provide a critical habitat feature previously not readily available in the pre-mine landscape.

Threatened and Endangered Species, and Species of Special Concern

Baseline studies and annual wildlife and vegetation monitoring address current species listed as threatened, endangered, or of special concern by Federal, tribal (Hopi or Navajo), or State agencies. Peabody promptly notifies the regulatory authorities of any Federal, tribal, or State listed species occurring on the permit area and would conduct the required mitigation or monitoring following consultation.

Surveys for nesting raptors in advance of active mining operations are conducted annually, and mitigation procedures are implemented as necessary after consultation with the regulatory authority if nesting raptors are located within the survey area. Prairie dog colonies are monitored annually for areal extent and sign of black-footed ferrets. If the size of a prairie dog colony exceeds the minimum acreage requirements in effect at the time, black-footed ferret surveys are conducted in accordance with guidelines specified by the regulatory authority. Mexican spotted owl surveys and monitoring were conducted over a 7-year period ending in 2000. Mexican spotted owl surveys will be reinitiated when mining activities are within 2 miles of any known nest site or the mixed-conifer habitat type adjacent to the lease area. Surveys or monitoring will be coordinated with the regulatory authority following approved protocols. Peregrine falcons were delisted in August 1999, and Peabody ended monitoring and breeding surveys in 2000. If listing status for the peregrine falcon changes or if the proximity of mining operations dictates, monitoring will be reinitiated after consultation with the regulatory authority. Mexican spotted owls and peregrine falcons were intensively monitored by Peabody from 1994 to 2000 and 1989 to 2000, respectively, with no apparent impacts on either species.

ABANDONMENT OF MINING FACILITIES

Abandonment activities would begin when particular facilities are no longer required to support mining operations. Facilities such as buildings, parking lots, roads, wells, and utilities that are requested to be kept by the tribes will be turned over to them. Other materials having economic value (such as structures and equipment) would be salvaged or recycled. All other materials would be disposed of using approved procedures and in accordance with the Navajo Nation Solid Waste Disposal regulations. All sites would be recontoured to conform to the natural landform, covered with topsoil, and revegetated, using the same post-mining techniques as those proposed for areas disturbed by mining.

In the event that cessation of mining operations was to occur in a coal-resource area with unmined but recoverable coal resources remaining, the following procedures would be implemented. If no further mining operations were to occur in the coal-resource area, final reclamation procedures, including backfilling and grading, topsoil replacement, and revegetation, would be carried out similar to all other areas proposed for mining disturbance as required under 25 CFR 211 and 30 CFR 59 and 132. Accurate survey information at the time of final mining operations would provide the location of final highwalls and coal-recovery limits in case mining is reinitiated at a future date resulting in a minimal loss of the coal resource. These procedures would minimize reffecting the land in the event of future surface coal-mining operations. In cases where the abandonment is temporary (temporary cessation), the coal seam(s) would be covered, access to the pit area would be blocked, and the highwall would be bermed for safety. Any backfill or cover material that contacts the remaining coal seam(s) would be inert and contain no combustible material. Sediment control and environmental monitoring of the area would be continued. Survey information at the cessation of operations would provide accurate location of the final highwall and coal-recovery limits to facilitate reinitiation of mining operations with minimal loss of the coal resource and minimizing any reffecting of the land as specified in 30 CFR 59 and 131. The decision to temporarily or permanently abandon operations is dependent on many factors including operational, market, contract, or customer.

Appendix A-2
Coal-Slurry Pipeline:
Typical Pipeline Construction,
Operation, and Maintenance

Appendix A-2 Coal-Slurry Pipeline: Typical Pipeline Construction, Operation, and Maintenance

INTRODUCTION

Reconstruction of the existing coal-slurry pipeline is proposed as part of the Black Mesa Project. This appendix provides a description of the typical construction procedures, operation and maintenance activities, and abandonment procedures associated with the pipeline. More detailed information specific to the Black Mesa Project would be prepared following engineering and design prior to construction, and would be documented in a construction, operation, and maintenance plan (or Plan of Development for the Bureau of Land Management [BLM]).

Black Mesa Pipeline, Inc. (BMPI) proposes to reconstruct the 273-mile-long coal-slurry pipeline to transport coal from the Black Mesa mining operation to the Mohave Generating Station. The pipeline would be welded steel with an external fusion-bonded epoxy coating to prevent corrosion. The existing pipeline consists of 260 miles of 18-inch outside diameter and 13 miles of 12.75-inch outside diameter steel pipe located at the western end into the Mohave Generating Station (Mileposts 260 to 273). (The length of the pipeline could differ if rerouted; detailed engineering and construction planning have not been completed and the length of the existing pipeline is given as an example.) The pipe diameter is reduced at Milepost 260 to absorb the excess pressure associated with a 3,000-foot drop in elevation near the end of the pipeline. Pipeline slopes are limited in order to limit build-up of solids in sags, which could occur during prolonged shutdown of the pipeline, as well as improve the system restart capability. The pipeline would operate 7 days a week, 365 days a year.

There are presently four booster-pump stations located along the existing coal-slurry pipeline, and no additional pumps would be needed. The length of pipeline sections between the pump stations are, in order, 82 miles, 42 miles, 53 miles, and 96 miles. Each pump station is a 10- to 20-acre fenced facility with the following principal structures: main pump building of steel-sided construction; residential trailers for employees; above-ground earthen water-storage reservoir; slurry settling and retention pond; pipeline fixtures including valves, piping, etc.; and an electrical substation. Pump Stations 1, 3, and 4 each have three electric-motor-driven pumps, and Pump Station 2, with a high-elevation lift, has four electric-motor-driven pumps. In full operation, nine pumps are operating with a spare pump on standby at each pump station. Each pump station has a water reservoir with sufficient water to flush out the downstream section and a dump pond to accommodate slurry from the upstream section in an emergency. The pump stations are controlled remotely via microwave linkage to a central control room in offices adjacent to the coal-slurry preparation plant attached to the Black Mesa mining operation. When in operation, each pump station is staffed with two technicians to provide routine maintenance and housekeeping. One of the technicians is on call at all times to handle unanticipated emergency situations.

CONSTRUCTION PROCEDURES

Pipeline

Construction activities would be performed by construction contractors that BMPI would retain and oversee. Any new pipeline alignment would be surveyed carefully and located to avoid areas of difficult terrain and other sensitive environmental and human features. Several other preconstruction activities would be completed prior to construction of the pipeline. These activities include, but are not limited to, verification of pipeline alignment; continued coordination with the landowners, land managers, and/or other affected interests; acquisition of permits; finalization of design; and procurement of materials.

Although there are no agency authorities that permit and regulate the pipeline, the provisions of the American Society of Mechanical Engineers (ASME) Code B31.11, “Slurry Transportation Piping Systems,” would be followed in the design, construction, operation, and maintenance of the coal-slurry pipeline. The construction supervisor would ensure that pipeline-construction activities are completed in conformance with all applicable requirements and that all environmental mitigation measures are identified and stipulations adhered to. All mitigation requirements would be incorporated into the project construction specifications and disseminated during preconstruction briefings so that mitigation requirements are understood by on-site construction and inspection personnel. Both the construction and maintenance activities would be performed in a manner that would minimize adverse effects on environmental cultural resource values. The Navajo Nation and Hopi Tribe would be consulted to ensure that all clearing, grading and construction activities where they have jurisdiction are conducted in such a manner as to minimize disturbance to traditional life ways. The Hopi Tribe and Navajo Nation would be consulted to ensure that all clearing, grading, and construction activities, where they have jurisdiction, are conducted in such a manner as to minimize disturbance to traditional lifeways.

Environmental inspectors would oversee all field activities. The environmental inspectors’ responsibilities would include, but not be limited to, inspecting erosion control, water resources, cultural resources, vegetation, protected wildlife species, and protected areas. The environmental inspectors also would evaluate the success of revegetation and stabilization of the right-of-way following construction. If deficiencies in the establishment of vegetative cover are discovered, the environmental inspectors would report these to the construction supervisor. All erosion-control devices are to remain in place and in a functional condition until stabilization is achieved, at which time the temporary erosion-control devices would be removed and disposed of in compliance with conditions agreed upon for the project. The environmental inspectors would oversee these activities as they are performed.

One construction spread of 400 personnel would be needed to complete the reconstruction of the coal-slurry pipeline. The majority of the construction work would be completed by a qualified workforce under contract to BMPI. Local workers would be employed to the extent practicable. Construction contractors may base their operations in Flagstaff, Arizona, and the base of operations may move as construction is completed along the pipeline.

It is anticipated that construction would take place over a period of approximately 18 months, with an anticipated start date of January 1, 2008, or as soon thereafter as the project is authorized and all permits have been issued. The in-service date of the Black Mesa Project is planned to be December 31, 2009. Commissioning and start-up of the coal-slurry pipeline is anticipated to require approximately 6 months after construction is complete.

Water Pollution Control

Construction activities would be performed by methods that would prevent entrance, or accidental spillage, of solid matter, contaminants, debris and other pollutants and wastes into streams, flowing or dry watercourses, lakes, and underground water sources. Such pollutants and wastes include but are not restricted to refuse, garbage, cement, concrete, sanitary waste, industrial waste, radioactive substances, liquid or semi-liquid petroleum products (oil), aggregate processing tailings, mineral salts, thermal pollution, and drilling fluids other than water. All construction activities would be performed under a Storm Water Pollution Prevention Plan (SWPPP).

Dust Abatement

The construction work would comply with all applicable Federal, tribal, State, and local laws and regulations regarding the prevention, control and abatement of dust pollution. The construction activities

would use efficient methods wherever and whenever required to prevent dust nuisance or damage to persons, property, or activities, including but not limited to crops, orchards, cultivated fields, livestock, wildlife habitats, dwellings and residences, agricultural activities, recreational activities, traffic, and similar conditions. Methods of mixing, handling, and storing cement, concrete aggregate, and other fine particulate matter would include means of eliminating atmospheric discharges of dust. The construction activities also would use watering trucks for dust abatement, where required.

Air Pollution Control

Construction activities would comply with applicable Federal, tribal, State and local laws and regulations concerning the prevention and control of air pollution. The construction activities would use such methods and devices as are reasonably available to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants. Equipment and vehicles that show excessive emissions of exhaust gases would not be operated until corrective repairs or adjustments have been made to reduce such emissions to acceptable levels.

Preservation of Historical and Archeological Data

If untreated archaeological or historical resources were discovered during construction, the work would cease immediately at that location and measures would be implemented to protect those resources while the find is evaluated. The appropriate agencies would be notified to implement the discovery plan defined by the Section 106 Programmatic Agreement and Treatment Plan developed for the project. If the discovery includes American Indian remains, the discovery would be treated pursuant to the applicable laws and regulations, as stipulated by the Programmatic Agreement. If the discovery included paleontological resources, the appropriate land-managing agency would be notified so that the discovery could be addressed in accordance with any applicable regulations.

Noise Abatement

Measures to reduce noise generated from construction activities when the activities are within 0.5 mile of a noise sensitive receptor (occupied dwelling) would be implemented, when required. The need for such measures would be determined during construction after evaluating the conditions on site (e.g., prevailing wind direction, the proximity of noise sensitive receptors, terrain, or presence of natural sound buffers that may alleviate the need for implementing noise reduction measures). Such measures may include, but are not limited to, the use of temporary sound baffle walls.

Light Pollution Abatement

Permanent and/or temporary artificial lighting used during construction and for permanent operations and maintenance would be directed to shine downward at an angle less than horizontal and aimed so that it is directed away from any residences and shielded so as not to include a residence in its direct beam. Any lighting would abide by Hopi Tribe and/or Navajo Nation laws governing light pollution. If there are none, the lighting would conform to State or county laws governing light pollution, whichever is more stringent.

Standard pipeline construction techniques would be employed along the pipeline route and would typically involve the following sequence: surveying and flagging the right-of-way, clearing and grading, excavation, stringing, bending, welding, field joint coating, lowering in, backfilling, hydrostatic testing, cleanup, restoration, and post-construction monitoring. Figure A-6 provides an illustration of the typical pipeline construction sequence. Vehicles and equipment typically include light-, medium-, and heavy-duty trucks, dozers, front-end loaders, backhoes, motor graders, cranes, a sideboom, a bending machine, welding machines, pipe cradles, a water pump, and air compressors.

Clearing and Grading

Construction activities would exercise care to preserve the natural landscape and would be conducted to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for temporary and permanent work, approved roads, or excavation operations, all trees, native shrubbery, and other vegetation would be preserved and would be protected from damage as is practicable. Clearings and cuts through vegetation would be minimized to the greatest extent practicable, and the clearings and cuts required or otherwise authorized would be shaped irregularly to soften undesirable aesthetic impacts. On completion of the work, all work areas would be left in a condition that would facilitate revegetation, provide for proper drainage, and prevent erosion. All unnecessary destruction, scarring, damage, or defacing of the landscape resulting from the construction would be repaired or otherwise corrected.

Vegetation would be cleared and the construction right-of-way would be graded to provide safe and efficient operation of construction equipment. Most of the coal-slurry pipeline would be constructed on the existing right-of-way, which was cleared during construction of the current pipeline. Topsoil would be stripped and segregated from subsoil in accordance with landowner or land-manager agreements. Space would be provided for temporary storage of spoil material and topsoil salvaged from the excavation. Figure A-7 shows a cross section of a typical construction right-of-way. The width of the right-of-way would be restricted to avoid undue surface disturbance to adjacent resources. The right-of-way boundaries are the limits of work and would be clearly staked or flagged. No disturbance would be allowed beyond the right-of-way limits.

Brush and shrubs within the right-of-way would be cut or scraped at/or near the ground level. Except for the area to be excavated for the trench, the vegetative root system and subsurface soils would be left intact to the greatest extent practicable. This would assist in stabilization of the soils within the right-of-way throughout construction. Timber and other vegetative debris may be chipped for use as erosion-control mulch, cut and stacked along the construction area, or otherwise disposed of in accordance with applicable regulations and landowner or land-manager preference.

The construction area would be graded to create a suitable work surface for construction vehicles. Grading would be performed by bulldozers, road graders, or other earth-moving equipment.

Clearing, grading, or other construction activities would not be conducted during conditions when the soil in the right-of-way of access roads is too wet to adequately support construction equipment. If construction equipment creates excessively deep ruts, support of equipment would be deemed inadequate and construction activities would be suspended until soil conditions improve.

Fences crossing the right-of-way would be braced, cut, and temporarily fitted with a gate to permit passage. During construction, the opening would be controlled as needed to prevent undesired passage. Upon completion of construction activities, existing improvements (e.g., fencing, cattleguards) would be replaced, braces left in place, and a permanent gate installed.

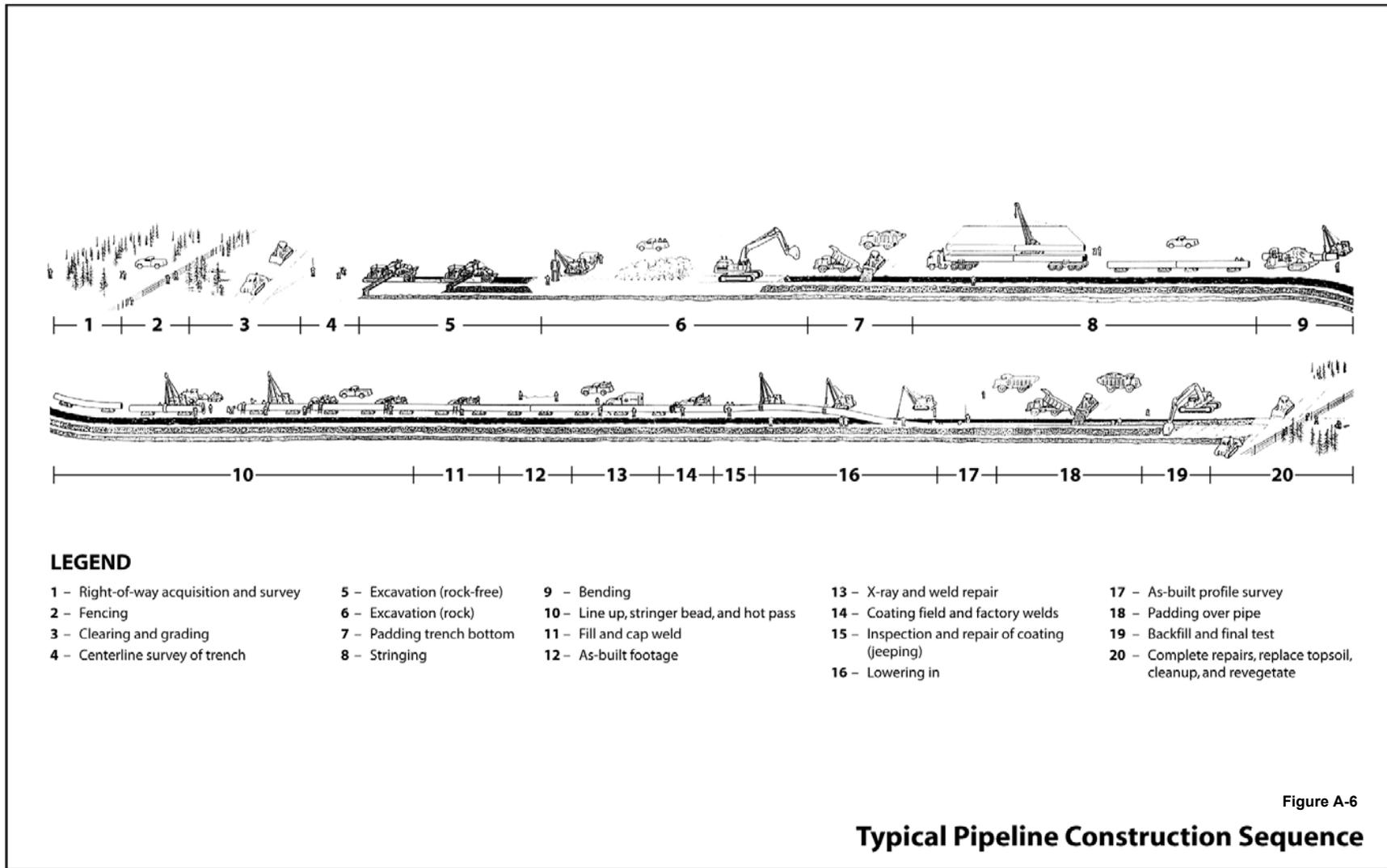
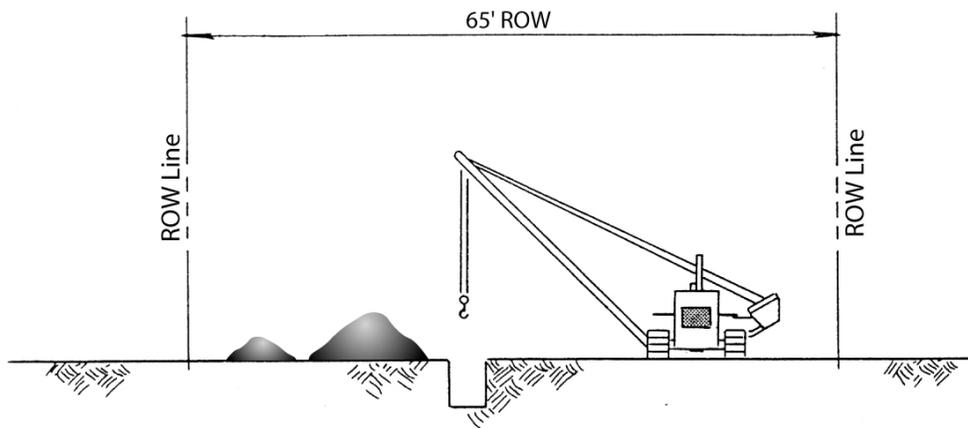
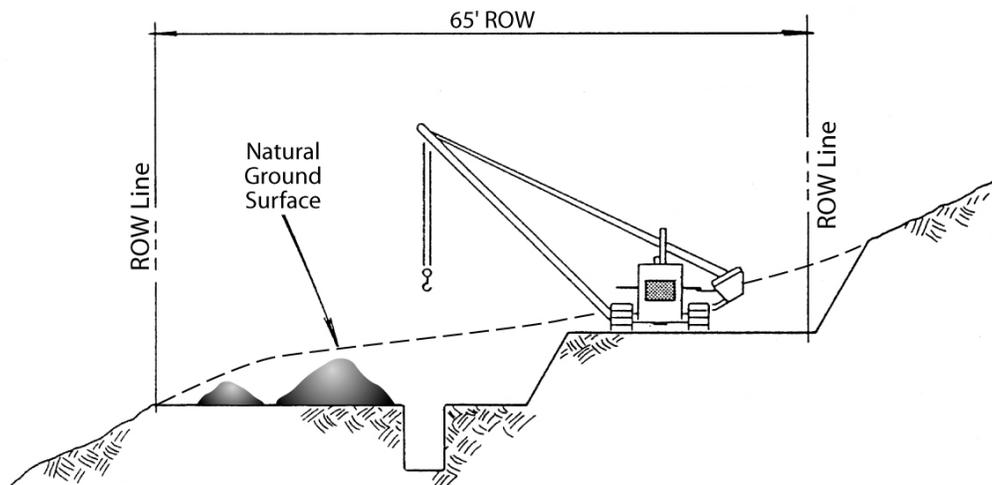


Figure A-6

Typical Pipeline Construction Sequence



CROSS SECTION ON EVEN TERRAIN



CROSS SECTION ON SLOPING TERRAIN

Figure A-7
Typical Cross Section on Varied Terrain

Best management practices that would be used by BMPI would minimize soil erosion and sedimentation during pipeline construction follow.

A SWPPP would be developed as part of final engineering and construction planning that would include measures to minimize soil erosion and sedimentation during and following pipeline construction. The following general soil erosion and sedimentation minimization best management practices would be included in the plan:

- Potentially erosion-sensitive areas would be identified and specific mitigation measures to address these areas included in the SWPPP.
- Weather would be considered when scheduling activities and monitored during construction to allow implementation of soil stabilization and sediment-control measures prior to the onset of adverse condition.
- Clearings and cuts through vegetation would be minimized to the extent practicable.
- Except for the areas to be excavated, the vegetative root system and subsurface soils in the construction zone would be left intact to the extent practicable.
- The quantity and duration of soil exposure would be minimized to the extent practicable.
- Dust-control measures would be implemented as needed to minimize nuisance dust.
- Temporary erosion controls would be installed and maintained during construction where site conditions warrant to reduce water velocity and redirect runoff from precipitation.
- Suitable diffusers and/or energy dissipation techniques would be used when discharging project water to washes, charcos, or approved depressions.
- All work areas would be left in a condition that would facilitate revegetation, provide for proper drainage and prevent erosion.
- Original land contours would be restored to conform to adjacent areas as near as practicable.
- Vegetation compatible with the planned land use and existing biotic community would be re-established following final grading as agreed to by the relevant regulatory agencies, tribes, and/or private landowners.
- In agricultural areas, subsoil would be scarified and the segregated topsoil returned to its original grade.
- Permanent erosion- and sediment-control measures such as diversion terraces would be installed as conditions warrant.
- Following construction, all erosion-control measures would be inspected and monitored as needed until final stabilization is achieved.

Excavation

Excavation of the pipeline trench would follow right-of-way clearing and grading. The majority of the excavation would be accomplished using machinery such as a ditch wheel that cuts a vertically sided trench approximately 36 inches wide (at the bottom) and generally to a depth sufficient to accommodate a minimum of 30 inches of cover in areas of normal excavation. Where excavation would occur in bedrock areas, the pipeline would be installed with a minimum of 18 inches of cover. In areas requiring special construction techniques (e.g., road and stream borings), the pipeline would be placed deeper. Topsoil and

subsoil would be sidecast to the same side of the trench in a two-pass excavation process. The first cut would be a shallow excavation that removes the topsoil and stockpiles it to the far edge of the nonwork side of the trench. The second cut would be the deeper excavation of 4 to 4.5 feet that removes the subsoil and also stockpiles it to the nonwork side but adjacent to the trench. It is anticipated that a maximum length of trench open at any one time would be approximately 2,500 feet for about three days.

Construction Methods in Special Areas

Specialized construction procedures would be used for construction activities in rugged terrain, residential areas, agricultural areas, and at road, railroad, and water-body crossings. However, civil and environmental surveys have not yet been conducted and determination of construction methods has not been made.

Steep Topography. Where severe side slopes are encountered, two construction techniques typically would be used. Using the cut-and-fill technique, the upslope side of the construction right-of-way would be cut during grading. The material removed from the cut then would be used to fill the downslope edge of the right-of-way in order to provide a safe and level surface from which to operate the heavy equipment. Alternatively, side-hill construction could use “two-toning” to provide two levels of work area. Side-hill areas could require additional temporary workspace downslope in order to effectively use these techniques. During grade restoration, the spoil would be placed back in the cut to restore approximate original contours.

Areas of steep slopes may require the use of winching techniques. In such circumstances, construction would require the use of winching tractors to hold each piece of equipment while working on the slopes to address safety concerns. The use of winch tractors in such areas would be necessary during both construction and restoration phases. The slopes would be restored to approximate original contours, and frequent trench and slope breakers would be used to reduce runoff and direct flow to vegetated areas off the right-of-way (refer to Figure A-7).

Road and Utility Crossings. Paved roads and highways would be crossed by horizontal boring at a specified depth beneath the surface. This method would be employed to avoid disruption of traffic. Heavier-wall pipe would be installed under the crossing.

Underground pipelines or utilities generally would be undercrossed. For such crossings, prior contact with the utility would have established any requirements for work performance or restoration. Before construction begins, the “one-call system” would be used for locating and marking the existing utility. At a minimum, the bore typically would allow a clearance of 12 inches between the proposed pipeline and other pipeline or utility. On either side of the crossing, the trench typically would not be excavated any closer than 5 feet from any existing pipeline or utility encountered in the right-of-way.

Water-body Crossings. There are several different construction methods that can be used to install pipelines at watercourse or water-body crossings. The pipeline installation method typically used depends on the size and sensitivity of the water body. The pipeline would cross some water bodies that are dry during much of the year. At these crossings, construction would occur during the dry season using conventional open-trench methods. The pipelines would be buried at sufficient depths, both on the banks and in the stream of the water body, to avoid future scouring that may expose or undermine the pipeline.

Typically, construction within water bodies would be completed as a distinct and independent construction operation from other work on the remainder of the right-of-way. This would allow the scheduling of crews and equipment to expedite construction activities across water bodies.

With the exception of the initial clearing equipment, only the equipment needed for instream excavation and backfilling would be allowed in the stream channel. All other construction equipment would cross the water body on temporary equipment bridges.

Horizontal directional drilling involves the use of a remotely guided drill head driven by a rotary drill rig using a drilling mud system for lubrication, cutting return, and to maintain hole integrity. In certain cases, this method is preferable since the pipeline is drilled underneath the watercourse with very little disturbance to the bed or banks of the watercourse. Pipe sections somewhat longer than the length of the drilled hole are strung and welded opposite the drill rig and then pulled back through the hole using the drill rig.

Use of this technique involves drilling a pilot bore hole underneath the watercourse towards a surface target, and back reaming the bore hole to the drill rig, then passing the reamer back to the opposite bank where the pipe is attached and pulled back toward the drilling rig. This process typically uses the freshwater gel mud system composed of a mixture of clean, fresh water as the base, a biodegradable or biopolymer drilling fluid lubricant as the viscosifier, and synthetic polymers to transport drilled spoil, reduce friction, and stabilize the bore hole. This method is less intrusive and is more favorable than an open-cut water crossing because it minimizes the potential to impact aquatic ecology.

One of the risks associated with horizontal directional drilling is the potential for escape of drilling mud into the environment as a result of a spill, tunnel collapse, or the rupture of mud to the surface. These ruptures are caused when excessive drilling pressure results in drilling mud propagating vertically toward the surface. If a rupture occurs in a watercourse, the fine clay particles can settle onto the bottom of the watercourse. The risk of ruptures can be reduced through proper geotechnical assessment practices, good drilling planning and execution, careful monitoring, and having appropriate equipment and response plans ready in the unlikely event that one occurs.

Pipe pulled into the directionally drilled holes would have a factory-applied coating of fusion-bonded epoxy and an overcoat of epoxy-based polymer concrete if stones, boulders, or solid rock are anticipated. Instead, the pipe would have a factory-applied coating of either epoxy or urethane. After welding the seams together, the joints would have the coating repaired.

Typically, the direction drilling would be done by a specialized crew of about 11 people using a directional drill rig, weld machines, and a small crane. Any other required equipment or personnel would be taken from the pipeline-installation crew.

This method would be used to install the pipeline beneath the Colorado River between Laughlin, Nevada, and Bullhead City, Arizona, and under the Little Colorado River east of Cameron, Arizona. At the crossing of the Colorado River near Bullhead City, the bore would begin about 200 feet from the eastern edge of the Colorado River channel, extending under the Colorado River at a depth of approximately 50 feet below the channel bottom (90 feet below ground surface). The bore would continue underground for approximately 3,300 feet and would exit the ground inside the fenced yard of the Mohave Generating Station. This virtually would eliminate all surface disturbance on the Nevada side of the Colorado River. All drilling operations would be confined to an approximate 200-foot by 200-foot temporary workspace at the entry site, a 100-foot by 150-foot temporary workspace at the exit location, and right-of-way along the path of the horizontal bore that would include the staging area for pipe strings for the pull backs.

At the crossing of the Little Colorado River, east of Cameron, the existing pipeline is buried in a trench. Horizontal drilling would be used to install the new pipeline beneath the river. The pipeline would be buried deep enough below the surface of the water channel and banks to avoid future scouring and/or erosion.

Blasting. It is not anticipated that blasting would be required along the coal-slurry pipeline alignment, as most of the pipeline follows and is adjacent to the existing pipeline, which required some blasting during the original construction and which is expected to have fractured the adjacent rock. If blasting would be necessary, all required authorizations would be obtained and all safety precautions observed. All blasting would be conducted in compliance with Federal, tribal, State, and local laws, regulations, and policies. After blasting has been completed, backhoes would be used to clean the trench for pipe installation. If blasting were required, the following safety precautions, at a minimum, would be taken:

- In areas near human use, blasting would be blanketed (matted).
- Landowners or tenants in proximity to the blasting would be notified in advance so that livestock and property could be adequately protected.
- Before blasting, the affected area would be checked to ensure that construction personnel, other persons, and all equipment are out of the danger area. Where blasting occurs adjacent to public or private roads, flagmen would be stationed at safe distances to control traffic and protect the public.
- Blasting would be controlled or limited where damage to rock mass could create slope instability.
- Extreme care would be used to avoid any damage to underground structures, cables, pipelines, springs, wells, or other water supplies. In areas where blasting is not feasible due to proximity to these items, the trench would be dug by conventional techniques.
- Blasting would not be used within or near stream or river channels without prior consultation with the appropriate jurisdictional agencies to determine what protective measures, if any, would be required to minimize damage to fish and aquatic life.

Stringing and Bending

Pipe would be shipped directly from the manufacturer by rail or truck to the storage sites for the coal-slurry pipeline. Potential sites include Flagstaff, Williams, Kingman, and Seligman, Arizona. The four fenced BMPI pump stations also would be used as construction staging areas. From those locations, the pipe would be hauled by truck to the pipeline right-of-way. Each segment of pipe would be unloaded by cranes or tractors equipped with side booms and slings, and strung parallel to the trench. The stringing operation would be coordinated with trenching and installation activities to minimize the amount of construction time.

After the segments of pipe are strung along the trench, but before the joints are welded together, pipe segments would be bent to accommodate horizontal and vertical changes in direction. Such bends would be made using an approved, cold, smooth bending machine with hydraulically operated equipment that makes the bend.

Welding

After the pipe is bent, the pipe segments would be aligned end-to-end and clamped into position. The coal-slurry pipeline then would be welded in compliance with ASME Code B31.11, "Slurry Transportation Piping Systems," and American Petroleum Institute 1104, "Standard for Welding

Pipelines and Related Facilities” (latest edition). Welds would be visually inspected by a qualified inspector and would be radiographically inspected. A contractor certified to perform radiographic inspection would be employed to perform this work. This inspection would adhere to ASME B31.11. Any defects in the welding would be repaired or removed as required by the specified regulations and standards.

Coating

As mentioned previously, the exterior would be coated with a fusion-bonded epoxy. After welding, field joints would be coated with applied fusion-bonded epoxy. Before the pipeline is lowered into the trench the coating would be inspected visually and mechanically, and any faults or scratches would be repaired.

Lowering and Backfilling

Once the coating operation has been completed, the pipeline would be lowered into the trench. Side-boom tractors would be used to simultaneously lift the pipe, position it over the trench, and lower it in place. The pipeline and trench would be inspected to verify that minimum cover is provided, the trench is free of rock or debris, external pipe coating is not damaged, and the pipe is properly fitted and installed into the trench.

After the pipeline is lowered into the trench, the trench would be backfilled with the excavated soil. Previously excavated materials would be pushed back into the trench using bladed equipment or backhoes. In areas where topsoil was segregated during trenching, the subsoil would be replaced in the trench first, followed by placement of the topsoil. Where the previously excavated material contains large rocks or other materials that could damage the pipe or coating, clean fill or protective coating, such as rock shield, would be placed around the pipe prior to backfilling. In order to maintain soil porosity in agricultural areas, no soil tamping would be performed as part of the backfilling process. As a result, a small crown of material would be left to account for future settling.

Cleanup and Restoration

After the pipeline has been installed, backfilled, and successfully tested, the right-of-way, temporary work areas, and other disturbed areas would be finish-graded and any remaining construction debris would be disposed of properly. Original land contours would be restored to conform to adjacent areas as near as practicable. In upland agricultural areas, subsoil would be decompacted and the segregated topsoil would be returned to its original horizon. Permanent erosion- and sediment-control measures, including diversion terraces and revegetation, would be installed at this time. In all wash crossings, the disturbed areas would be restored and revegetated. Additionally, each wash crossing would be re-inspected and monitored after the restoration activities have occurred to ensure that natural flow patterns and revegetation have successfully occurred. All viable, protected plants, including cacti and yucca, would be salvaged and used during restoration. Reseeding on public lands would be done with native species found in the area. Private and public property such as fences, gates, driveways, and roads disturbed by pipeline construction would be restored to original or better condition.

All waste materials including, but not limited to, excess spoils, waste materials, rubbish, sanitary waste, roadway pavement materials, etc., would be disposed of at the conclusion of construction in approved disposal facilities according to its type. Excess rocks, not reburied in the trench, would be scattered within the right-of-way in a way that would not impede vehicle or game movement. Windrows of rock would not be allowed. Materials would be recycled whenever practical. The disposal of all materials would be in accordance with applicable Federal, tribal, State, and local laws and regulations.

Should a conflict exist in the requirements for cleanup and disposal of waste materials, the most stringent requirement would apply. Records would be kept of the types and amounts of waste materials produced during construction and of the disposal of all waste materials on or off the job site.

In addition, an environmental site assessment would be performed at the following construction locations: all hazardous waste accumulation areas and all hazardous material and petroleum-dispensing and storage areas where the aggregate storage of hazardous materials or petroleum at the site is 110 gallons or more.

This site assessment would be performed by a qualified environmental consultant or equivalent and would document through appropriate analytical sampling and testing that all sites are free of the effects of contamination (i.e., contaminant concentrations are less than applicable Federal, tribal, State, or local action cleanup levels).

Upon completion of the work, and following removal of all materials from the project area, work areas would be regraded and left in a neat manner conforming to the natural appearance of the landscape.

Hazardous materials, as defined by 40 CFR 261.3, as defined by Federal Standard No. 313, as amended, and any other hazardous materials or substances identified by Federal, tribal, State, and local laws or regulations that are used during construction would be disposed of in accordance with the applicable laws and regulations. Only disposal facilities that are approved for disposal of hazardous wastes would be used and records would be kept of all such disposal. Hazardous wastes would be recycled whenever possible.

Construction-generated waste materials that may be hazardous would be tested and the results submitted to the appropriate agency for review as needed. Construction-generated waste materials known or found to be hazardous by testing shall be disposed of in approved treatment or disposal facilities in accordance with applicable Federal, tribal, State, and local regulations, standards, codes, and laws. A copy of the hazardous waste manifest would be retained.

Waste materials not generated during construction but discovered at the site during construction would be identified immediately. If the waste is suspected to be hazardous, the on-site personnel would avoid the waste. The on-site personnel would continue to avoid the waste area until the material has been properly and legally evaluated. The waste then would be sent to an appropriate disposal facility.

All nonhazardous waste materials including, but not restricted to, refuse, garbage, sanitary waste, industrial wastes, oil and other petroleum products, and roadway pavement materials would be disposed of during construction by removal from the construction area to an approved disposal facility. No burying or burning of any materials would be allowed on site. Material to be disposed of by removal from the construction area would be removed prior to completion of the work. All materials removed would be disposed of in compliance with all applicable Federal, tribal, State, and local ordinances.

Hydrostatic Testing

Hydrostatic testing would be conducted to verify the integrity of the pipeline. Once the pipeline is installed, hydrostatic testing would be performed in segments. Integrity is tested by capping the pipeline segments with test manifolds and filling the capped segments with water. The water then is pressurized and held for not less than 4 hours. Any significant loss of pressure indicates that a leak may have occurred and would require further inspection.

The primary source of water for the hydrostatic testing would be water wells owned by BMPI at Kayenta, Arizona, and Pump Station 4. Municipal water also would be available at numerous points along the pipeline, but it is anticipated that the existing coal-slurry pipeline may be used to move hydrostatic-test

water up and down the pipeline from the company-owned wells. The water required for hydrostatically testing the pipeline would be minimized by transferring the water used to test one section to the next section for testing, where possible.

Prior to filling the pipeline with water, a sizing plate and cup pegs would be pushed with air through the proposed test segment to ensure that no abnormalities or dents are present along the pipeline. The volume of water used to test each pipeline segment would be pushed by air through the pipeline to each successive pipeline segment.

Where required, the test water would be discharged onto the surface of the ground within the right-of-way using energy dissipation and filtration devices (e.g., hay bales and silt fences) to reduce the velocity of the discharged water, thereby reducing potential for erosion.

Access Roads

Existing roads would be used to access the pipeline. The cleared right-of-way would be used for travel during construction. After construction, access along the route for inspections and maintenance would be along the right-of-way. New roads would be required only in a few locations.

OPERATION AND MAINTENANCE

The coal-slurry pipeline would be operated and maintained in accordance with ASME Code B31.11, "Slurry Transportation Piping System," and standard procedures established by the pipeline owner to ensure safe operation and integrity of the pipeline. The operation and maintenance of the pipeline would be performed by qualified and trained employees. Personnel would be capable of monitoring the pipeline's operating conditions as well as controlling flows and pressure through the pipeline.

Facilities at the pump stations include pump houses, a water well, a cooling tower, a water pond, and coal-slurry pond. Chemicals used at the facility include ethylene glycol (for pump temperature control), a liquid oxygen scavenger (to prevent rust in the pipeline), oil, paint, and various greases and lubricants. Chemical wastes at the pump station are collected and hauled offsite by a licensed contractor for disposal.

Field operations personnel would make regular visits to the pipeline facilities. During these visits, they would inspect the facilities and conduct routine maintenance in conformance with established procedures. Qualified operating and service personnel would, as necessary, check and repair all equipment to ensure safe and reliable operations. BMPI would have an Emergency Response Plan in place.

Pipeline Releases

When the Black Mesa Pipeline was designed in the late 1960s, a corrosion allowance of 0.002 inch per year was specified to allow for loss of pipe wall thickness due to corrosion or erosion during the life of the pipeline. Since there was no operating history for long-distance coal slurry pipelines, the designers did not have historical data on which to base their corrosion allowance.

When the current operators of the pipeline purchased it in 1987, they found that the previous operator had not taken steps to reduce or eliminate the entrainment of oxygen into the slurry at the pump stations nor had they used chemical treatments to scavenge the oxygen that may have entered the system or eliminate corrosive bacteria that could be present in the pipeline. Upon assuming operations, the current operator modified the mainline pump operation to eliminate oxygen entering the pipeline at the pump stations and introduced a program to monitor and treat for corrosive bacteria. It has been observed that the

slurry is generally not erosive to the inner wall of the pipeline and the primary mode of most failures has been corrosion.

Although there have been 31 pipeline failures of varying types and sizes during the 35 years that it was operated, only one event occurred in the first 20 years of operation that was not the result of human error (e.g., third-party backhoe excavation accidents, operator error with a control valve). Some of these failures appeared to be the result of corrosion acting on poor quality pipe. Extensive wall thickness losses have been observed in random joints of the pipe. Adjacent joints, produced by the same mill and with the same specifications and wall thickness exhibited widely different corrosion rates. Remote pressure-monitoring devices were installed after the pipeline had operated for some time that would prevent many of the leaks that occurred initially and would prevent many potential leaks in the reconstructed system.

In preparing the design for reconstructing the coal-slurry pipeline, BMPI reviewed the corrosion and failure history of the pipeline since initial operation began. This study revealed that most of the failures occurred immediately downstream of the pump stations, where oxygen had entered the pipeline. This study also revealed that the highest historical corrosion rate immediately downstream of the pump stations could reach 0.003 inch to 0.004 inch per year.

BMPI subsequently developed the following design criteria for reconstructing the pipeline:

- Design corrosion allowance, 0.005 inch per year;
- Minimum pipe yield strength, 60,000 pounds per square inch (the original pipe yield strength is 52,000 pounds per square inch); and
- Minimum pipe wall thickness, 0.250 inch (there is approximately 80 miles of 0.219 inch wall thickness pipe in the current pipeline).

Also, the pipeline would be protected from corrosion with external coating and a cathodic protection system designed according to National Association of Corrosion Engineers standard RP-01-69-92. The main characteristics of this system are as follows:

- Sacrificial anodes along the pipeline and at road crossings, block valves, and station pipeline.
- Installation of test leads at various points along the pipeline to read potentials.
- An integrated current system provided by rectifiers would be installed, if needed.
- Effects due to high-voltage electric conductors would be mitigated if and where needed.

Using these design criteria, implementing rigid independent inspection programs at the pipe mill and continuing the operating practices developed since 1987, including elimination of oxygen entering the system at the pump stations and maintaining a corrosion monitoring and treatment program, the reconstructed pipeline is expected to operate for its design life of 16 years with no internal failures.

In the unlikely event of a pipeline failure, procedures have been established to respond immediately. The failure would be detected by the Supervisory Control and Data Acquisition System (SCADA), which monitors pressures and flow rates along the pipeline 24 hours per day. Mainline block valves are located at key points along the pipeline, such as major water crossings and at the top of major elevation drops to isolate the pipeline into sections. The block valves are remotely operated and connected to the pipeline system's SCADA system. In the event of a leak or any other abnormality in the operation of the pipeline, the SCADA system would close the remotely operated valves, and isolate that particular section of the

pipeline. Closure of the valve would stop the majority of the slurry flow out of the pipeline because there would no longer be pressure in that section of the pipeline to force the slurry out.

The amount of slurry that may be released from a leak would not be equivalent to the volume of slurry contained between two block valves, rather, it would be a fraction of that amount. Determining the actual amount of slurry that may be released during a spill is difficult, and dependent on numerous variables (i.e., location of the leak on the pipe—top of the pipe versus bottom of the pipe, or the terrain where the leak occurred—in a flat location versus on a slope). A reasonable estimate of slurry that may be lost during a pipeline failure can be derived by reviewing the failure data from the original pipeline, and calculating an average amount of slurry lost based on those failures. BMPI has reviewed this historical data, and calculated that an average leak over the life of the pipeline was 100 cubic yards of slurry. More than 90 percent of the leaks were less than 30 cubic yards, or approximately two dump truck loads. Five large leaks occurred on the original line that resulted in slurry spills of approximately 565 cubic yards each. This size of a spill would cover a land area of approximately 0.7 acre with 6 inches of coal.

Unlike an oil or gas pipeline, a coal slurry leak results in the release of fresh water and inert, nontoxic coal. The water tends to immediately soak into the ground and the coal remains on the surface. Depending upon the size of the spill and the landowner's wishes, the spill would either be: (1) left as is; (2) buried on location; or (3) removed with a front-end loader and hauled away to a user who can burn the coal. The coal recovered from the last leak on the Black Mesa Pipeline was hauled, at the request of BLM, to a site for use in the restoration of an abandoned mine.

Concurrent with closing the block valves, the SCADA system automatically would notify BMPI operations personnel who immediately would travel to the location of the leak to evaluate the situation, for both responding to the spill and beginning to plan a repair of the pipeline. If the leak were to occur on-land, typically the slurry would leak to the surface and flow in a narrow meandering path, the direction and length of which would depend on the terrain. If needed, the remaining slurry in that segment of pipeline would be pumped into a pond, designed and constructed for that purpose, at the closest pump station along the pipeline. BMPI would employ one of the following as possible courses of action for remediation:

- ***Leave the coal in place as deposited.*** Leaving the coal in place and allowing natural attenuation to dissipate the discharge is a viable option wherever the coal is of such insignificant volume that its potential environmental harm is negligible. A volume is considered insignificant when the native soil can still be seen through the coal deposit (i.e., a “dusting”). Coal fines are nontoxic and do not present a hazard to the public or local wildlife. The primary impact of a release would be visual. When the discharged coal is greater than a dusting, BMPI may propose to leave the coal in place as deposited when it is determined that (a) the damage to the vegetation and terrain in the area caused by removal of the deposit would outweigh the overall potential benefit of removing the coal; or (b) the deposit causes no potential harm to human health or the environment.
- ***Partial removal and burial of the coal.*** In those areas where the coal deposit threatens growth of native vegetation but BMPI determines that complete removal is not practical, mechanical removal of the coal and burial on or off-site is appropriate if BMPI has obtained written permission of the landowner and has obtained any required permits.
- ***Complete removal of the coal and contaminated soils.*** Complete removal is appropriate when BMPI determines that removal will not harm native vegetation or the terrain, the deposit is accessible, and is of a significant volume.

All coal removed from the discharge area is (a) buried on- or off-site with the land-manager's or landowner's permission and only after having obtained any required permit; (b) taken to a BMPI facility for storage and use; (c) returned to the mine; and/or (d) disposed of in an ADEQ-permitted landfill.

The likelihood of a leak occurring under the Colorado River, the only perennial river crossed by the pipeline, is extremely low. The existing pipeline operated for 35 years with no leaks under or near the Colorado River. The original design specified very heavy wall thickness pipe near and under the river. The existing pipeline under the river has a wall thickness of 0.750 inch, which is several times the thickness required to contain the pressure experienced under normal operation. As an additional safety device, a block valve will be installed upstream of the river crossing, approximately 700 feet from the river. This valve would be controlled by the SCADA system as previously discussed, and would be closed automatically in the event of a leak or any other abnormality in the operation of the pipeline. Closure of the valve adjacent to the Colorado River crossing would stop coal-slurry flow into the leak area.

The new pipeline design includes the use of pipe material and wall thickness equal to, or exceeding, the design of the original pipeline. In the extremely unlikely event of a leak occurring under the river, BMPI anticipates that the environmental impact would be limited to a short-term sedimentation type of release extending for a short distance down stream of the point of the leak. The coal slurry consists of fresh water and finely ground coal, an inert, nontoxic substance. There are no chemical additives, petroleum, or petrochemicals contained in the slurry. The coal slurry would be diluted quickly by the large volume of river water, and the coal would settle on the bottom of the river bed in a very dispersed fashion.

ABANDONMENT

Should coal-slurry pipeline operations not resume, aboveground structures and equipment would be removed and salvaged to the extent feasible and, in most cases, the pipeline would be purged, capped, and abandoned in place. Any areas disturbed during abandonment would be revegetated and restored in accordance with landowner requests or the applicable agency requirements in effect at the time.

Appendix A-3
C Aquifer Water-Supply System:
Typical Well Field and Pipeline Construction, Operation, and Maintenance

Appendix A-3
C Aquifer Water-Supply System:
Typical Well Field and Pipeline
Construction, Operation, and Maintenance

INTRODUCTION

Salt River Project (SRP) and the other future co-owners of the Mohave Generating Station propose to construct a new water-supply system including a pipeline and two pump stations to supply water from a new well field near Leupp, Arizona, to the Black Mesa Mine, a distance of approximately 108 miles (Figures A-8 and A-9). The primary purpose of the pipeline is to convey 6,000 acre-feet per year (af/yr) of water to the Black Mesa Complex for mine operations-related and local domestic uses as well as for a medium for transporting coal (in a slurry that is 50 percent water and 50 percent coal) from Black Mesa mining operation to the Mohave Generating Station. However, the pipeline also could be sized and constructed to convey an additional 5,600 af/yr to provide water to Navajo and Hopi tribal communities along the way.

Under the 6,000 af/yr alternative, the well field would be located on Navajo Nation land in the triangular area approximately bounded by (Arizona) State Route 99, Canyon Diablo, and the Burlington Northern Santa Fe Railroad just north of Red Gap Ranch and Interstate 40 (I-40). Twelve wells would be developed to provide 6,000 af/yr of water to the Black Mesa Complex. Collector piping would transport the water to a storage tank located near Indian Route 6930 and Canyon Diablo.

The initial 12 wells chosen for the 6,000 af/yr development would not be the closest to the storage tank. Figure A-10 is a conceptual diagram of the well field to show the potential spacing of the wells; however, the specific locations for well sites have not yet been identified. The wells that were chosen represent the locations where the maximum amount of access roads and collection piping would need to be installed during the initial phase of work when the greatest amount of construction work would be done. By choosing this method of installation, the impact would be reduced in the future if additional wells should need to be installed. The specific location of individual wells would be determined following detailed well-field engineering, which would include judicious siting to avoid sensitive environmental areas. Archaeological surveys of the well sites would be conducted and the Navajo Nation would be consulted to minimize disruptions to local residents.

Under the 11,600 af/yr alternative, the well field would be composed of two sections. Five additional wells would be developed in the Navajo section of the well field identified above to provide up to 3,600 af/yr of water to the Navajo Nation. A second section of the well field would be developed just south of the main well field on Hopi Tribe land in the triangular area approximately bounded by the Burlington Northern Santa Fe Railroad, Canyon Diablo, and I-40, an area known as Hart Ranch, owned by the Hopi Tribe. Four wells would be developed in this section of the well field to provide up to 2,000 af/yr of water to the Hopi Tribe. Collector piping would transport the water from all wells to a single storage tank located near Indian Route 6930 and Canyon Diablo. All together, the well field would comprise 21 wells providing 11,600 af/yr of water to the Black Mesa Complex and to the tribes.

The pipeline facilities required to supply 11,600 af/yr of water are slightly larger than those required for a 6,000 af/yr project. Where it is more cost effective to build for the expansion to 11,600 af/yr at the time of initial construction, all piping, buildings, and equipment would be sized accordingly. This initial upsizing would include the well field, one pump station, and the main water-supply pipeline. As tribal demand develops, additional facilities would be constructed as needed.

For example, the main water-supply pipeline would need to have a maximum size of 26 inches in diameter to supply 6,000 af/yr to the mine with most piping being 21, 23 and 24 inches. However, those sections of the pipeline that eventually would need to convey up to 11,600 af/yr would have larger diameter pipe sizes installed during initial construction, as it is more cost effective to install a larger size now than it would be to replace the smaller pipeline with a larger size later or install a second pipeline to convey the additional 5,600 af/yr. Similarly, the electrical-supply system that would be installed would be capable of supplying power for the total system. One pump station also would be constructed using a slightly larger building such that an additional pumping position could be added at minimal cost when needed.

C-Aquifer Well Field

The well field would consist of production wells, access roads, a distribution electric-power system, a storage tank, and associated piping. The wells would be spaced such that there is a minimum separation between each site of 1.2 to 1.5 miles. One main collector line would be constructed along the southern edge of each developed well field to convey pumped groundwater to the storage tank. One main collector line would be constructed on the Navajo well field for the 6,000 af/yr alternative. A second main collector line would be constructed on the Hopi portion of the well field for the 11,600 af/yr alternative. Piping from the individual wells would discharge to either the collector lines or transmission main line, whichever is closer to the well location. Individual wells would be brought on line or turned off to maintain a constant water level within the storage tank.

The preliminary design of each well incorporates the following:

- 1,100-foot-deep, 24-inch-diameter pilot borehole;
- 1,000-foot-deep, 18-inch-diameter standard casing;
- 400 feet of 12-inch-diameter manufactured steel well screen;
- Filter pack;
- Cement seal and conductor casing;
- Bottom trap (tailpipe); and
- Casing centralizers.

Screened intervals may alternate with blank sections to maximize infiltration from isolated water-bearing zones, depending on the formation materials. The filter pack would be washed and screened natural siliceous sand composed of not less than 95 percent hard, dense, well rounded, stable grains so as to be nonreactive and insoluble to weak reducing agents or other common components of groundwater.

Each developed well site would be approximately 50 feet by 50 feet and would require a permanent right-of-way or easement to accommodate the well site. Each well site would include security fencing, lighting, gravel paving, electrical equipment, and associated instrumentation and control equipment. Deep well submersible pumps, each rated at approximately 400 gallons per minute (gpm) and 300 horsepower,

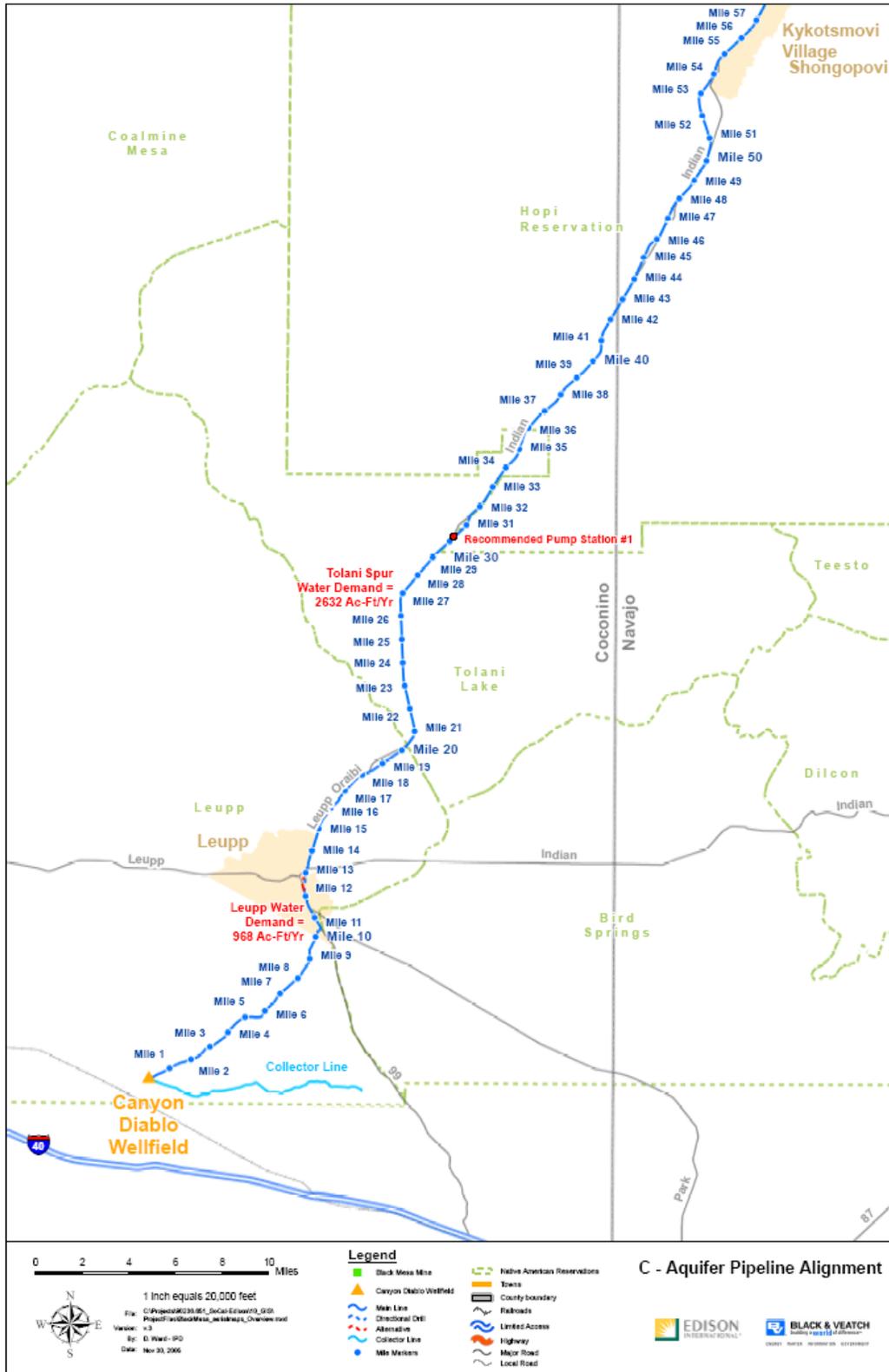


Figure A-8 (1 of 2)

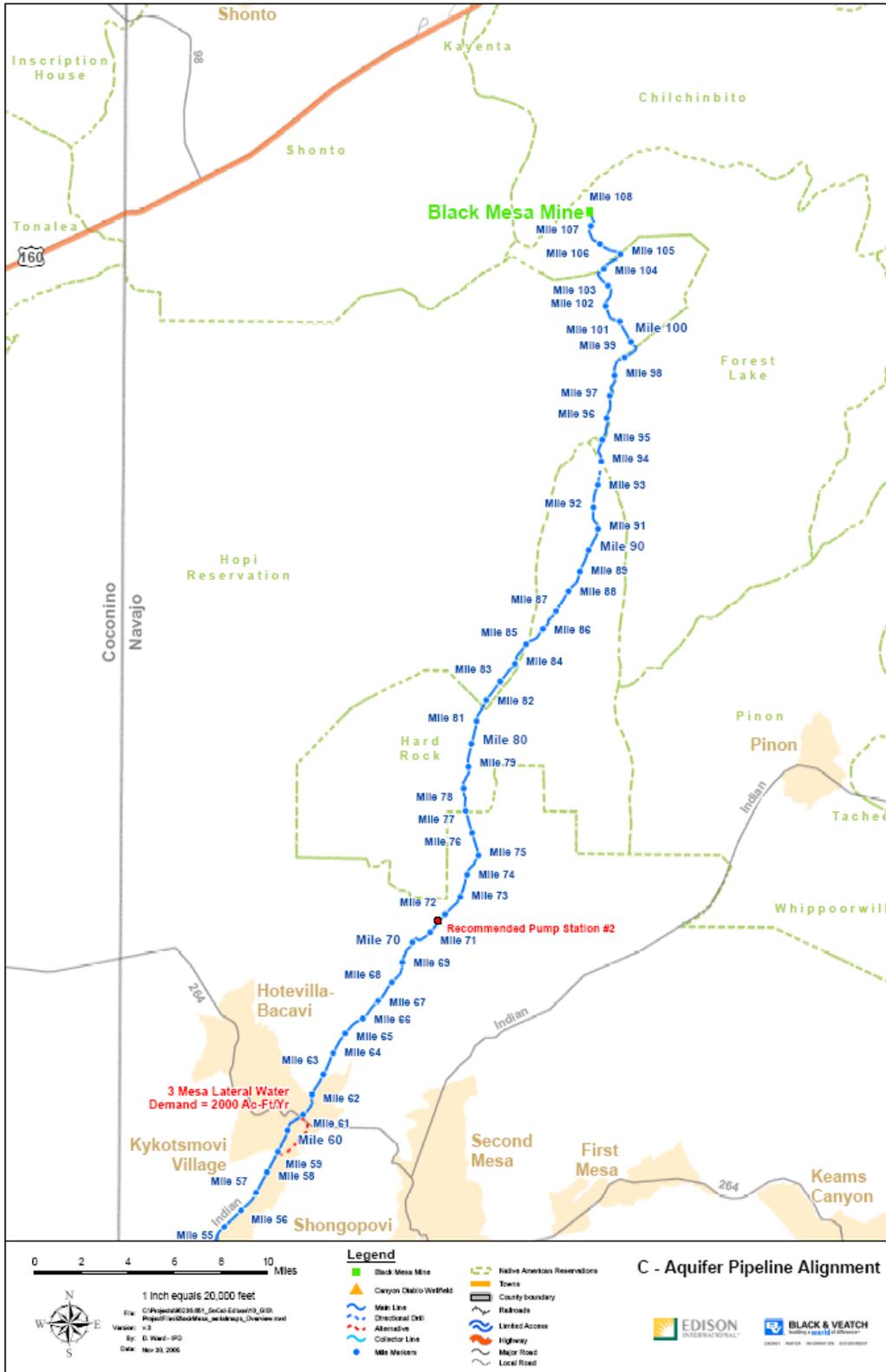


Figure A-8 (2 of 2)

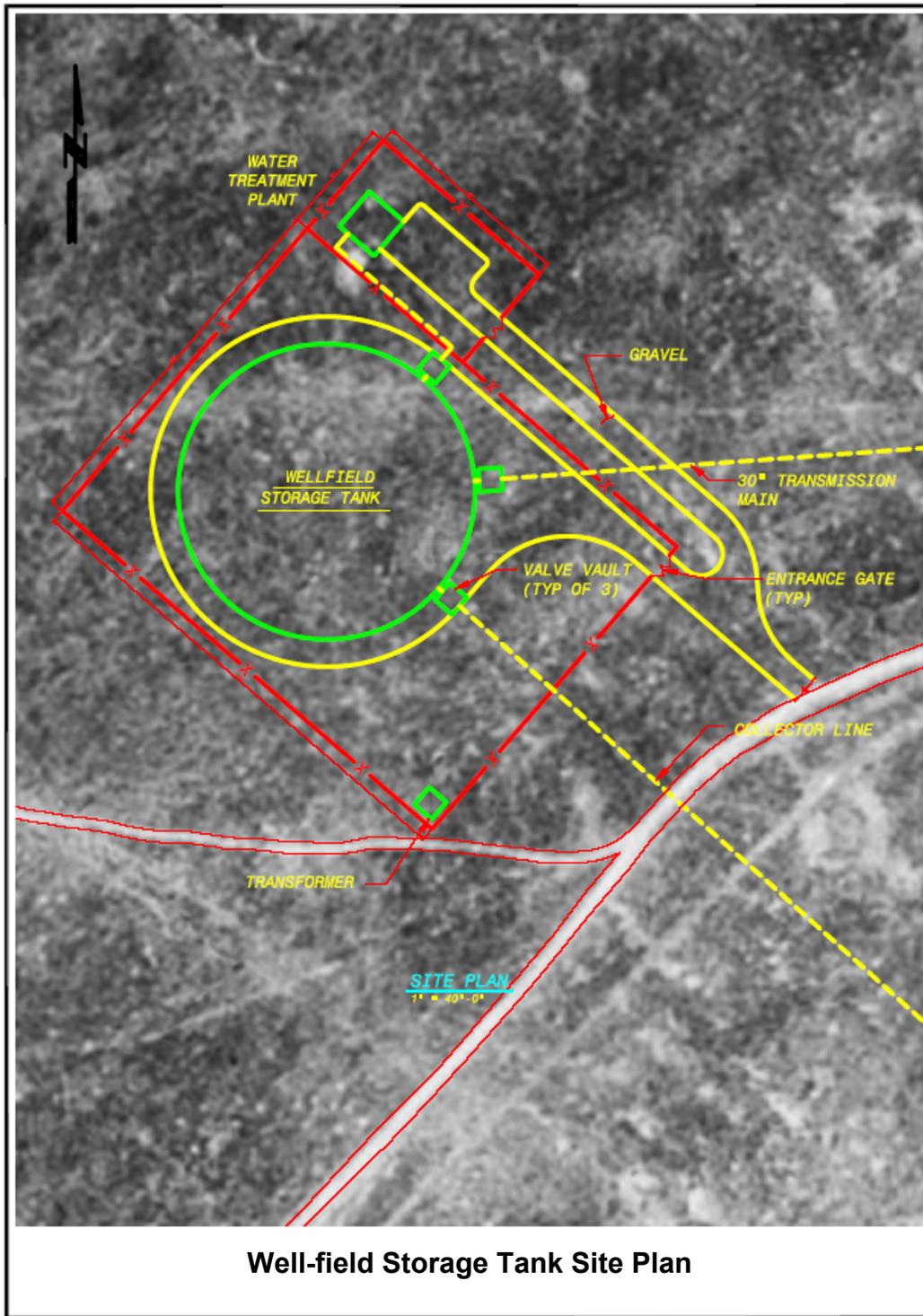


Figure A-10

would be used for groundwater pumping. Each pump would discharge groundwater through a 6-inch-diameter steel pipe with isolation valves and backflow prevention valves to either the nearest collector pipeline or the main water-supply pipeline. All piping and valves (in valve boxes) would be buried below ground with at least a 3-foot minimum cover. The only aboveground equipment at each well site would be the security fencing, lighting, and a small electrical-power and control cubicle. Lights would be designed and operated so as to minimize the amount of light visible at night to local residents. Each well site would be monitored and operated from a remote location, either from the main water-supply pipeline pump stations; a main control room in Flagstaff, Winslow, Leupp, or Window Rock, Arizona; or a secondary control room at the Black Mesa Complex.

Well-field collector piping would range in size from 6 inches to 16 inches in diameter, depending on the location and alternative selected. The piping would be steel, cement-mortar lined (CML) and tape wrapped, or epoxy or polyurethane coated, for corrosion protection and buried below ground with at least a 3-foot minimum cover. The collector piping would be buried in the roadway of the new access roads to the well sites. Below-ground system-isolation valves in valve boxes would be provided, as necessary. The approximate amount of piping is as follows:

- 6,000 af/yr Alternative

Pipe Size	6-inch	8-inch	10-inch	12-inch	14-inch	16-inch
Length, miles	11.6	0.7	1.7	1.5	2.6	1.8

- 11,600 af/yr Alternative

Pipe Size	6-inch	8-inch	10-inch	12-inch	14-inch	16-inch
Length, miles	15.2	2.2	3.2	1.5	2.6	1.8

One storage tank requiring a permanent right-of-way or easement of approximately 215 feet by 215 feet would be provided at the well field to provide one day's storage for the mine and supply the local well-field distribution system (refer to Figure A-10). The storage tank site would be equipped with security fencing and lighting. Lights would be designed and operated so as to minimize the amount of light visible at night to local residents. The storage tank would be as follows:

Type	Fixed roof
Material	Welded steel ¹
Diameter, feet	130
Height, feet	60
Capacity, gallons	6,000,000
Days storage	One

Single-lane access roads with turnouts for passing, as appropriate, would be constructed to each site from the existing roads in the area. The expected permanent right-of-way or easement width required is estimated to be 25 feet. The roads would be graded and compacted and would not be paved. The collector piping would be buried along one side of the road and the electrical distribution system would be constructed along the other side of the road. All roads and well sites would be routed or sited in a manner to avoid sensitive areas (e.g., cultural resources, biological resources).

¹ The steel tank would be lined.

A new, wood-pole power-distribution system would be provided by Navajo Tribal Utility Authority (NTUA) to supply power to each well site located on Navajo Nation land. NTUA would supply 24.9 kilovolt (kV), 3-phase, 60-Hertz power to each site where pole top transformers would transform the power down to 4.16kV at each well site. A small transformer at each site would transform the 4.16kV power down to lower voltages, as necessary, for such uses as lighting, communication, and control power.

The power supply for the new NTUA² distribution system would be supplied by Arizona Public Service (APS)³ from a new 230/69kV substation that also would provide power to water-supply pipeline pump stations. Power to the new 230/69kV substation would come from an existing 230kV transmission line that essentially parallels Indian Route 15. The new substation would be built along the existing APS 230kV transmission line right-of-way approximately 4 miles west of the intersection of Indian Route 15 and State Route 99. The new 230/69kV substation would be comprised to two sections. The first section would be to provide 69kV power to the pump stations and the second section would be to provide 69kV power to the NTUA. The well field would be supplied through a new substation that would be built by NTUA. The NTUA substation would be located adjacent to the APS 230/69kV substation. APS would install a 69kV primary metered delivery point to NTUA at this location. NTUA would then extend a service line southeast towards the well field following the 230kV transmission right-of-way until it intersects Indian Route 6930 where it would turn and follow Indian Route 6930 into the well field. APS would construct a new radial 69kV line that would parallel Indian Route 15 until it intersects the new pipeline; at that point the line would parallel the proposed pipeline route to the location of Pump Station No. 1 near the Navajo Hopi Reservation boundary at about Milepost 30 where APS would install a 69kV primary metered delivery point for the NTUA. Construction of the radial 69kV line would continue from Pump Station No. 1 to Pump Station No. 2 north of Kykotsmovi at about Milepost 72. The NTUA would build a 69/24.9kV substation adjacent to the APS substation or at approximately Milepost 6 along the main transmission line route in the well field, in order to provide power to the well field. (This substation arrangement also would be capable of supplying power for the additional 3,600 af/yr of water for the Navajo Nation.) At each well site, the power would be transformed from 24.9kV to 4kV or 480 volts from a pole-top transformer.

The system would be designed such that NTUA could extend the well-field distribution system to provide power to local residents living within the well field area. Similarly, the transmission line could be designed such that it could be upsized by APS or NTUA to serve other existing or future load centers on the Hopi and Navajo Reservations.

Power to the four wells on Hopi Tribe land would be provided in the same manner as above, except that the power would be supplied by APS. To provide power to the Hopi well field, APS would either extend a new line from the NTUA 24.9kV wood-pole line to the Hopi well field or provide service from some other nearby APS location. APS also would use wood-pole structures.

Figure A-11 shows a concept of the well field power distribution system.

² This is a “best guess” based on discussions with NTUA as NTUA has not formally replied to the request for the Method of Service.

³ This is a “best guess” based on discussions with APS as APS has not formally replied to the request for the Method of Service.

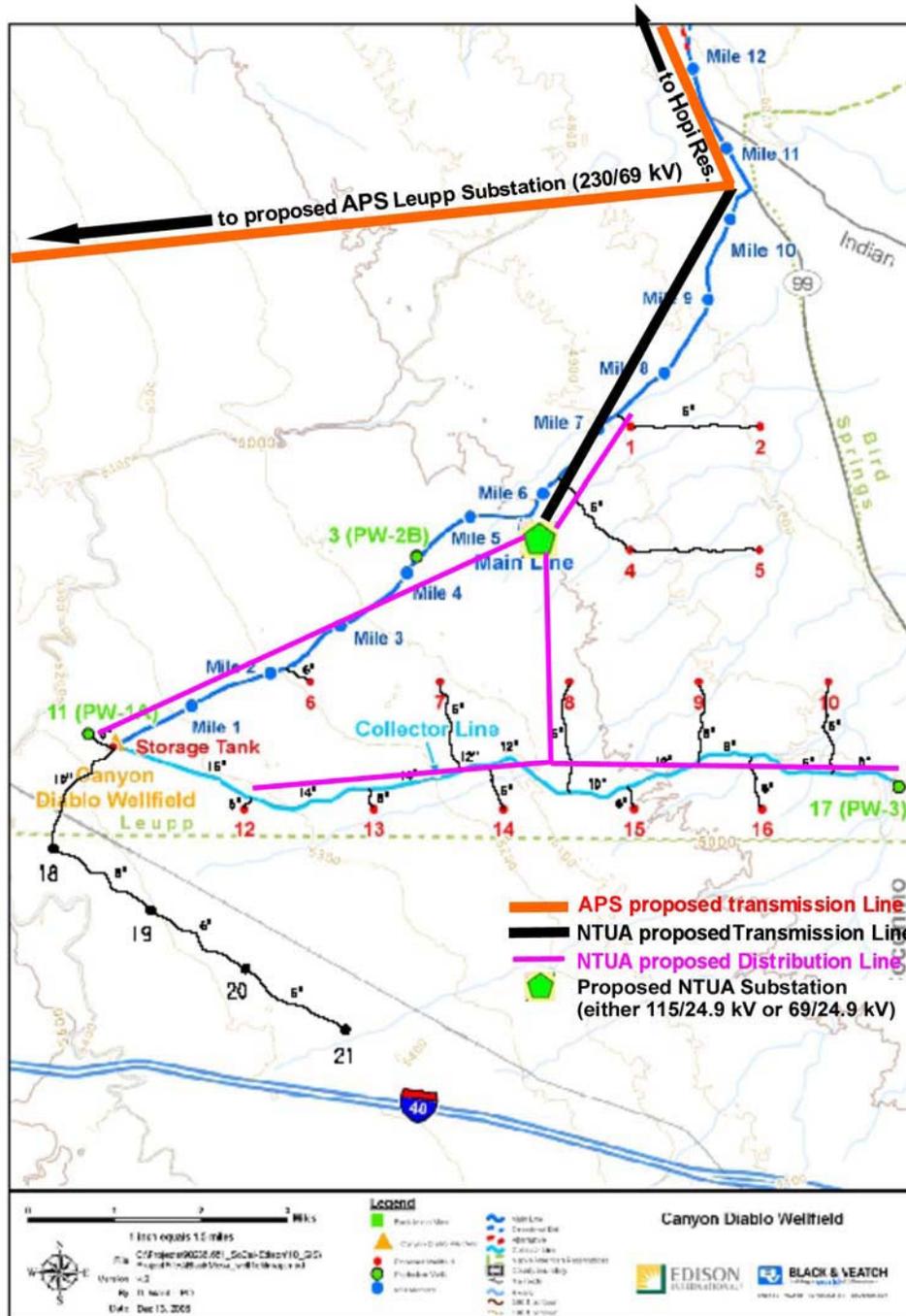


Figure A-11
Concept of Power Distribution System for Well Field

C Aquifer Water-Supply Pipeline

General Description

The main water-supply pipeline would extend approximately 108 miles from the storage tank in the well field near Leupp, Arizona, to the Black Mesa Complex. The permanent expected rights-of-way or easement width required is estimated to be 20 feet. For the 6,000 af/yr alternative, the pipeline would be designed for a constant flow of 6,000 af/yr to the mine. For the 11,600 af/yr alternative, it would be designed for an eventual maximum flow of 11,600 af/yr of total water supply with a constant flow of 6,000 af/yr to the mine. Depending on which alternative is constructed initially, the pipe sizes would range from 18 to 26 or 30 inches. The maximum working pressure is 574 pressure per square inch gauge (psig). The pipe material would be American Water Works Association (AWWA) C200 steel pipe. The approximate amount of piping is as follows:

- 6,000 af/yr Alternative:

Pipe Size	18-inch	21-inch	23-inch	24-inch	26-inch
Length, miles	12.2	20.1	36.0	33.7	7.0

- 11,600 af/yr Alternative:

Pipe Size	18-inch	24-inch	25-inch	26-inch	30-inch
Length, miles	8.0	31.0	24.9	32.0	13.1

The pipe would be CML and tape wrapped, or epoxy or polyurethane coated, for corrosion protection and buried with a 3-foot minimum cover (for freeze protection). The pipeline also would be cathodically protected with an active system of anodes placed approximately every 30 miles. The anode spacing allows for the power sources to be located at the well field, pump stations, and the mine.

The pipeline would contain two pump stations: one located at about Milepost 30 and the second at about Milepost 73. Water would flow by gravity from the storage tank in the well field to the Tolani Lake Pump Station (Pump Station 1). From there it would be pumped to Oraibi Pump Station (Pump Station 2). The Oraibi Pump Station would pump the water to the high point in the pipeline at approximately Milepost 101 from which it would flow by gravity to the Black Mesa Complex.

Canyon Diablo Well Field to Leupp

This pipeline segment would begin at the Canyon Diablo well-field storage tank. From the storage tank, the pipeline would run northeast along Indian Route 6930 approximately 10 miles to State Route 99. Along Indian Route 6930 the pipeline alignment would be within the graded roadway alignment. The pipeline then would run northeast along State Route 99 and then north approximately 3 miles to Leupp. The pipeline in this area would be 21 inches in diameter for the 6,000 af/yr alternative or 30 inches in diameter for the 11,600 af/yr alternative.

Two floodplain crossings occur between about Mileposts 4 and 5 and between Mileposts 10 and 11. The pipeline would be buried deeper in these two locations and encased in concrete through the floodplain crossing. The pipeline alignment along Indian Route 6930 and State Route 99 is mostly high desert plain and would be within the roadway easement. In this section, the pipeline alignment would be offset from the paved roadway on the west side of the road.

Leupp-Little Colorado River Crossing

This section of the pipeline between about Mileposts 12 and 14 would run south of Leupp and across the Little Colorado River. The 100-year flood elevation establishes the limits of the river crossing. Two types of crossings are being considered for the Little Colorado River: (1) directional drilling and (2) using an abandoned steel bridge. Briefly, these two alternatives are described below.

Directional Drilling

This alternative would involve drilling a horizontal tunnel approximately 50 to 200 feet beneath the Little Colorado River and pulling the pipeline through the tunnel. In this segment, the pipeline would be 24 inches for either alternative to minimize the cost of the directional drill. Also in this segment, the internal coating of the pipe would be either a fusion bonded epoxy or polyurethane rather than the CML because the CML would crack due to the curvature required to feed the steel pipe into the tunnel bore. This alternative is estimated to cost approximately \$6.5 million.

Bridge Crossing

The second alignment would use an existing abandoned steel bridge. The pipe would be buried up to the bridge and daylight prior to the bridge access ramp. The pipe would be supported above the deck along the length of the bridge and then transition to below grade once across the bridge. Using the existing bridge would include modifications to the bridge including a new walkway, pipe supports, and gates at each end to restrict access. The entire length of the open trench constructed pipeline within the limits of the floodplain would require concrete encasement. This option also may require conducting a Section 404 process for construction activities within the floodplain. Furthermore, the bridge is considered by the Navajo Nation to be a historical site. The bridge is not, however, currently listed in the National Register of Historic Places as a historical site. Preliminary investigation indicates that the Navajo Nation would allow the pipeline to use the bridge to cross the Little Colorado River. This alternative is estimated to cost approximately \$1.7 million.

Both crossing alternatives are technically feasible. Directional drilling would most likely be the most environmentally favorable of the two options. However, directional drilling is significantly more expensive and the issue of drilling mud disposal would have to be addressed. Even though significantly more expensive, directional drilling is presently the preferred alternative because it allows the pipe to be buried much deeper to avoid potential adverse impacts on the pipe from flood conditions as well as result in less environmental impact. However, more detailed engineering investigations may result in a change in preference to use the bridge crossing.

Leupp to Kykotsmovi

This pipeline segment would begin at Leupp and continue on to Kykotsmovi, Milepost 60. In this segment, the pipeline would run parallel to Indian Route 2 and the Tolani Lake Pump Station would be located at about Milepost 30. The pipeline alignment along Indian Route 2 is mostly high desert plain and would be within the roadway easement. In this section, the pipeline alignment would be offset from the paved roadway on the west side of the road. Between Leupp and the Tolani Lake Pump Station, the pipeline would consist of 21-, 24-, and 19-inch-diameter segments for the 6,000 af/yr alternative. For the 11,600 af/yr alternative, the pipeline would be 24 or 25 inches in diameter between Leupp and the Tolani Lake Pump Station. Between the Tolani Lake Pump Station and Kykotsmovi, the pipeline would be 23 inches in diameter for the 6,000 af/yr alternative or 26 inches in diameter for the 11,600 af/yr alternative.

Kykotsmovi

This section of the pipeline, from about Milepost 59 to 61, would run through Kykotsmovi. The pipe in this area would be 23 inches in diameter for the 6,000 af/yr alternative or 26 inches in diameter for the 11,600 af/yr alternative. Two alternative alignments are being considered for Kykotsmovi. The first option follows the main road through town and would be buried beneath the paved roadway. The second option follows the bypass road along the eastern edge of Kykotsmovi. This pipeline alignment would be within the roadway easement. In this option, the pipeline alignment would be offset from the paved roadway on the west side of the road. The advantages of the main road option are that the length of the pipeline is shorter and the route is currently the preferred option of the community. Although this alignment contains numerous utilities located in the roadway, it is expected that fewer utilities are present than on the alternate route. These utilities are mostly unmarked and would have to be located prior to final design and construction. The bypass alignment also would encounter some conflicts, and the right-of-way along Indian Route 2 at this location is narrower. The main road option is considered the preferred alternative at this time.

Kykotsmovi to Dinnebito Wash

This section of the pipeline from about Milepost 61 to 94 would run along Indian Route 2 and from Kykotsmovi to the Dinnebito Wash. This section includes Oraibi Pump Station at about Milepost 72 along a section of unimproved road. The area north of Kykotsmovi includes traditional Hopi farmlands. Therefore, the pipeline alignment would be in the western portion of the graded roadway to avoid disturbing active farmlands. At approximately Milepost 70, the roadway is elevated above the surrounding floodplain. The pipeline alignment in this area would remain within the roadway. However, the route may entail removal and replacement of an existing corrugated metal pipe drain that crosses the road. This segment of the pipeline would be 24 inches in diameter for the 6,000 af/yr per year alternative or 25 inches in diameter for the 11,600 af/yr alternative from Kykotsmovi to Oraibi Pump Station. For both alternatives, the pipeline would be 24 inches in diameter from the pump station to Milepost 94.

At about Milepost 71.5, the pipeline alignment would separate from Indian Route 2 and follow an existing unimproved two-track road to Milepost 75. The pipeline would run on the west side of the two-track road to avoid interference with the Oraibi Wash to the east. Road improvements would be made once the pipeline construction is complete. The improvements would consist of grading (blading) and compaction. In this section of the pipeline, the permanent right-of-way or easement would be 25 feet to accommodate the access road.

From about Milepost 75 to 94.5, the pipeline alignment would follow Indian Route 41 (Turquoise Trail). The pipeline alignment would again leave the graded roadway at approximately Milepost 91. The alignment would follow an existing power line easement to the Dinnebito Wash. The alignment was selected to avoid significant rock formations along the roadway from Milepost 91 to the Dinnebito Wash.

Dinnebito Wash Crossing

The original proposed pipeline alignment from the Bureau of Reclamation consisted of two separate nonboring wash crossing options in this area. These types of crossings would require extremely deep trenching, more than 40 feet in depth in the vertical walls on each side of the wash to ensure that the pipeline is buried at least 10 feet below the bottom of the wash, or routing the pipeline above ground across two separate bridges spanning the wash. To avoid these complications, directional drilling is proposed to cross the wash. Directional drilling would begin at Milepost 93 and extend to Milepost 94.5. Unlike the Little Colorado River crossing, the diameter of the Dinnebito Wash boring can be reduced to a more optimal diameter of 18 inches.

Dinnebito Wash to Black Mesa Complex

This section of the pipeline from Milepost 94.5 to 108 would run along Indian Route 8034 and Indian Route 41 to the mine entrance road at Milepost 108. From this point, the pipeline would follow the Black Mesa Complex entrance road through the mining operations area. The pipeline would terminate at the existing 5-million-gallon storage tank at the coal-preparation facilities. This section of the pipeline would be 24 inches in diameter to the high point in the route at approximately Milepost 101 where it would be reduced to 18 inches to slow the gravity flow to the mine. The pipeline alignment would be in the western side of the graded roadway.

Tolani Lake and Oraibi Pump Stations

The pipeline would have two pump stations located at Mileposts 30 and 72. The overall footprints for the pump station are approximately 31,350 square feet (0.7 acre) for Tolani Lake Pump Station and 25,500 square feet (0.6 acre) for Oraibi Pump Station. Permanent rights-of-way or easements to accommodate these two sites and the access road into each would be required (Figures A-12 and A-13). Each pump-station site would be enclosed by a security fence and the open areas within the fence would be covered with gravel. A 10-foot-wide concrete apron has been incorporated on the sides of the pump station that would have the most vehicular or pedestrian traffic. A 4-foot-wide sidewalk has been incorporated on the other sides of the building.

Each pump station would have a building to enclose the pumps and other equipment such as motor control centers, air compressor, fire protection, etc. to provide both weather protection and security and to allow maintenance during inclement weather. The building sizes are approximately 60-feet wide by 65-feet long by 20-feet high for Tolani Lake Pump Station and 60-feet wide by 56-feet long by 20-feet high for Oraibi Pump Station. Both pump stations would be identically sized for the 6,000 af/yr and 11,600 af/yr alternatives. The buildings also would have an indoor lay-down area to allow some maintenance to be performed. Each pump station would have a water-storage tank to help regulate flow and maintain net positive suction head to the pumps. The tanks also are sized to provide a maximum flow for approximately one hour with no water coming into them. Lighting would be designed to minimize the amount of light visible at night.

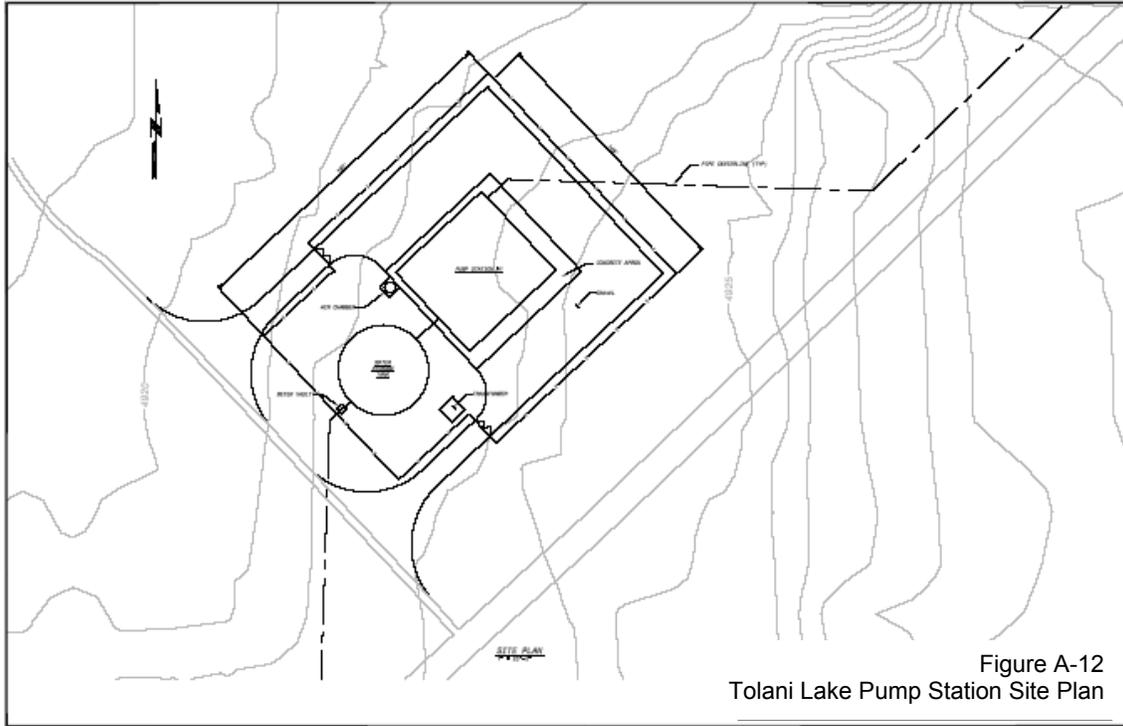


Figure A-12
Tolani Lake Pump Station Site Plan

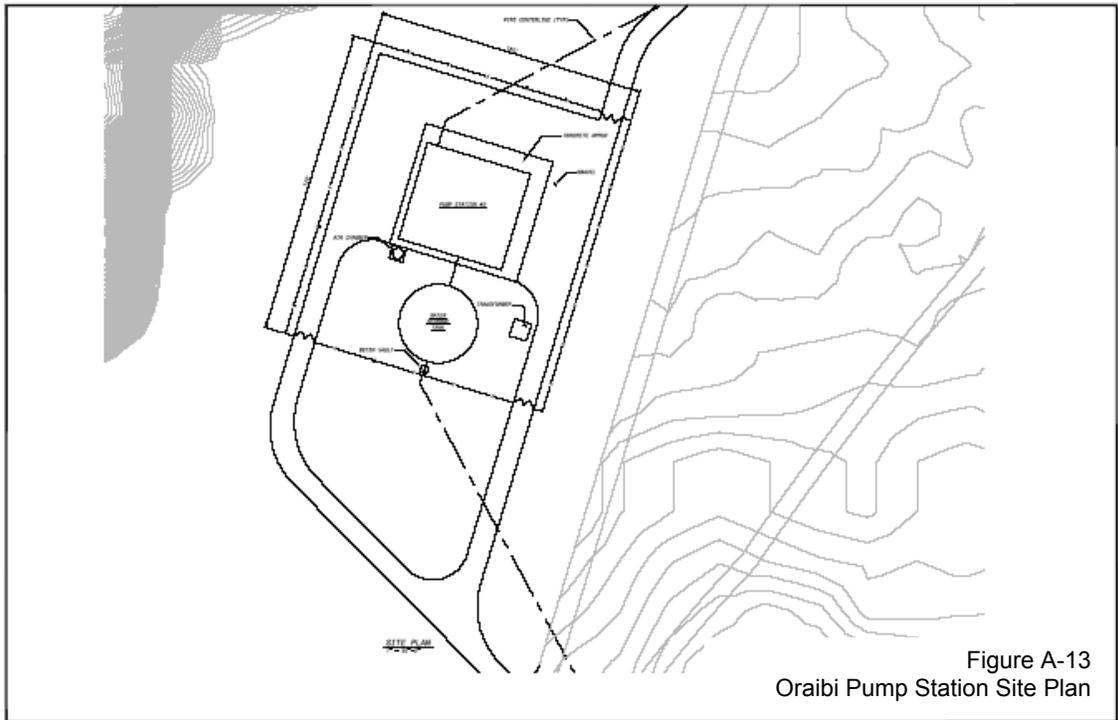


Figure A-13
Oraibi Pump Station Site Plan

Both pump stations would have three pumps for delivering water to the mine plus an installed fourth pump as a spare. For the 11,600 af/yr alternative, the Tolani Lake Pump Station would be constructed slightly larger to accommodate a fifth pump position for providing water to the local communities. The fifth pump position would be constructed at the time the additional wells are developed in the Hopi Tribe well field. To ease operation and maintenance of the system, all of the pumps at both pump stations would be interchangeable. The data for the major pump station equipment are as follows:

<u>Design Conditions</u>	<u>Tolani Lake Pump Station</u>	<u>Oraibi Pump Station</u>
Location, mile	30	72
Elevation, feet	4,922	5,814
Maximum flow rate gpm (af/yr)	4,960 (8,000)	3,720 (6,000)
Minimum flow rate gpm (af/yr)	3,720 (6,000)	3,720 (6,000)
Total dynamic Head, feet (psig)	1,325 (574)	1,325 (574)
Water storage tank, diameter x height ⁴	50'-0" x 20'-0"	44'-0" x 20'-0"
Water storage tank volume, gallons	294,000	227,500
Type of pump	Vertical	Vertical
Number of pumps (ultimate)	4 (5)	4 (4)
Electrical load maximum/ running, kilovolt amperes	3,220/2,565 ⁵	2,600/1,950

The pump stations would be designed to be unmanned and operated from a remote location, either from the main control room, the secondary control room at the Black Mesa Complex, or from each other. Each pump station also would have facilities for periodic visits by operating and maintenance personnel including restroom facilities. Potable water would be supplied by using bottled water. Industrial use and toilet flush water would come from the pipeline pump discharge. Sewage treatment would use a septic tank and leach field. Any other liquid wastes within the buildings would be collected and removed using a vacuum truck.

Electrical Supply

Electrical power to the pump stations would be provided by APS via a 69kV, 3-phase, 60-Hertz steel-pole transmission line constructed on the opposite side of the roadway (east side) from the pipeline. For the Tolani Lake Pump Station, which is on the Navajo Reservation, APS would supply power to a NTUA meter and NTUA then would provide the power to the pump station. For the Oraibi Pump Station, the power would be supplied directly by APS as the pump station is on the Hopi Reservation.

A 69/4.16kV step-down transformer located outside of the building would be required to provide power to each pump station. All other 480 volt and 110 volt power requirements within the building would be provided from the 4.16kV system. Control and voice communications between the pump stations, control rooms, and well field would be made via a fiber optic cable underbuilt on the new transmission line, by microwave or by a fiber-optic cable buried along side of the pipeline; the final selection would be determined later.

⁴ The pump station storage tanks would be bolted or welded steel and lined.

⁵ Initially, this load would be 1,950 kilovolt amperes. Only when the fifth pump is installed is when the load would be 2,565 kilovolt amperes.

CONSTRUCTION PROCEDURES

Construction techniques and procedures would be basically the same as those described in Appendix A-2, Construction Procedures, except construction would be performed by a single engineering, procurement, and construction (EPC) contractor that would design the pipeline, well field, and pump stations and who then would subcontract and manage the actual work done by contractors that specialize in the specific type of construction being performed; i.e., cross-country pipeline, well drilling, directional drilling, or tank erector work. The EPC would construct the access roads and pump stations. SRP would oversee and manage the EPC contractor.

General

General construction would be the same as described in Appendix A-2, General, except the provisions of the AWWA would be followed in the design, construction, operation, and maintenance of the well field, collector pipelines, and the main water-supply pipeline. Furthermore, any additional requirements imposed by the Hopi Tribe, Navajo Nation, Bureau of Reclamation, or the Bureau of Indian Affairs also would be followed. Both tribes would be consulted to ensure that all clearing, grading, and construction activities are conducted in such a manner as to minimize disturbance to traditional lifeways.

Clearing and Grading

Clearing and grading would be the same as Appendix A-2.

Blasting

This would be the same as Appendix A-2. Blasting would be considered only if conventional trenching were not possible.

Clean-Up and Restoration

Clean-up and restoration would be the same as Appendix A-2.

Well Field Construction

There are five major activities that would be performed to develop the well field. These are (1) constructing access roads; (2) drilling well sites; (3) installing collector piping; (4) erecting storage tank; and (5) installing the electrical-power supply. It is expected that the design and contractor selection for this work would take approximately 14 months and that the construction activities would require approximately 18 months. Except for APS and NTUA materials, all materials for the wellfield construction would be shipped directly from the manufacturer to either Flagstaff, Arizona, or an equivalent location if delivery is by rail and the materials transshipped to a storage area near the well-field storage tank. Materials would be shipped directly to the storage area if delivery is by truck. From the storage area, material would be moved to where it would be installed at the time of construction. APS materials would be shipped to their service center in Flagstaff, Arizona, and NTUA materials to their facilities in Window Rock, Arizona.

Constructing Access Roads

Wherever possible, existing roads such as Indian Road 6930 would be used for access. However, approximately 19.9 miles of new access roads for the 6,000 af/yr alternative or 26.5 miles for the 11,600 af/yr alternative ultimately would be required for the collector piping and to access each of the well sites. The access roads would require a permanent right-of-way or easement width of 25 feet and an additional 15 feet of temporary right-of-way or easement width during construction. The new access

roads would be single lane with turnouts, as appropriate, to allow vehicles to pass one another. The roads would be constructed by using bulldozers, a road grader for blading, and compaction equipment. After the vegetation is removed, the area would be graded to the proper contour, and be compacted, where necessary. If necessary, streams and washes would be crossed using corrugated metal pipe drain crossings.

Typically the access roads would be constructed by a single crew consisting of 14 people (surveyors, heavy equipment operators, laborers, drivers, foremen) with 9 pieces of heavy construction equipment (bulldozers, road graders, roller, watering truck, front-end loader, dump trucks). The work is expected to take approximately 1 month.

Drilling Well Sites

In addition to the 50 feet by 50 feet permanent well site area, each well site would require an additional 200 feet by 200 feet temporary construction lay-down area for drilling equipment, materials, etc. The work at each site would consist of drilling the well; installing the pump; connecting the well to the collector piping; installing the electrical, communication, and control equipment; and testing the well.

The wells would be drilled using appropriate and approved drilling methods. Bentonite drilling fluids would not be allowed. Biodegradable or biopolymer drilling fluids would be allowed if used in accordance with manufacturer's instructions. Drill cuttings would be disposed of in accordance with the Stormwater Prevention Pollution Plan (SWPPP), the Navajo Nation Department of Water Resources and/or the Hopi Tribe Standard Specifications for Well Drilling, and the National Environmental Policy Act Categorical Exclusion Checklist. After drilling the 24-inch bore hole, an 18-inch standard casing would be installed with 12-inch standard well screens and a filter pack.

Determination as to whether drill cuttings are contaminated or noncontaminated would be determined by appearance, odors, or tested characteristics (e.g., pH).

Contaminated drill cuttings (e.g., cuttings containing sewage, contaminated material, or other toxic or waste residues) would be stockpiled temporarily on a minimum 20-mil thick, lined barrier and covered with visqueen or other tarp material and then removed from the project area and disposed of at a permitted waste disposal facility during the final site cleanup consistent with the SWPPP.

Uncontaminated drill cuttings would be spread in areas that are already disturbed or devoid of vegetation to the extent practicable. The drill cuttings would be spread to blend with the existing terrain, to a depth of no greater than 6 inches. Disturbed areas would be stabilized to minimize erosion and sedimentation.

Each well would be production tested individually. Temporary discharge piping would be installed to direct the water discharged from the well site. It is estimated that the development and production testing of the wells may generate as much as 7 million gallons of water per well. Water from drilling and development operations would be disposed of in the following manner or in a similar manner as approved by the local regulators, as follows:

- Any water containing additives would be collected and contained in lined ponds, the additives allowed to settle, and the water allowed to evaporate. If evaporation is not practicable, any water containing additives would be collected and contained in "baker" tanks, the additives allowed to settle, and the water separated from the waste. The additives would be disposed of consistent with the description in the paragraph titled Clean-Up and Restoration in Appendix A-2. The remaining water would be considered to be free of additives and would be disposed of as described below.

- Water that contains greater than 5,000 part per million (ppm) or 5 milliliter (ml) sediment per 1,000 ml of discharge water, as determined using an Imhoff Cone, and 10 nephelometric turbidity units (NTU) for turbidity, would be discharged into temporary settling tanks or lined pits until the water contains 5,000 ppm or 5 ml sediment per 1,000 ml of discharge water or less, as determined using an Imhoff Cone, and 10 NTU or less for turbidity. The water then would be discharged as described below. The remaining material would be disposed of consistent with the description in the paragraph titled Clean-Up and Restoration in Appendix A-2.
- Water that contains 5,000 ppm or 5 ml sediment per 1,000 ml of discharge water or less, as determined using an Imhoff Cone, and 10 NTU or less for turbidity, would be disposed of at approved locations (e.g., charco or approved depressions) consistent with the SWPPP. To prevent erosion or damage to channels and depressions at discharge locations, suitable diffusers, or energy dissipaters as required in the SWPPP would be used. Such discharge would not make any access route impassable.
- Clean aquifer water from pump-testing operations that contains 5,000 ppm or 5 ml sediment per 1,000 ml of discharge water or less, as determined using an Imhoff Cone, and 10 NTU or less for turbidity), also may be made available for beneficial use by the local inhabitants, or may be discharged to their steel storage tanks, if capacity is available. The remaining water would be discharged at approved locations (e.g., charco or approved depressions), consistent with the SWPPP. To prevent erosion or damage to channels and depressions at discharge locations, suitable diffusers or energy dissipaters as required in the SWPPP would be used. Such discharge would not make any access route impassable.

In addition to the development and production testing, water would be sampled and tested for quality. Water samples would be collected and analyzed for each completed well in accordance with Table A-2 below or as otherwise required by permit or regulation. Water-quality samples would be submitted to a state certified (inorganics) analytical laboratory, preferably one in Arizona. All results of laboratory analysis would be included in the well-installation report.

Table A-2 Groundwater Sampling, Collection, and Preservation Details for Wells

Constituent	Sample Container/ Preservative	Volume (ml)	Recommended Testing Method/ Maximum Holding Time
Total dissolved solids	Plastic or glass/4°C	250	SM 2540C/7 days USEPA 160.1
Chloride, sulfate, fluoride, nitrate (as nitrogen)	Plastic or glass/4°C	250	USEPA 300.0/28 days
pH	Plastic or glass/4°C	250	SM 9040/EPA150.1/Immediately
Calcium, magnesium, sodium, potassium, silica, arsenic, iron	Plastic or glass/4°C/ HNO ₃	1,000	USEPA 200.7,8/6 months
Total alkalinity	Plastic or glass/4°C	250	SM 2320B/USEPA 310.1/14 days
Isotope analysis (D/H and O18/O16)	Plastic or Glass/4°C/ HNO ₃	1,000	6 months
Metals: Copper, lead mercury, nickel, selenium, zinc	Plastic or glass/4°C/ HNO ₃	1,000	USEPA 200.7 (ICP total metals)/ 6 months

NOTES: ml = milliliters
 °C = degrees Centigrade
 HNO₃ = nitric acid
 USEPA = U.S. Environmental Protection Agency
 ICP = inductively coupled plasma spectrometry

Typically the wells would be installed by a single, specialized crew consisting of 8 people using a drill rig and supply truck. The work is expected to take approximately 13 to 14 months for the 12 wells needed for the 6,000 af/yr alternative. Approximately 22 months would be needed for the 11,600 af/yr alternative if all 21 wells were installed at the time of initial construction. It is estimated that a single crew of eight people would conduct the drilling (driller, laborers, electrician, driver, foremen).

Installing Collector Piping

It is expected that the collector piping would be AWWA C151 slip jointed, CML, ductile iron pipe. Standard pipeline construction techniques would be employed along the pipeline route and typically involve the following sequence of activities: surveying and flagging the route, clearing and grading, excavation, placing the pipe bedding, stringing, lowering into the trench, joining the pipe, backfilling, hydrostatic testing, startup and testing, cleanup, restoration, and post-construction monitoring.

The pipe trench would be excavated on one side of the access road such that there is a minimum 3-foot cover. The trench would be excavated such that it is 36 inches wide or there is a clearance of 12 inches on either side of the pipe, whichever is greater. Trench minimum widths would be as follows:

Pipe Size	6-inch	8-inch	10-inch	12-inch	14-inch	16-inch
Trench width, inches	36	36	36	36	38	40

The majority of the excavation would be accomplished using equipment such as a ditch wheel that cuts a vertically sided trench approximately 36 inches wide at the bottom and generally to a depth sufficient to accommodate a minimum of 36 inches of cover. When necessary, a rock breaker would be used and the broken material removed using a back hoe or similar type equipment. If necessary, blasting would be used as a last resort. Topsoil and subsoil would be side cast to the same side of the trench in a two-cut process. The first cut is a shallow excavation that removes the topsoil and stockpiles it to the far edge of the nonwork side of the trench. The second cut is the deeper excavation that removes the subsoil and stockpiles it adjacent to the topsoil also to the far edge of the nonwork side of the trench. It is anticipated that the maximum length of trench that would be open at any one time would be approximately 1,250 feet for a time period of about three days.

Existing graded roads would be crossed using an excavated trench. Where the collector piping crosses streams and washes, the trench would be excavated to provide at least 10 feet of cover between the top of the pipe and the bottom of the stream/wash bed and the pipe would be encased in concrete.

The pipe lengths, either 18 or 20 feet with a factory applied CML, would be unloaded from the supply trucks along the working side of the open trench. After excavation, where necessary, the trench would be partially filled with a compacted granular bedding material made up from local materials, which would be either crushed rock or pea gravel (coarse aggregate size No. 7). This bedding material would either consist of 3 inches of granular soil or 6 inches of crushed rock depending on the local materials.

The pipe lengths then would be lowered into the trench using a small crane. After the pipe has been laid in the trench, typically 2 to 3 joints would be made up at a time by using chokers and come-alongs to pull the pipe together to make up bell and spigot type slip joints. These 2 to 3 sections then would be joined to the pipe installed previously. The pipe cannot be joined and then lowered into the trench because the bending that would occur would damage the CML.

The trench would be backfilled up to the centerline of the pipe with additional compacted granular material. The trench then would be backfilled to 6 inches above the top of the pipe with compacted

embedment of finely divided job-excavated material free from debris, organic material, and stones. The trench then would be backfilled with the excavated side-cast material with the topsoil filling in the last 1 to 2 feet of the trench. The pipeline then would be hydrostatically tested in segments. Water for the hydrostatic testing would come from the well development tests.

A typical single crew for collector piping construction would consist of 22 people (heavy equipment operators, laborers, drivers, foremen, superintendent) and would be installed by a single crew using 16 pieces of heavy construction equipment (trench excavator, bulldozer, front-end loader, backhoe, small cranes, rock breaker, dump trucks, road grader, 18-wheel flatbed trucks). The work is expected to take approximately 13 to 14 months for the 6,000 af/yr alternative and 22 months for the 11,600 af/yr alternative, if all 21 wells are installed.

Erecting Storage Tank

The well-field collection storage tank would be a field erected, coated, welded or bolted carbon-steel tank fabricated and stamped in compliance with AWWA D100, D102 or D103 code requirements. The tank would have a maximum diameter of 130 feet and a maximum height of 60 feet. Tank materials would be rolled at a factory to the required curvature and shipped to the job site in small radial arc components of approximately 10 feet by 25 feet and welded or bolted in place. Steel shell segments would be positioned in place by on-site cranes of approximately 10- to 20-ton capacity. The tank shell foundation would use a perimeter ring wall construction method. Steel girders, beams, and poles would be used for structural support of the tank roof with a few center supports. The structural welding of supports would require code-certified welders.

Site conditions in the tank pad area of 215 feet by 215 feet would need forms placed and concrete poured for the ring wall foundation as well as reinforced steel cages embedded in concrete to strengthen and provide support for the tank shell. In addition to the permanent right-of-way or easement, a temporary easement of 300 feet by 300 feet would be needed as a construction lay-down area for equipment and materials and a construction office trailer. All of the well-field work would be coordinated from this location as well.

Typically a single crew consisting of 15 people (crane operator, welders, pipefitters, electricians, laborers, drivers, foremen) using a small crane, welding machines, diesel generator, 18-wheel flatbed trucks, and an office trailer would erect the tank. The work is expected to take approximately 3 months.

Installing Electrical-Power Supply

The electrical supply for the wells located on land owned by the Navajo Nation would be constructed by and would receive power from NTUA. The electrical supply for the four wells located on land owned by the Hopi Tribe (11,600 af/yr alternative) would be constructed by and would receive power from APS. It is expected that both NTUA and APS would use the same construction methods to erect their distribution lines. Wooden poles would be set within the rights-of-way or easements for the access roads and well sites and on the opposite side of the road from the collector piping. The excess spoils from the holes would be used either in the grading of the access roads or well sites, or would be disposed of in an approved disposal location. The location of the holes for the poles would be adjusted in the field to avoid any sensitive environmental or cultural resource areas.

Typical distribution lines would be installed by a single crew consisting of 18 (journeymen linemen, apprentice linemen, utility laborers, driver, foreman) using line trucks, cable truck, and an 18-wheel flatbed. The work is expected to take approximately 13 to 14 months for 6,000 af/yr alternative and

22 months for the 11,600 af/yr alternative if all 21 wells are constructed. The work could be finished earlier until all of the well sites are completed.

Water-Supply Pipeline and Pump-Station Construction

Water-supply pipeline and pump station construction would be the same as the well field construction with the following changes. There are five major activities that would be performed to construct the main water-supply pipeline and pump stations. These are (1) constructing the main water-supply pipeline; (2) the directional drilling crossings; (3) constructing the two pump stations; (4) installing the electrical-power supply; and (5) road improvements. It is expected that the design and contractor selection for this work would take approximately 14 months and that the construction activities would require approximately 22 months. It is expected that the main water-supply pipeline and the pump stations would be constructed at the same time.

Constructing Main Water-Supply Pipeline

Construction of the water-supply pipeline would be the same as the collector piping with the following changes. It is expected that the main water-supply would be AWWA C200, CML, exterior tape wrapped, welded-steel pipe. Standard pipeline construction techniques would be employed along the pipeline route.

The pipe trench would be excavated on the western side of the road for paved roads or on one side of the road bed for unpaved roads such that there is a minimum of 3 feet of cover. The trench also would be excavated such that the minimum widths would be as follows:

Pipe Size	18-inch	24-inch	25-inch	26-inch	30-inch
Trench width, inches	64	72	75	77	85

The extra trench width is required so that there is room to weld the sections together in the trench, to repair the exterior coating in the trench and to provide room to install the granular embedment material up to the centerline of the pipe ensuring that there are no voids between the embedment material and the pipe.

Existing graded roads would be crossed by excavated trench. Existing paved roads would be crossed using directional drilling. Where the pipeline crosses the Little Colorado River and the Dinnebito Wash, the crossings would be made by directional drilling.

The pipe lengths, up to 80 feet with a factory applied CML and external tape wrap, would be unloaded from the supply trucks along the working side of the open trench. Bedding material would either consist of 3 inches of granular soil or 6 inches of crushed rock (depending on the local materials) beneath piping up to 26 inches in diameter and 6 and 9 inches respectively beneath 30-inch pipe.

After the pipe has been laid in the trench, it would be joined by welding in accordance with AWWA C206 using appropriate weld procedures and welders qualified by American National Standards Institute/American Welding Society D1.1. Both the interior and exterior coatings then would be repaired.

Excess spoils from the excavation would be hauled away and disposed of in an approved disposal site. In lieu of a hydrostatic test, 100 percent radiography of 10 percent of the welds may be used in accordance with AWWA C206.

Typically each main water-supply pipeline crew would consist of 33 people (heavy equipment operators, welders, laborers, drivers, foremen, superintendent, construction manager) using 30 pieces of construction equipment (trench excavator, bulldozer, front-end loader, backhoe, small cranes, rock breaker, dump trucks, road grader, welding machines, portable rock crushing plant, 18-wheel flatbed trucks). It is anticipated that the main water supply would be installed by three crews, and the work is expected to take approximately 22 months for either alternative.

Directional Drilling Crossings

Horizontal directional drilling for the water-supply pipeline would be conducted in the same manner as described in Appendix A-2 under the heading Construction Methods in Special Areas.

It is anticipated that this work would take one week for each paved road crossing and four weeks each for the Little Colorado River (24-inch-diameter pipe, 7,920 feet long) and Dinnebito Wash (18-inch-diameter pipe, 5,280 feet long) crossings for either alternative.

Constructing Two Pump Stations

The pump stations would be constructed of filled concrete-block walls on a concrete-slab foundation, open web joist roofing with metal decking and single-ply roofing, and bullet- and intrusion-proof exterior doors and roof hatches. A single, general engineering contractor would be used to construct both pump stations. Once a crew is finished at the first site, for example, the crew pouring the concrete foundations and erecting the concrete block walls would move on to the second site.

At each site, the sequence of construction would be to clear and grade the site; excavate for the septic field, foundations, building, storage tank; pour the foundations; erect the walls; install the roof; install all of the piping valves, pumps, surge tanks, electrical switchgear, controls and communication equipment, air compressor, carbon dioxide fire-suppression system, water-storage tank, gravel paving, and security fence and security lighting; and make the connection to the APS and/or NTUA transmission system.

It is anticipated that the pump stations would be constructed one after the other by a single crew of 56 (heavy equipment operators, welders, pipe fitters, electricians, instrument technicians, carpenters, laborers, drivers, foremen, superintendent) using 23 pieces of equipment (bulldozer, front-end loader, backhoe, small and large cranes, welding machines, diesel-power generator, 18-wheel flatbed trucks, dump trucks, portable concrete batch plant, concrete delivery trucks, office trailer). The work is expected to take approximately 14 months for either alternative.

Installing Electrical-Power Supply

Providing power to the pump stations would require building a new 230/69kV substation approximately 4 miles west of the intersection of State Route 99 and Indian Route 15 near Leupp, Arizona, in the existing 230kV transmission line right-of-way, building a new 61-mile-long 69kV transmission line to the two pump stations, and installing a 69/4.16kV step-down transformer at each pump station. All of this work would be performed by APS except for the 69/4.16kV step-down transformer at the Tolani Lake Pump Station, which would be installed by the NTUA.

It is estimated that the new substation would require a permanent 200 feet by 200 feet site plus a 1-acre temporary site for construction lay down. Steel poles for the transmission line would be set either within the main water transmission pipeline right-of-way or easements on the opposite side of the road from the main water-supply pipeline. The excess spoils from the substation construction and the transmission line foundation holes would be hauled away and be disposed of in an approved disposal location. The location

of the holes for the poles would be adjusted in the field to avoid any sensitive cultural or environmental areas.

Building the new substation would include clearing and grading, excavating for foundations, pouring the concrete foundations, erecting steel switch racks and busses, installing insulators, disconnect switches, circuit breakers, transformers, conductors, control and communication cabinets, stringing new conductors from the existing 230kV transmission line into the substation (which also may require erecting two new dead-end transmission towers), paving the area with gravel, and installing security fencing and lighting. To install the steel-pole transmission line, the work would include digging holes for the foundations, pouring concrete, setting the anchor bolts, erecting the steel poles, installing the insulators and stringing the conductors. Communication cable(s) would be under built on the transmission line steel poles.

It is anticipated that a single crew consisting of 36 people (journeymen linemen, apprentice linemen, utility laborers, heavy equipment operators, instrument technicians, drivers, superintendent) using 16 pieces of equipment (line truck, bulldozer, front-end loader, backhoe, small cranes, welding machines, diesel-power generator, 18-wheel flatbed trucks, dump trucks, office trailer) would install the new substation. The new transmission line would be constructed using a crew of 19, using line trucks, a small crane, cable pulling rig, and an 18-wheel flatbed. The work is expected to take approximately 12 months for the substation and 14 months for the transmission line for either the eastern or western water-supply pipeline alternative. The transmission line cannot be completed until both pump stations are completed.

Road Improvements

Road improvements would be the same as for well field access roads except for the following changes. Existing roads such as Indian Route 6930, State Route 99, Indian Route 2, Indian Route 22, Indian Route 8034, and Indian Route 41 would be used to the maximum extent possible. Where necessary, dirt roads would be improved to accommodate the main water-supply water pipeline and existing traffic. However, approximately 5 miles of new access roads would be required between Mileposts 71 and 76 and in the vicinity of the Dinnebito Wash to allow access to the main water-supply water pipeline. The new road between Mileposts 71 and 76 would be single lane with turnouts as appropriate to allow vehicles to pass one another.

APPENDIX B



Appendix B
Estimated Costs for Proposed Coal-Delivery System

Appendix B Estimated Costs for Proposed Coal-Delivery System

Coal-Slurry Pipeline

	Capital Cost (\$ Million)	Annual Operation and Maintenance Cost (\$ Million)
Existing Route	200	24
Existing Route with Realignments	200	24

SOURCE: Black Mesa Pipeline, Inc. 2005

NOTES: The capital costs do not include right-of-way costs.

Water-Supply System

Route/Component	6,000 af/yr Alternative		11,600 af/yr Alternative	
	Capital Cost ⁴ (\$ Million)	Annual Operation and Maintenance Cost ⁴ (\$ Million)	Capital Cost ⁴ (\$ Million)	Annual Operation and Maintenance Cost ⁴ (\$ Million)
Eastern Route				
Well Field	23	1.0	30	1.3
Pump Stations	11	2.2 ⁶	12	2.6 ⁶
Water-supply pipeline ³	145	-	155	-
Water ⁵	-	5.4	-	5.4
Total ¹	179	8.6	197	9.3
Western Route				
Well Field	23	1.0	30	1.3
Pump Stations	22	5.0 ⁶	23	5.4 ⁶
Water-supply pipeline ³	169	-	179	-
Water ⁵	-	5.4	-	5.4
Total ²	214	11.4	232	12.1

SOURCES: Peabody Western Coal Company 2005; Southern California Edison Company 2006

NOTES: ¹Includes costs for well field, 108 miles of pipeline (includes West Kykotsmovi and north crossing of the Little Colorado River subalternatives), and two pump stations.

²Includes costs for well field, 137 miles of pipeline, and four pump stations.

³Does not include costs for right-of-way.

⁴2006 dollars.

⁵Annual water royalties to Hopi Tribe and Navajo Nation.

⁶Includes operation and maintenance for pipeline

Kykotsmovi Area Subalternatives

Subalternative	Capital Cost (\$ Million)
West Kykotsmovi	2.7
East Kykotsmovi	3.4

NOTE: The estimate for the West Kykotsmovi subalternative is the applicant's preferred alternative and included as part of the eastern alternative cost estimate above.

Little Colorado River Crossing

Subalternative	Capital Cost (\$ Million)
North crossing (horizontal bore under river)	6.5
South crossing (historic highway bridge)	1.7

NOTE: The estimate for the horizontal bore under the Little Colorado River is the applicant's preferred alternative and included as part of the eastern alternative cost estimate above.

APPENDIX C



Appendix C
Legal Authorities and Mandates

Appendix C

Legal Authorities and Mandates

A number of Federal statutes have been enacted over time to establish and define the authority of Federal agencies. Following is a list of major legal authorities.

The National Environment Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 et seq.) requires the consideration and public availability of information regarding the environmental impacts of major Federal actions significantly affecting the quality of the human environment. The law further requires the Federal authorized officers to identify and describe the significant environmental issues associated with their decisions and to develop alternatives to a proposed action (including the alternative of no action). Federal authorized officers must disclose the direct, indirect, and cumulative effects of the decisions; adverse environmental effects that cannot be avoided; the relationship between short-term uses of the human environment and the maintenance of long-term productivity; and any irreversible or irretrievable commitments of resources made by the decision.

The Clean Air Act (CAA) of 1990, as amended (42 U.S.C. 7418) requires Federal agencies to comply with all Federal, state, and local requirements regarding the control and abatement of air pollution. This includes abiding by the requirements of state implementation plans. The Clean Air Act provides that each state is responsible for ensuring achievement and maintenance of air quality standards within its borders so long as such standards are at least as stringent as Federal standards established by the U.S. Environmental Protection Agency (USEPA).

The Clean Water Act (CWA) of 1987, as amended (33 U.S.C. 1251) establishes objectives to restore and maintain the chemical, physical, and biological integrity of the Nation's water. Upon passage of the Environmental Quality Acts and adoption of the water-quality standards, state agencies were empowered to enforce water quality standards as long as they are at least as stringent as the Federal standards established by the USEPA. Also, Section 404 of the CWA, administered by the U.S. Army Corps of Engineers, requires that "waters of the U.S." be protected by permits prior to dredge or fill activities occurring in such areas. Waters include intermittent streams, mud flats, and sand flats. Wetlands that meet jurisdictional criteria of Section 404 of the CWA are partially protected in that a permit is required prior to any dredge or fill activity occurring in such areas.

The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.) provides a means whereby the ecosystems upon which threatened and endangered species depend may be conserved and to provide a program for the conservation of such threatened and endangered species (section 1531 (b), Purposes). The ESA requires all Federal agencies to seek to conserve threatened and endangered species, utilize applicable authorities in furtherance of the purposes of the ESA (Sec. 1531 (c) (1), Policy), and avoid jeopardizing the continued existence of any species that is listed or proposed for listing as threatened and endangered or destroying or adversely modifying its designated or proposed critical habitat (Sec. 1536 (a), Interagency Cooperation). The U.S. Fish and Wildlife Service (FWS) is responsible for administration of this Act, which also requires all Federal agencies to consult (or confer) in accordance with Section 7 of the ESA with the Secretary of the Interior, through the FWS and/or the National Marine Fisheries Service, to ensure that any Federal action or activity is not likely to jeopardize the continued existence of any species listed or proposed to be listed under the provisions of the ESA, or result in the destruction or adverse modification of designated or proposed critical habitat (Sec. 1536 (a), Interagency Cooperation, and 50 CFR 402). Mitigation measures are developed through the consultation process and are put forth as suggested conservation measures included in a formal FWS biological opinion, which addresses whether the proposed action would jeopardize the continued existence of any officially listed endangered or threatened species.

The Federal Water Pollution Control Act (33 U.S.C. 1323) requires the Federal land manager to comply with all Federal, state, and local requirements, administrative authority, process, and sanctions regarding the control and abatement of water pollution in the same manner and to the same extent as any nongovernmental entity.

The Safe Drinking Water Act (42 U.S.C. 201) is designed to make the Nation's waters "drinkable" as well as "swimmable." Amendments in 1996 established a direct connection between safe drinking water and watershed protection and management.

The Resource Conservation and Recovery Act (RCRA) of 1976 (PL 89-72) gave the USEPA the authority to control hazardous waste from "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous wastes.

The Wilderness Act, as amended (16 U.S.C. 1131 et seq.) authorizes the President to make recommendations to the Congress for Federal lands to be set aside for preservation as wilderness.

The Antiquities Act of 1906 (16 U.S.C. 431-433) protects cultural resources on Federal lands and authorizes the President to designate national monuments on Federal lands.

The Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C 470) secures, for the present and future benefit of the American people, the protection of archaeological resources and sites that are on public lands and American Indian lands, to foster increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals having collections of archaeological resources and data which were obtained before October 31, 1979.

The National Historic Preservation Act (NHPA) (1966), as amended (16 U.S.C. 470) expands protection of historic and archaeological properties to include those of national, state, and local significance and directs Federal agencies to consider the effects of proposed actions on properties eligible for or included in the National Register of Historic Places (NRHP). The Act mandates that when Federal undertakings (i.e., Federal projects or federally funded or licensed projects) are planned and implemented, the responsible Federal agencies give due consideration to historic properties (i.e., resources eligible for the NRHP), regardless of land status. Regulations for *Protection of Historic Properties* (36 CFR Part 800) define a process for demonstrating such consideration by consulting with the State Historic Preservation Officers, Federal Advisory Council on Historic Preservation, and other interested organizations and individuals.

The American Indian Religious Freedom Act (AIRFA) of 1978 (42 U.S.C. 1996) establishes a national policy to protect and preserve the right of American Indians to exercise traditional Indian religious beliefs or practices.

The Historic Sites Act of 1935 (16 U.S.C. §461-467) defines a national policy to identify and preserve historic sites, buildings, objects, and antiquities of national significance. The law authorizes the Secretary of the Interior to conduct surveys, collect and preserve data, and acquire historic and archaeological sites.

The Archaeological and Historic Preservation Act (AHPA) of 1974 (16 U.S.C. §§469-469c) provides for preservation of archaeological and historical information that might otherwise be lost as a result of Federal construction projects and other federally licensed activities and programs. This Act stipulates that up to one percent of the funding appropriated by Congress for Federal undertakings can be spent to recover, preserve, and protect archaeological and historical data. A subsequent amendment authorized the one percent limit to be administratively exceeded under certain circumstances.

The Native American Grave Protection and Repatriation Act (NAGPRA) of 1990 (25 U.S.C. §§3001-3013) protects the human remains of indigenous peoples and funerary objects, sacred objects, and items of cultural patrimony on Federal lands. The Act also provides for the repatriation of such remains and cultural items previously collected from Federal lands and in the possession or control of a Federal agency or federally funded repository.

The Curation of Federally Owned and Administered Archaeological Collections (36 CFR Part 79) stipulates standards for facilities that curate federally owned archaeological collections, which include not only artifacts but also all associated records and reports in order to ensure long-term preservation of such collections.

The White House Memorandum on Government-to-Government Relations with Native American Tribal Governments of 1994 set forth guidelines requiring Federal agencies to adhere to directives designed to ensure that the rights of sovereign tribal governments are fully respected

Indian coal leasing statutes govern the leasing, exploration, mining, and reclamation of Indian lands and include Sec. 4, Act of May 11, 1938, (52 Stat. 347); Act of August 1, 1956 (70 Stat. 774); 25 U.S.C. 396a-g; and 25 U.S.C. 2 and 9; 34 Stat. 539; 35 Stat. 312; 25 U.S.C. 355 NT; 35 Stat. 781; Sec. 1, 49 Stat. 1250; 25 U.S.C. 473a; 49 Stat. 1967; 25 U.S.C. 501, 502; and 52 Stat. 347.

The Surface Mining Control and Reclamation Act (SMCRA) of 1977 (30 U.S.C. 1201 et seq.) requires application of unsuitability criteria prior to coal leasing and also to proposed mining operations for minerals or mineral materials other than coal.

The Mining and Mineral Policy Act of 1970 (30 U.S.C. 21a) establishes a policy of fostering development of economically stable mining and minerals industries, their orderly and economic development, and studying methods for disposal of waste and reclamation.

The Public Rangelands Improvement Act (PRIA) of 1978 (43 U.S.C. 1901) provides that the public rangelands be managed so that they become as productive as feasible in accordance with management objectives and the land use planning process established pursuant to 43 U.S.C. 1712.

The Carlson-Foley Act of 1968 (P.L. 90-583) directs Federal agencies to enter upon lands under their jurisdiction having noxious plants (weeds), and destroy noxious plants growing on such land.

The Federal Noxious Weed Act of 1974 (7 U.S.C. 2801-2814) provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health. The Act requires that each Federal agency develop a management program to control undesirable plants on Federal lands under the agency's jurisdiction; establish and adequately fund the program; implement cooperative agreements with state agencies to coordinate management of undesirable plants on Federal lands; establish integrated management systems to control undesirable plants targeted under cooperative agreements. A Federal agency is not required to carry out management programs on Federal lands unless similar programs are being implemented on state or private lands in the same area.

The Act also directs the Secretaries of Agriculture and the Interior to coordinate programs for control, research, and educational efforts associated with noxious weeds. The Secretaries must identify regional control priorities and disseminate technical information to interested state, local, and private entities.

The Plant Protection Act of 2000 (P.L. 106-224) prohibits the import, export, and movement in interstate commerce, or mailing of any plant pest unless authorized by the Secretary of Agriculture; authorizes the

Secretary to prohibit or restrict the import, export, or movement in interstate commerce of any plant, plant product, biological control organism, noxious weed, or means of conveyance to prevent the introduction or dissemination of a plant pest or noxious weed; and combines all or a portion of 11 acts or resolutions into one act.

The Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712) implements various treaties and conventions between the United States and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the Act, taking, killing or possessing migratory birds is unlawful.

The Fish and Wildlife Coordination Act of 1958, as amended (16 U.S.C 661-667) proposes to assure that fish and wildlife resources receive equal consideration with other values during the planning of water resources development projects. The Act requires coordination with FWS by the U.S. Department of Energy when a project is planned that may affect a body of water. It also requires coordination with the head of the state agency that administers wildlife resources in the affected state.

The Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901-2911) authorizes financial and technical assistance to the states for the development, revision, and implementation of conservation plans and programs for nongame fish and wildlife.

The Wild and Free Roaming Horse and Burro Act of 1971 (16 U.S.C. 1331) places all wild and free roaming horses and burros under the jurisdiction of the Secretary of the Interior for the purpose of management and protection to achieve and maintain a thriving natural ecological balance on the public lands. The Act calls for the maintenance of current population inventories, provides for the humane destruction of sick or lame animals, and allows for adoption by qualified individuals in the case of excess populations.

Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (49 *Federal Register* 7629 [1994]) requires that each Federal agency consider the impacts of its programs on minority populations and low-income populations.

Executive Order 13007 – Indian Sacred Sites (61 *Federal Register* 26771 [1996]), requires Federal agencies to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites.

Executive Order 13287 – Preserve America directs Federal agencies to provide leadership in preserving America's heritage by actively advancing the protection, enhancement and contemporary use of historic properties owned by the government, emphasizing partnerships. Under this order, agencies shall cooperate with communities to increase opportunities for public benefit from, and access to, Federally owned historic properties.

Executive Order 13084 – Consultation and Coordination with Indian Tribal Governments provides, in part, that each Federal agency shall establish regular and meaningful consultation and collaboration with American Indian tribal governments in the development of regulatory practices on Federal matters that significantly or uniquely affect their communities.

Executive Order 13112 – Invasive Species provides that no Federal agency shall authorize, fund or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive

species; and that all feasible and prudent measures to minimize risk or harm will be taken in conjunction with the actions.

Secretarial Order 3175 (incorporated into the Departmental Manual at 512 DM 2) requires that if Department of the Interior agency actions might impact Indian trust resources, the agency explicitly address those potential impacts in planning and decision documents, and the agency consult with the tribal government whose trust resources are potentially affected by the Federal action.

Secretarial Order 3206 – American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act requires Department of the Interior agencies to consult with Indian Tribes when agency actions to protect a listed species, as a result of compliance with the ESA, affect or may affect of Indian lands, tribal trust resources, or the exercise of American Indian tribal rights.

Federal Land Policy and Management Act (FLPMA) of 1976, as amended (43 U.S.C. 1701 et seq.) provides the authority for the Bureau of Land Management (BLM) land use planning. This statute and its implementing regulations define principles for the management of public land and its resources. This Act directs the Secretary of the Interior to develop, maintain, and, when appropriate, revise land use plans that provide for the use of public land managed on the basis of multiple use and sustained yield unless otherwise specified by law. Through FLPMA, BLM is responsible for the management of the public land and resources and their various values. FLPMA specifically states that public land will be managed under the principles of multiple use, and, further, indicates that multiple use includes harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment.

The Forest and Rangeland Renewable Resources Planning Act of 1974 called for the management of renewable resources on national forest lands. The National Forest Management Act of 1976 reorganized, expanded and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974. The National Forest Management Act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System. It is the primary statute governing the administration of national forests.

The Multiple-Use Sustained-Yield Act of 1960, 16 U.S.C. §§ 528-531, June 12, 1960, declares that the purposes of the national forest include outdoor recreation, range, timber, watershed and fish and wildlife. The Act directs the Secretary of Agriculture to administer national forest renewable surface resources for multiple use and sustained yield.

APPENDIX D



Appendix D
Truck Alternative Study
Technical Memorandum
Black Mesa Project EIS

Prepared for
Office of Surface Mining Reclamation and Enforcement

Prepared by
URS Corporation

April 2006

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1.0 PURPOSE OF REPORT

The purpose of this technical memorandum is to address the conceptual feasibility of the transportation of coal by truck between the Black Mesa mining operation in northeastern Arizona and the Mohave Generating Station near Laughlin, Nevada.

2.0 PROJECT DESCRIPTION

One of the purposes of the Black Mesa Project is to continue to supply the coal from the Black Mesa mining operation in northeastern Arizona (approximately 125 miles northeast of Flagstaff) to the Mohave Generating Station in Laughlin, Nevada. Since 1970, Peabody Western Coal Company (Peabody) has been supplying coal from the Black Mesa mining operation to the Mohave Generating Station, a coal-fired, steam electric-generating power plant with a capacity of 1,580 megawatts of power. The plant is owned jointly by Southern California Edison (SCE), Salt River Project, Los Angeles Department of Water and Power, and Nevada Power Company. The Black Mesa mining operation is the sole supplier of coal for the Mohave Generating Station and the Mohave Generating Station is its sole customer. Coal is delivered some 273 miles from the Black Mesa mining operation in the form of slurry (about 50 percent water and 50 percent coal) to the Mohave Generating Station by the Black Mesa Pipeline, owned and operated by Black Mesa Pipeline, Inc.

On February 17, 2004, Peabody submitted a permit application proposing several revisions to the life-of-mine (LOM) mining plans for the Black Mesa Complex to the Office of Surface Mining Reclamation and Enforcement (OSM). The Black Mesa mining operation is authorized to mine coal until such time as OSM makes a decision on the LOM permit application submitted by Peabody. Issuance of the LOM revision for the Black Mesa mining operation would allow continued coal mining at the operation in order to supply the Mohave Generating Station through 2026.

OSM determined that an environmental impact statement (EIS) would be required to address the LOM revisions and associated actions. As a result of public outreach at the beginning of the EIS process, one of the issues identified from public comments was opposition to the use of water for the industrial purpose of transporting the coal. One alternative means of transporting the coal that was suggested by the public was shipping the coal by trucks. Although trucking the coal has been addressed by the Department of the Interior and SCE in previously conducted studies, for the purposes of the current EIS (in progress), OSM requested that URS Corporation review the previous studies and address the conceptual feasibility and cost for transporting the Black Mesa coal by trucks.

3.0 CONCEPTUAL OPERATIONS PLAN

3.1 DESCRIPTION OF TRUCK ROUTE

The truck alternative would require trucks loaded with coal to travel 330 miles one-way southwest on U.S. Highway 160 through Tuba City, south on U.S. Highway 89 to Flagstaff, west on Interstate 40 (I-40) to Kingman, and west on State Highway 68 to the Mohave Generating Station in Laughlin. The reverse trip would use the same route. The segment distances for the proposed truck route would be as follows:

Segment	Distance (in miles)
Black Mesa Complex on U.S. Highway 160 to intersection of U.S. Highway 89	69
U.S. Highway 89 to Flagstaff	65
Flagstaff to Kingman on I-40	159
Kingman to Mohave Generating Station along State Highway 68	37
Total One-Way Truck Route Distance	330

3.2 TRAFFIC VOLUME (LOADED DIRECTION)

If the LOM permit application is approved, the average annual production of the Black Mesa mining operation that is transported to the Mohave Generating Station will increase from about 4.8 million tons to 5.4 million tons of washed coal.

3.3 TRUCK FREQUENCY

To develop truck frequencies, operating characteristics such as travel distances, operating speeds, and vehicle capacities must be determined. This section will outline the operating characteristics required to develop the required truck frequencies.

3.3.1 Travel Distances, Operating Speeds, and Trip Time

For the overall truck route, the average speed is assumed to be 50 miles per hour. Given the 330-mile one-way route distance (derived in Section 2) the travel time would range between 6.5 and 7 hours. For the purpose of estimating costs and required vehicles, 7 hours was used to account for the loading and unloading of trucks. This equates to a 14-hour round-trip time.

To haul the 5.4 million tons of coal that would be required to be transported annually between the Black Mesa Complex and the Mohave Generating Station, it would take 216,000 truckloads (assuming a 25-ton payload per truck). This equates to 592 loaded trucks per day assuming 355 days per year to account for holidays and potential highway closures caused by major storms. Divide 592 by 24 hours equals about 24.7 trucks per hour or an average of one loaded truck every 2.4 minutes (a truck in either direction every 1.2 minutes).

For a 7-hour one-way trip (with loading and unloading) the total trip time would be 14 hours, or 840 minutes. Divide 840 minutes by a 2.4-minute frequency equals a total of 350 trucks. For efficient operation, approximately 20 percent of the fleet would need to be spares for operation and maintenance. In this case, 70 spares would be required, bringing the total number of trucks to 420.

The 216,000 truckloads per year with 660-mile round trips would log 142,560,000 truck miles per year. Divided by the number of trucks, 420, each truck would log approximately 339,429 miles per year, which is about three times the average annual mileage for trucks.

3.3.2 Truck Tractor and Trailer Types and Quantity

Tractors with heavy haul specifications would be required, as they would be required to pull a 25-ton payload for the 330-mile trip to the generating station. This is due to the 80,000-pound weight limit for a 19,000-pound tractor and a 50,000-pound weight limit for an 11,000-pound trailer. These tractors would be equipped with three or four axles, tandem drive axles, with or without a pusher axle, a 16,000- to 18,000-pound front axle, and a 46,000-pound tandem rear axle. Tractors with or without sleepers could be used.

The average cost for tractors that would meet these specifications is \$110,000 for 2005-2006 models. Due to the continuous heavy payloads, the service life would be approximately three years. It should be noted that the normal average service life of a tractor is approximately nine years; however, in this setting, trucks would log nearly three times as many annual miles as a typical truck would ordinarily experience.

Trailer specifications would include a 38- to 40-foot-length by 102-inch-width, aluminum construction with end dump and tandem axles. Trucks also would be required to have and use a tarp. The average cost for trailers that would meet these specifications is \$50,000 for 2005-2006 models. Due to the continuous heavy payloads, the service life would be approximately six years.

3.3.3 Other Operational Information

The Federal Motor Carrier Safety Administration under the Department of Transportation provides Federal regulations that govern the trucking industry that operators must adhere to in terms of hours of driving that are allowed per day or week. Truck drivers are allowed a maximum of 11 service hours after 10 hours of off-duty time. Further, truck drivers are allowed a maximum of 60 hours in 7 days or 70 hours in 8 days. This cycle may resume after a 34-hour “weekend.”

With 14 hours for a round trip, 216,000 truckloads per year equates to 3,024,000 truck hours per year. Each driver is expected to work 1,904 hours per year, which is basically 365 days minus eight holidays, 10 vacation days, 5 sick days, and 104 weekend days (a total of 127 days off), which equals 238 8-hour days per year. Divide 3,024,000 hours by 1,904 hours per year equals 1,589 full-time drivers needed for this operation. For the past few years, the trucking industry has experienced a driver shortage, and this operation would add a large amount to this shortage. The work hours specified will likely be necessary in order to attract and keep drivers. These work hours will be possible if a relay system is used that allows drivers to be home every night or day.

4.0 TRUCK RELATED IMPROVEMENTS

4.1 HIGHWAYS

The 330 miles of highways used along the truck route would need to be upgraded to higher standards suitable for continuous heavy truck traffic. As a comparison, U.S. Highway 287 in southern Colorado was recently reconstructed to better accommodate large volumes of truck traffic. What became known as the “Super 2” project involved a reconstruction of the two-lane state highway. Because of the large volume of trucks along this route, the project constructed two 12-foot through lanes (one in each direction) as well as 10-foot shoulders on both sides of the roadway. This would allow enough room for trucks to be completely off of the roadway in the case of breakdowns. Additionally, the significant truck traffic required the use of 10 to 12 inches of concrete rather than shallower bituminous (asphalt) surface that is traditionally used on such roadways. It is assumed that this infrastructure upgrade would be required for the entire truck route between the Black Mesa Complex and the Mohave Generating Station, with improvements to both two- and four-lane portions of the proposed highway network of the truck alternative. The four-lane segment of the route is located on I-40 between Flagstaff and Kingman, which is classified as rural interstate and is generally separated by a depressed median.

4.2 COAL FACILITIES

The improvements required for each segment involving the Black Mesa Complex and the Mohave Generating Station would be a new conveyor belt from the coal-washing facility to a new silo, and truck flood loader to serve the Black Mesa mining operation. At the Mohave Generating Station, a new coal stacker and reclaim facilities would be required, as would a conversion of the Mohave Generating Station to allow the burning of dry coal.

5.0 COST ESTIMATES

5.1 CAPITAL COST ESTIMATES

The truck alternative would require significant capital costs including upgrades to existing infrastructure and purchasing new equipment to facilitate the transfer of coal. Such costs include the following:

- Upgrading the current highway infrastructure;
- Purchasing truck equipment for coal hauling; and
- Upgrading the coal facilities to accommodate hauling by truck.

The total of these costs are expected to be approximately \$2,410 million.

5.1.1 Highways

The 330 miles of highways used along the truck route is projected to cost \$3.0 million per mile per two lanes to upgrade for heavy trucks. The section of I-40 that the route would use is priced at \$6.0 million per mile because the interstate is essentially the equivalent of two, two-lane sections. The total cost for 330 miles would be approximately \$2,113 million including design, construction, and contingency costs.

Segment	Cost/Mile (millions)	Miles	Total Segment Cost (millions)
Black Mesa Complex on U.S. Highway 160 to intersection of U.S. Highway 89	\$3.0	69	\$207.0
U.S. Highway 89 to Flagstaff	\$3.0	65	\$195.0
Flagstaff to Kingman on I-40	\$6.0	159	\$954.0
Kingman to Mohave Generating Station along State Highway 68	\$3.0	37	\$111.0
<i>Subtotal</i>		<i>330</i>	<i>\$1,467.0</i>
Design, Construction, Contingency, etc.			\$645.5
Total One-Way Truck Route Distance		330	\$2,112.5

5.1.2 Truck Tractors and Trailers

The truck alternative requires the purchase of 420 new tractor-trailer sets for semi-truck operation. Current tractors required for this operation cost about \$110,000 each and trailers cost about \$50,000 each. The 420 tractors would cost a total of \$46.2 million and the 420 trailers would cost a total of \$21 million, which comes to a grand total of \$81 million including design, construction, and contingency costs for 420 semi-truck sets for the initial cost.

The Black Mesa mining operation is expected to be in operation for a period of 16 years; as a result, additional semi-trucks would need to be purchased as the initial sets wear out. Due to the heavy use that would be required, it is estimated that tractors would have a 3-year life and the trailers would have a 6-year life. In this scenario, 2,520 tractors and 1,260 trailers would need to be purchased over the 16-year operation. The total capital cost for the semi trucks over the 16-year operation would be approximately \$408.2 million, including \$277.2 million for the tractors and \$63.0 million for the trailers.

Segment	Cost/Unit	Units	Total Initial Year Cost (millions)	16-Year Life Span Units	16-Year Life Span Cost (millions)
Semi-Truck Tractors	\$110,000	420	\$46.2	2,520	\$277.2
Semi-Truck Trailers	\$50,000	420	\$21.0	1,260	\$63.0
Subtotal			67.2		\$340.2
Design, Construction, Contingency, etc.			\$13.4		\$68.0
Total Cost (millions)			\$80.6		\$408.2

5.1.3 Coal Facilities

Improvements to existing coal facilities for truck transport are expected to be similar to the rail alternative improvements. The estimated capital cost for new coal loading and unloading facilities and for the conversion of the Mohave Generating Station to dry coal are taken from the Peabody Corporation Mohave Power Plant Coal Conversion Study, March 2003, by Burns & McDonnell and SCE (2005, personal communication, L. Johnson, September 9), respectively. The cost estimates including design, construction management, etc., and contingency are:

- \$30.0 million for coal loading and unloading facilities
- \$99.1 million for conversion to dry coal
- \$10.0 million for truck inspection and maintenance facility
- \$77.4 million for design, construction management, contingency, etc.
- **\$216.5 million Total**

Use of dry coal at the Mohave Generating Station is not allowed under the station's existing Title V air quality permit and would require the facility to undergo New Source Review under the Clean Air Act. This could result in a change in operations or the installation of additional air pollution control equipment to meet Best Achievable Control Technology Standards. The cost of any such additional air pollution control equipment or changes in operations required by air permitting activities have not been included in these cost estimates.

5.1.4 Total Cost Summary

Once the capital costs are calculated for highway improvements, purchase of trucks, and construction of new facilities, the total cost in millions of 2006 dollars is as shown on the following table.

Category	Cost
Highway	\$2,112.5
Trucks	408.2
Facilities	216.5
Total Cost (millions)	\$2,737.2

Financing costs are not included.

5.2 ANNUAL OPERATING COST ESTIMATES

5.2.1 Black Mesa Complex to Mohave Generating Station

The annual operation and maintenance cost is based on \$1.90 per mile to own and operate a truck in 2006. This \$1.90 includes owner operation with fuel (\$.90), driver cost (\$.70), and other expenses (\$.30). The average owner operation cost is \$.60; this cost is increased 150 percent for this study due to the high miles on the trucks. Other expenses generally count for 20 percent of the operation cost. With an estimated 142,560,000 truck miles per year, the annual operation and maintenance cost would be approximately \$271 million. This includes the operation of 216,000 truckloads per year over 330 miles for a one-way trip and the maintenance of a semi-truck fleet of 420 tractor-trailers.

5.3 ANNUALIZED COST PER TON OF COAL

The annualized cost per ton of coal is calculated from the annualized capital and operation and maintenance (O&M) costs divided by the annual coal tonnage. The annualization factors are based upon the 16-year life expectancy of the coal operation and annualized factors used by the Federal Transit Administration. The details for the annualized cost per ton of coal are shown in the following table.

Cost Category	Useful Life (years)	Annualization Factor	Truck Total Cost (\$ millions)	Contingency (\$ millions)	Total Capital Cost Including Contingency (\$ millions)	Truck Annualized Cost (\$ millions)
Support Facilities						
Running Maintenance Facility	16	0.1059	\$10.000	\$2.500	\$12.500	\$1.324
Coal Facilities	16	0.1059	\$129.100	\$74.878	\$203.978	\$21.601
Trucks						
Highways and Roads	16	0.1059	\$1,467.000	\$645.480	\$2,112.480	\$223.712
Traffic Signals	16	0.1059		\$0.000	\$0.000	\$0.000
Purchase/Lease, Real Estate	16	0.1059		\$0.000	\$0.000	\$0.000
Truck Tractors	16	0.1059	\$277.200	\$55.440	\$332.640	\$35.227
Truck Trailers	16	0.1059	\$63.000	\$12.600	\$75.600	\$8.006
Capital Cost			\$1,946.300	\$790.898	\$2,737.198	\$289.869
Annual O&M Cost						\$271.000
Total Capital and O&M Cost						\$560.869
Annualized Cost per Ton of Coal						\$103.86

NOTE: Annualized cost per ton of coal = Annualized cost divided by annual coal tonnage.

APPENDIX E



Appendix E
Railroad Alternative Study
Technical Memorandum
Black Mesa Project EIS

Prepared for
Office of Surface Mining Reclamation and Enforcement

Prepared by
URS Corporation

June 2006

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LIST OF ACRONYMS

AAR	Association of American Railroad
BNSF	Burlington Northern Santa Fe
CTC	Centralized Traffic Control
EIS	Environmental Impact Statement
GIS	Geographic Information System
LOM	Life-of-Mine
mph	miles per hour
O&M	operating and maintenance
OSM	Office of Surface Mining Reclamation and Enforcement
Peabody	Peabody Western Coal Company
SCE	Southern California Edison
USGS	U.S. Geological Survey

1.0 PURPOSE

The purpose of this technical memorandum is to address the conceptual feasibility and cost for the transportation of coal by railroad between Black Mesa Complex in northeastern Arizona and the Mohave Generating Station near Laughlin, Nevada.

2.0 PROJECT DESCRIPTION

One of the purposes of the Black Mesa Project is to continue to supply the coal from the Black Mesa Complex in northeastern Arizona (approximately 125 miles northeast of Flagstaff) to the Mohave Generating Station in Laughlin, Nevada. Since 1970, Peabody Western Coal Company (Peabody) has been supplying coal from the Black Mesa Complex to the Mohave Generating Station, a coal-fired, steam electric-generating power plant with a capacity of 1,580 megawatts of power. The plant is owned jointly by Southern California Edison Company (SCE), Salt River Project, Los Angeles Department of Water and Power, and Nevada Power Company. The Black Mesa mining operation is the sole supplier of coal for the Mohave Generating Station and the Mohave Generating Station is its sole customer. Coal is delivered some 273 miles from the Black Mesa Complex in the form of slurry (about 50 percent water and 50 percent coal) to the Mohave Generating Station by the Black Mesa Pipeline, owned and operated by Black Mesa Pipeline, Inc.

On February 17, 2004, Peabody submitted a permit application proposing several revisions to the life-of-mine (LOM) mining plans for the Black Mesa Complex to the Office of Surface Mining Reclamation and Enforcement (OSM). The Black Mesa mining operation is authorized to mine coal until such time as OSM makes a decision on the LOM permit application submitted by Peabody. Issuance of the LOM revision for the Black Mesa Complex would allow continued coal mining at the Black Mesa mining operation in order to supply the Mohave Generating Station through 2026.

OSM determined that an environmental impact statement (EIS) would be required to address the LOM revisions and associated actions. As a result of public outreach at the beginning of the EIS process, one of the issues identified from public comments was opposition to the use of water for the industrial purpose of transporting the coal. One alternative means of transporting the coal that was suggested by the public was shipping the coal by rail. Although rail has been addressed by the U.S. Department of the Interior, SCE, and Peabody in previously conducted studies, for the purposes of the current EIS (in progress), OSM requested that URS Corporation review the previous studies and address the conceptual feasibility and cost for transporting the Black Mesa coal by rail.

3.0 CONCEPTUAL RAILROAD ALIGNMENTS

The closest rail line to the Black Mesa Complex and the Mohave Generating Station is the Burlington Northern Santa Fe (BNSF), a major U.S. east-west rail line (Map E-1). To reach the BNSF from the Black Mesa Complex and then from the BNSF to the Mohave Generating Station, it would be necessary to construct a spur for each segment. This section discusses the basic criteria used for new railroad construction and contains a description of potential new railroad alignments and each of the existing BNSF Railway Company alignments.

3.1 CONCEPTUAL DESIGN CRITERIA

The design criteria used for developing the conceptual railroad alignments involving new construction included current BNSF standards and American Railway Engineering and Maintenance Association standards and practices. The design criteria selected gives consideration for the operation of 125-car coal trains. The basic criteria included:

- Maximum gradient of 1.5 percent with 1.0 percent preferred.
- Maximum (tightest) mainline curve radius of 6 degrees (approximately 1,000-foot radius).
- Maximum right-of-way width of 60 feet to accommodate main track and a siding or future second main track on 15-foot centers, a 15-foot-wide maintenance access road located 10 feet from the nearest track centerline, as well as 10 feet for drainage along each side of the right-of-way.
- All new railroad track construction would consist of continuous-welded 141# rail section (the rail weighs 141 pounds per yard of length), concrete crossties, spring clips, and double shoulder tie plates to fasten the rail to the ties, 12 inches each of subballast and ballast, and concrete highway/railroad crossing surfaces.
- Turnouts (track that allows a train to switch from one track to another, diverging track) have 141# rail on wood crossties and would be #24 for main line junctions and sidings and #10 for yard and spur tracks (the larger the turnout number, the higher the train speed allowed).
- New railroad construction on existing BNSF track would be equipped with bidirectional Centralized Traffic Control (CTC) railroad signaling.
- Highway/railroad at-grade crossings would be equipped with crossbucks and stop signs for private roads, flashing lights, and bells for low-volume public roads, and flashing lights, bells, and gates for high-volume public highway crossings. Intersections with interstate and U.S. highways would be grade separated.

Bridges on new railroad construction would be either pre-stressed concrete or steel-through-plate girder bridges.

3.2 CONCEPTUAL RAILROAD ALIGNMENTS

The railroad alignments considered in this technical memorandum include:

- New construction from the Black Mesa Complex to the BNSF near Winslow, Arizona.
- Existing BNSF between Winslow and Franconia, Arizona.

- New construction between Franconia and the Mohave Generating Station from the east.
- Existing BNSF between Franconia, Arizona, and a location west of Needles, California, plus new construction between the BNSF and the Mohave Generating Station from the west.

3.2.1 Black Mesa Complex to BNSF at Winslow

This segment of the proposed railroad coal route extends for approximately 164 miles between the Black Mesa Complex end of the route and the BNSF at Winslow, Arizona (refer to Map E-1). It involves new railroad construction, as there is no railroad in the vicinity. The north end, or mine, of the alignment is located near the existing loadout for the Kayenta Mine. A new conveyor system from the mine to the loadout, a new coal-storage silo, a new loop track, and a new unit train loading facility would be required at the Black Mesa Complex. A 120- to 130-car coal train would be loaded in approximately 4 hours.

From the Black Mesa Complex, the alignment would run southwest along U.S. Highway 160, parallel to the electrified Black Mesa and Lake Powell Railroad to Cow Springs, pass south of Tuba City, and follow the Little Colorado River the rest of the way into Winslow. At Winslow, the coal-haul line would join the existing BNSF double-track main line just west of town. In several locations, the maximum railroad gradient exceeds the 1.5 percent maximum specified in the design criteria. This may or may not be resolved should engineering be performed on the alignment. Following the Little Colorado River represents the easiest railroad course compared to any other potential alignments investigated in previous studies.

3.2.2 Existing BNSF Railway Between Winslow and Franconia, Arizona

This segment is different than previously recommended alignments. Previous alignments went as far as Kingman before diverging from the BNSF to Laughlin. The route between Kingman and Laughlin from the east is not viable due to residential and commercial development just west of Kingman and the Black Mountains that trend north and south between Laughlin and Kingman. By going approximately 36 miles farther west to Franconia, the railroad alignment passes to the south of the development and mountains before turning northward to Laughlin and the Mohave Generating Station.

The existing BNSF route between Winslow and Franconia consists of approximately 267 miles of double track. The track is in excellent condition due to the fact that it is the BNSF's primary route between Los Angeles and Chicago. The line handles top priority intermodal traffic along with a variety of merchandise and other traffic. Currently, traffic over the line averages more than 60 trains per day. The operating speed limit for freight trains over most of the line is 70 miles per hour (mph).

3.2.3 Franconia to the Mohave Generating Station from the East

This proposed segment of the railroad coal route approaches the Mohave Generating Station from the southeast and involves approximately 35 miles of new railroad construction (Maps E-2 and E-3). The alignment diverges from the BNSF main line just west of Franconia, parallels the Black Mountains to the west of the wilderness area and the development along the Colorado River as it runs northward, and approaches the Mohave Generating Station from the east in the vicinity of Silver Creek Wash. A new railroad bridge will be required across the Colorado River. In several locations, the maximum railroad gradient exceeds the 1.5 percent maximum specified in the design criteria. This may or may not be resolved should engineering be performed on the alignment.

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Map E-1 Conceptual Rail Alignments

Black Mesa Project EIS

LEGEND

- New Rail Alignment: Black Mesa Mine to BNSF at Winslow
- New Rail Alignment: Franconia to Mohave Generating Station from the East.
- New Rail Alignment: West of Needles to Mohave Generating Station from the West
- Existing BNSF Railway
- Peabody Lease Boundary
- Areas of Critical Environmental Concern
- Wilderness Areas

Surface Management

- Bureau of Land Management
- U.S. Forest Service
- National Park Service
- U.S. Fish and Wildlife Service
- National Wildlife Refuge
- Bureau of Reclamation
- Indian Lands
- Military Reservations
- State Trust
- County, Park and Outdoor Recreation Areas
- Private

General Features

- River
- Lake
- Navajo Reservation Boundary
- Hopi Reservation Boundary
- State Boundary
- County Boundary
- Interstate/US Highway/State Route
- Railroad

SOURCE:
URS Corporation 2005
Arizona State Land Department 2005
Environmental Research Institute 2004

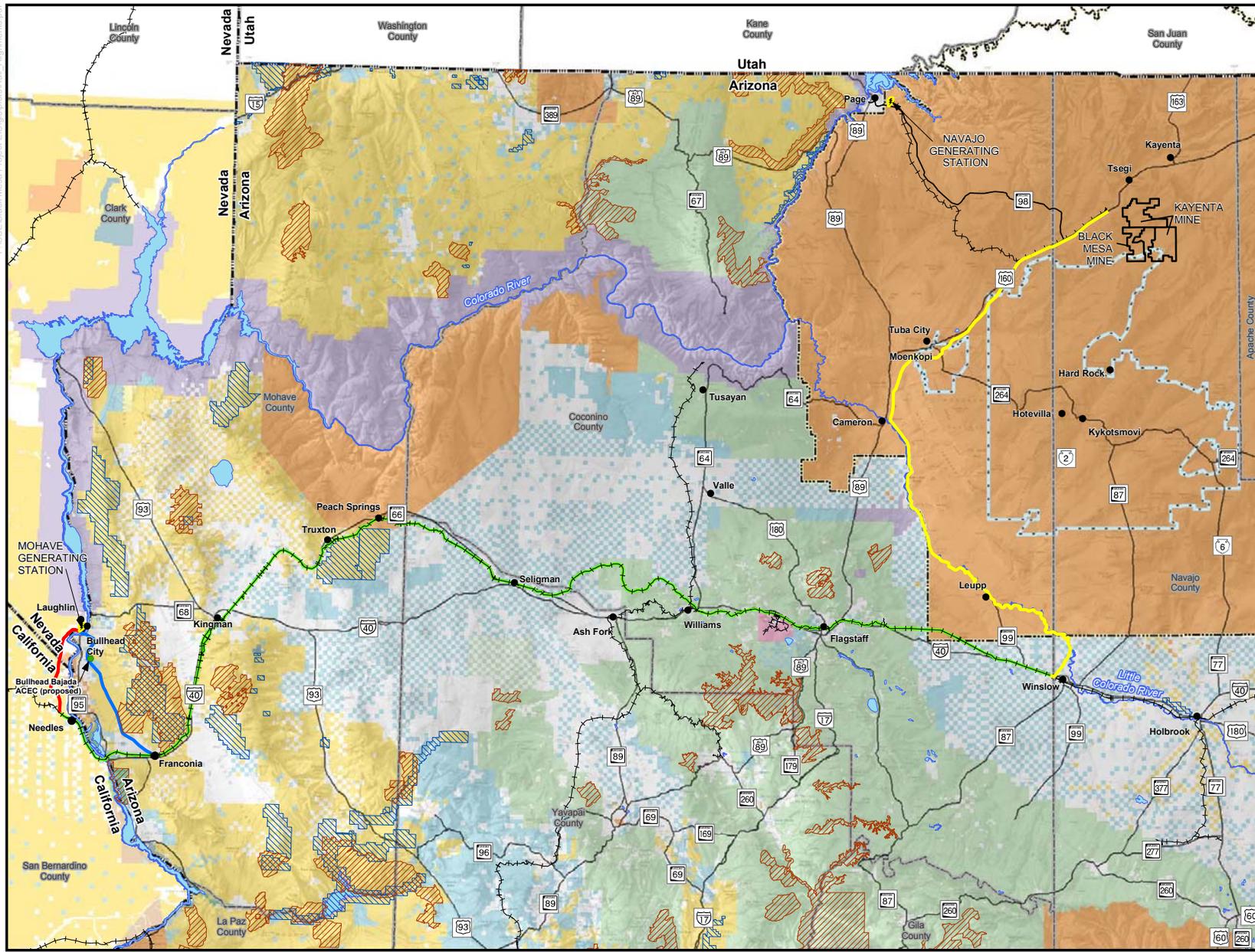
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July 2006

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Map E-2 Rail Spur: BNSF to Mohave Generating Station

Black Mesa Project EIS

LEGEND

- New Rail Alignment: Franconia to Mohave Generating Station from the East.
- New Rail Alignment: West of Needles to Mohave Generating Station from the West
- Existing BNSF Railway
- Areas of Critical Environmental Concern
- Wilderness Areas

Surface Management

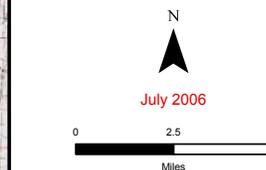
- Bureau of Land Management
- U.S. Forest Service
- National Park Service
- U.S. Fish and Wildlife Service
- National Wildlife Refuge
- Bureau of Reclamation
- Indian Lands
- State Trust
- Private

General Features

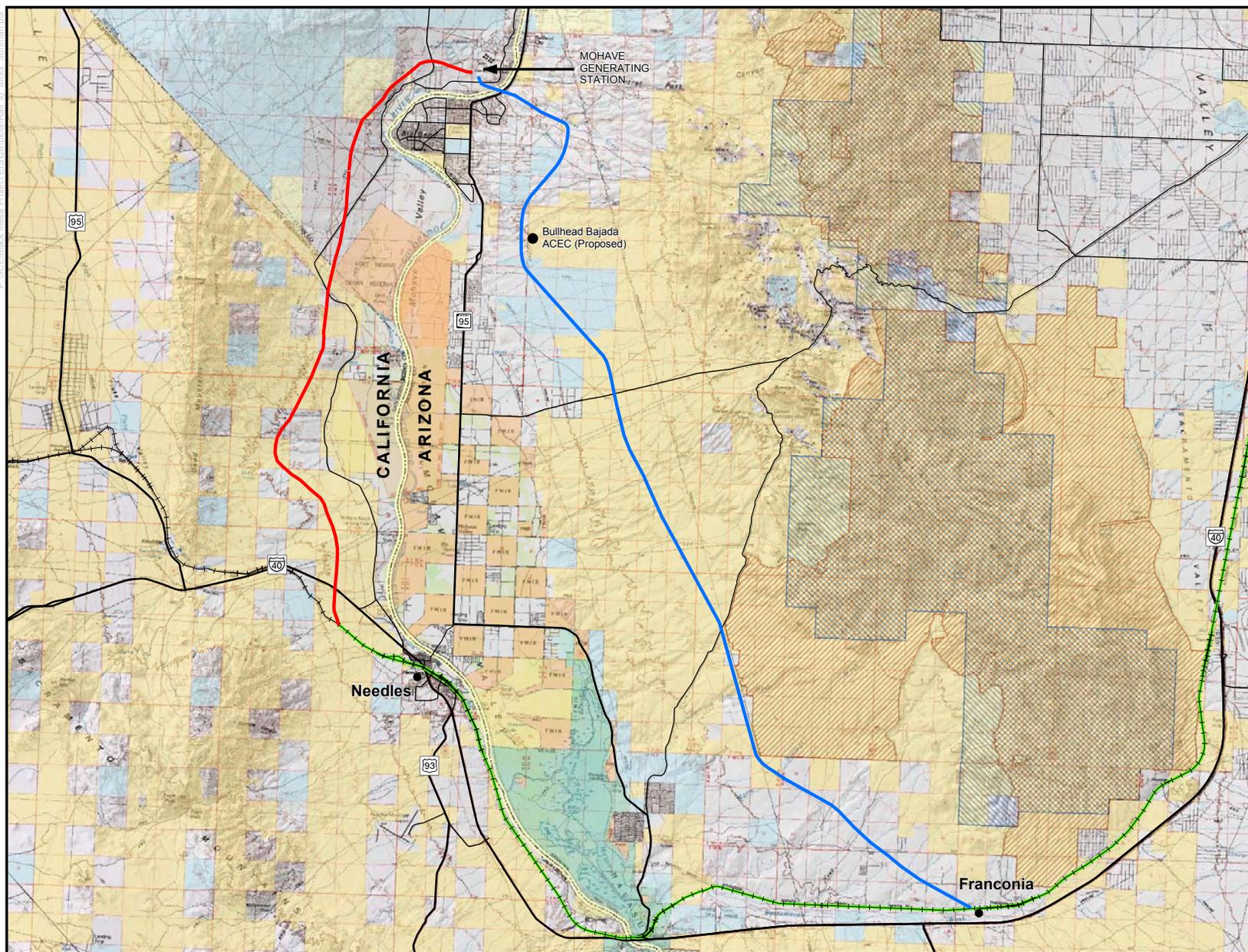
- State Boundary
- Interstate/US Highway/State Route
- County/Local Road
- Railroad

NOTE: Potential ACEC in Bullhead City Area

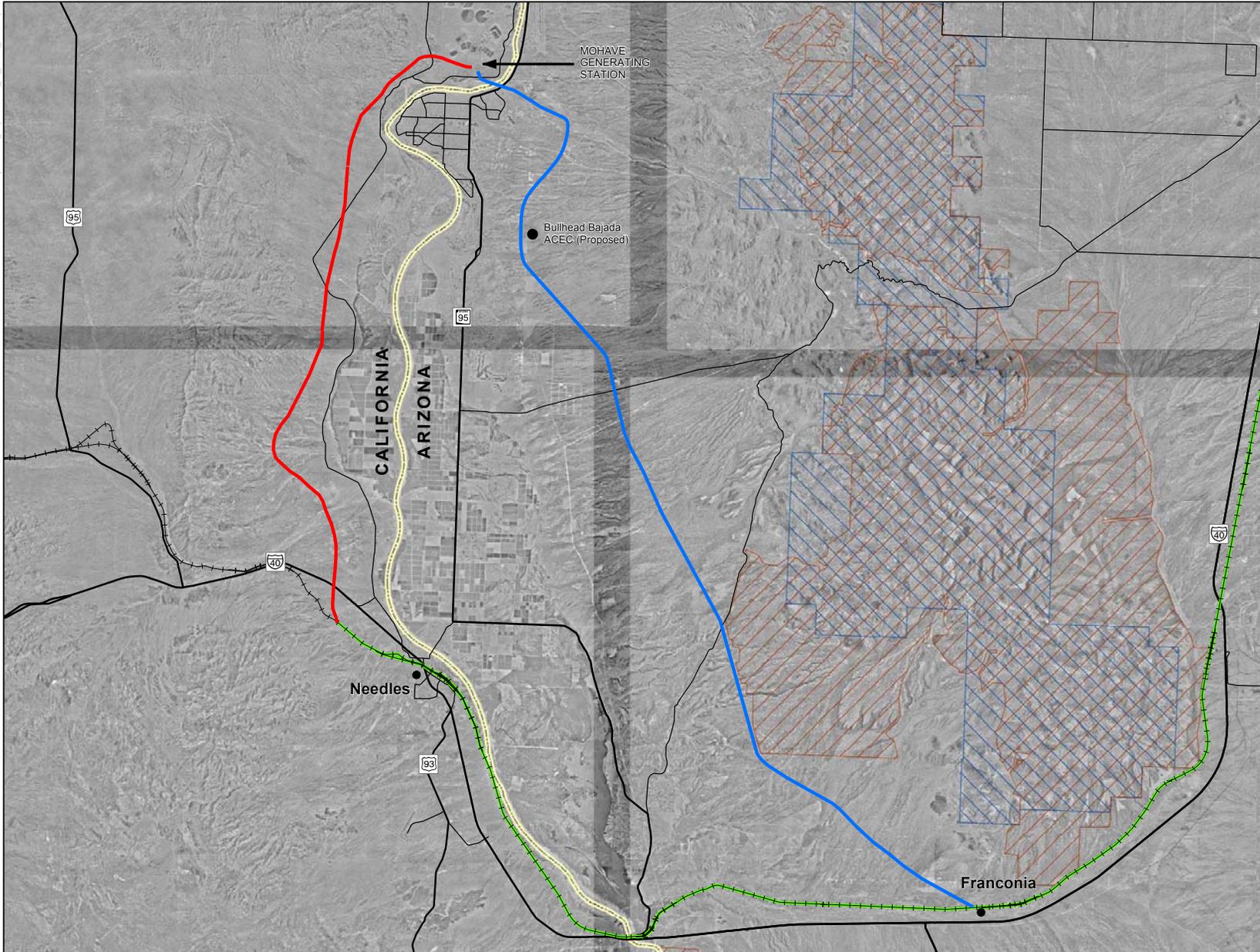
SOURCE:
 URS Corporation 2005
 Arizona State Land Department 2005
 Environmental Systems Research Institute 2004
 Map created with TOPOI(tm) (c)2002 National Geographic Holdings (www.topo.com)



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Map E-3 Rail Spur: BNSF to Mohave Generating Station (aerial imagery)

Black Mesa Project EIS

LEGEND

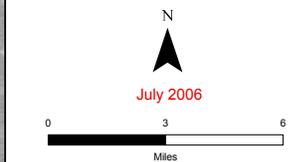
- New Rail Alignment: Franconia to Mohave Generating Station from the East.
- New Rail Alignment: West of Needles to Mohave Generating Station from the West
- - - Existing BNSF Railway
- Areas of Critical Environmental Concern
- Wilderness Areas

General Features

- State Boundary
- Interstate/US Highway/State Route
- County/Local Road
- Railroad

NOTE: Potential ACEC in Bullhead City Area

SOURCE:
URS Corporation 2005
Arizona State Land Department 2005
Environmental Systems Research Institute 2004



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3.2.4 BNSF Between Franconia and a Location West of Needles, California, and New Construction to the Mohave Generating Station from the West

This segment provides a potential alignment into the Mohave Generating Station from the west (refer to Maps E-2 and E-3). As the BNSF track heads west out of Needles, it climbs away from the Colorado River. At a location 3 or 4 miles west of Needles, this alignment diverges northward and then finally eastward to the Mohave Generating Station. The distance between Franconia and the point where the alignment diverges is approximately 29 miles. The distance from the BNSF to the Mohave Generating Station is approximately 23 miles. In several locations between west Needles and the Mohave Generating Station, the maximum railroad gradient exceeds the 1.5-percent maximum specified in the design criteria. This may or may not be resolved should engineering be performed on the alignment. The total distance from Franconia to the Mohave Generating Station is approximately 52 miles with 23 miles of the total involving new railroad construction.

4.0 CONCEPTUAL OPERATIONS PLAN

The proposed operations plan for the transportation of coal by railroad from the Black Mesa Complex to the Mohave Generating Station is based on previous studies with revisions as necessary. The operations plan brings together traffic volume, travel distances, operating speeds, trip time, frequency, railroad rolling stock (locomotives and cars), and other pertinent operational considerations into a cohesive operating entity that is capable of performing the transportation function as intended.

4.1 TRAFFIC VOLUME

If the LOM permit application is approved, the average annual production of the Black Mesa mining operation that is transported to the Mohave Generating Station will increase from about 4.8 million tons to 5.4 million tons of washed coal.

4.2 TRAVEL DISTANCE, OPERATING SPEEDS, AND TRIP TIME

The proposed railroad route between the Black Mesa Complex and the Mohave Generating Station consists of a total of approximately 466 to 483 miles, depending on the route. The mileage for each of the two potential routes is described in Table E-1.

Table E-1 Mileage for Each Segment

Segment	Miles
Eastern Approach to Mohave Generating Station	
Black Mesa Complex to BNSF at Winslow	164
Winslow to Franconia	267
Franconia to Mohave Generating Station from east	35
<i>Total Railroad Miles</i>	<i>466</i>
Western Approach to Mohave Generating Station	
Black Mesa Complex to BNSF at Winslow	164
Winslow to Franconia	267
Franconia to 3 to 4 miles west of Needles	29
West of Needles to Mohave Generating Station	23
<i>Total Railroad Miles</i>	<i>483</i>

The maximum train operating speed limits and trip times for the various route segments would vary depending on curves, grades, and congestion along the alignment. Using typical operating speeds for similar alignments, the maximum and average train operating speeds, in mph, and the average trip time, in hours, for loaded trains are shown in Table E-2.

For empty train movements, the average trip time from the Mohave Generating Station to the Black Mesa mining operation loadout is estimated to be 11 hours (rounded to the nearest half-hour) for either the eastern approach or the western approach.

Table E-2 Typical Operating Speeds and Trip Time

Segment	Maximum Speed (mph)	Average Speed (mph)	Trip Time (hours)
Eastern Approach to Mohave Generating Station			
Black Mesa Complex to BNSF at Winslow	40	20	8.2
Winslow to Franconia	70	45	6.0
Franconia to Mohave Generating Station from east	40	20	1.8
Total Railroad Miles			16.0
Western Approach to Mohave Generating Station			
Black Mesa Complex to BNSF at Winslow	40	20	8.2
Winslow to Franconia	70	45	6.0
Franconia to west of Needles	70	40	0.7
West of Needles to Mohave Generating Station	40	20	1.2
Total Railroad Miles			16.1

4.3 TRAIN REQUIREMENTS

Based on the volume of 5.4 million tons of coal to be transported from the Black Mesa Complex to the Mohave Generating Station, the terrain encountered and current unit coal train technology, the following assumptions about train requirements have been made:

- The average train would include 125 aluminum, rotary dump, coal gondola cars with four modern, six-axle locomotives (two locomotives pulling at the front of the train and two distributed power units pushing at the rear of the train).
- The overall train length would be approximately 7,800 feet.
- The average load per car would be 115 tons of coal (143 tons gross car weight less 28 tons empty car weight equals 115 tons for load).
- The total average weight of coal load per train would be 14,375 tons (125 cars times 115 tons of coal per car).
- The average time to load or to unload 125 cars is 4 hours (about 2 minutes per car including train movement. During unloading, 2 cars are dumped at a time and the train is inspected before heading back to the mine).
- The operation of the coal trains would be based on a 6 days per week, 50 weeks per year schedule (300 days per year).
- The total round trip time is estimated to be 39 hours (4 hours to load plus 16 hours loaded movement plus 4 hours to unload plus 11 hours empty movement plus 4 hours for unscheduled delay time).

Given these assumptions, 3 train sets would be needed to transport 5.4 million tons of coal per year from Black Mesa to the Mohave Generating Station. The number of train sets required is based on the following calculations:

- Number of loaded trains per year: 5.4 million tons of coal per year divided by 14,375 tons per train equal 376 loaded trains per year.

- Number of loaded trains per day: 376 trains per year divided by 300 operating days per year equal 1.25 loaded trains per day.
- 300 days per year times 24 hours per day equals 7,200 available hours per year. 7,200 hours minus 1,400 hours per year for FRA and AAR Interchange inspections and other such downtime equals 5,800 operating hours per year per train. 5,800 hours divided by 39 hours per round trip equals 149 trips per year per train set. 376 loaded trains per year divided by 149 trips per train equals 2.5 or 3 train sets. The difference between 2.5 and 3 train sets would provide service reliability in the event of weather, train delays, accidents, track maintenance windows, and other unforeseen conditions. Note that if only 2 train sets were provided, then only 298 loaded trains would be operated per year (2 times 149 trips each) or each train would have to operate 188 trips per year (376 divided by 2 trains) continuously for 364 days per year (188 trips times 39 hours plus 1,400 hours for inspections, etc. divided by 24 hours per day) without allowance for unexpected downtime. Number of locomotives: 4 locomotives per train times, 3 train sets equal 12 locomotives.
- Number of coal cars: 125 cars per train times 3 train sets equal 375 cars.
- Other operational information

The identification of the entity that would perform the railroad operations over the new railroad segments is not considered in this report. The operation of the existing BNSF segment would definitely remain under the control of the BNSF due to the importance of the line. The operation of the new railroad segments could be performed under contract by the BNSF, a shortline railroad or regional carrier, a private company or joint owner, or a new operating entity.

It is assumed that locomotive and coal-car inspection and routine maintenance would be performed at a new facility to be located in Needles (preferred location due to its proximity to BNSF's facilities located in Barstow) or Winslow and that major repairs and overhauls would be contracted to the BNSF or a private repair shop.

5.0 RAILROAD IMPROVEMENTS

The railroad improvements required for the transportation of coal from the Black Mesa Complex to the Mohave Generating Station over the new railroad segments and the existing BNSF segment are identified in this section. The improvements are based on current railroad construction practices for heavy-haul lines. Distances, quantities, and other characteristics are estimated based on BNSF System Timetable information and the mapping approach described below.

Alignment Delineation and Digitizing: The Black Mesa Project alternative alignments were hand-drawn onto 1:100,000 Scale U.S. Geological Survey (USGS) quadrangle paper-copy maps, which then were converted into geographic information system (GIS) format using “heads-up” digitizing techniques. Scanned, digital copies of the paper-copy quadrangle maps were used in Arc/Info, ArcMap 8.3 GIS software to digitize the line features from the paper-copy maps.

Alternatives Intersection Analysis: To determine where alternatives intersected with a road or stream, vector-based GIS datasets were required. USGS 1:100,000 scale digital line graph, which are the features found on the quadrangle maps (roads, streams, sections, etc), were overlaid with the alternatives. A spatial analysis routine was then performed to determine these intersections, and a corresponding database listing the conflicts was generated.

Slope Analysis: Since a slope of 1.5 percent or less is required for proper function of coal rail car operations, a slope analysis of the alternatives was performed. Within the GIS software, USGS 30-meter digital elevation models were color-coded by their percent slope values, the alternatives were overlaid, and segments in violation of the 1.5 percent rule can easily be identified.

5.1 NEW RAILROAD CONSTRUCTION

The improvements required for each segment involving new railroad construction are listed below.

5.1.1 Black Mesa Complex to BNSF at Winslow

The improvements for this 164-mile segment of the route include:

- 164 miles of new main track
- 12 miles of new passing siding track (3 miles each for four sidings; 1 siding at the Black Mesa loadout, 1 at Winslow, and 2 along the route approximately 55 miles apart at milepost 55 and milepost 110)
- New connection with BNSF and universal crossover at Winslow
- New control points, interlockings, and modifications to existing CTC signal system at Winslow
- 3 miles for new loop track at coal load-out at Black Mesa Complex
- 72 new bridges totaling an estimated average of 6,900-track-feet in length (12 at 200 feet, 30 at 100 feet, and 30 at 50 feet or less)
- 130 new highway/railroad at-grade crossings (82 with crossbucks, 43 with flashers, and 5 with flashers and gates)
- 656 new drainage culverts (estimated 4 culverts per mile for new construction)

- Excavation estimated to total 98,400,000 cubic yards of cut and fill (600,000 cubic yards per mile average)
- 1,197 acres of right-of-way (based upon 60-foot width and 7.3 acres per mile)

5.1.2 Franconia to Mohave Generating Station from the Southeast

The improvements for this 35-mile segment of the route include:

- 35 miles of new main track
- 6 miles of new passing siding track (3 miles each for 2 sidings; 1 siding near the unloading loop at the Mohave Generating Station and 1 near Franconia)
- New connection with BNSF and universal crossover at Franconia
- New control points, interlockings, and modifications to existing CTC signal system at Franconia
- 3 miles for new loop track at coal rotary dumper at Mohave Generating Station
- 52 new bridges totaling an estimated average of 3,450 track-feet in length (one at 500 across Colorado River, 1 at 200 feet, 5 at 100 feet, and 45 at 50 feet or less)
- 30 new highway/railroad at-grade crossings (12 with crossbucks, 16 with flashers and gates, and 2 grade separations)
- 140 new drainage culverts (estimated 4 culverts per mile for new construction)
- Excavation estimated to total 17,500,000 cubic yards of cut and fill (500,000 cubic yards per mile average)
- 256 acres of right-of-way (based upon 60-foot width and 7.3 acres per mile)

5.1.3 West of Needles to Mohave Generating Station from the West

The improvements for this 23-mile segment of the route include:

- 23 miles of new main track
- 6 miles of new passing siding track (3 miles each for 2 sidings; 1 siding near the unloading loop at the Mohave Generating Station and 1 west of Needles)
- New connection with BNSF and universal crossover west of Needles
- New control point, interlocking, and modifications to existing CTC signal system west of Needles
- 3 miles for new loop track at coal rotary dumper at Mohave Generating Station
- 6 new bridges totaling an estimated average of 600-track-feet in length (6 at 100 feet)
- 22 new highway/railroad at-grade crossings (9 with crossbucks, 12 with flashers and gates, and 1 grade separation)
- 92 new drainage culverts (estimated 4 culverts per mile for new construction)
- Excavation estimated to total 11,500,000 cubic yards of cut and fill (500,000 cubic yards per mile average)
- 168 acres of right-of-way (based upon 60-foot width and 7.3 acres per mile)

5.2 EXISTING BNSF RAILWAY

The improvements required for each segment involving existing BNSF Railway Company trackage are listed below.

5.2.1 BNSF Between Winslow and Franconia

The improvements for this 267-mile segment of the route include:

- 30 miles of new third main track and 4 associated universal crossovers (located in conjunction with westbound grades and current congested areas)
- New control points, interlockings, and modifications to existing CTC signal system for new third main track
- Estimated 3 new bridges at 100 feet each for new third main track
- Modifications to estimated 15 highway/railroad crossings for new third main track (average of 1 crossing every 2 miles)

5.2.2 BNSF Between Franconia and New Connection West of Needles

The improvements identified for this 29-mile segment of the route include:

- 2 miles for new siding and universal crossover at Needles
- New control point, interlocking, and modifications to existing CTC signal system at Needles for new siding

In addition, a contract would need to be negotiated with the BNSF for the movement of the coal trains.

5.3 OTHER RAILROAD FACILITIES

The improvements required for Federal Railroad Administration regulations (49 CFR Part 229 for example) and AAR Interchange rules (particularly for wheels, air brakes, and couplers) for routine servicing, inspection, and maintenance of the locomotives and coal cars would include a running inspection and maintenance facility which would consist of a two-track shop with support facilities: one track for two locomotives with a pit and floor jacking work positions and one track for two coal cars with floor jacking work positions. This would require an estimated total of 20,000 square feet of shop floor space. Capability for locomotive fueling and sanding and storage of locomotives and coal cars also will be provided.

5.4 COAL FACILITIES

The improvements required for each segment involving the Black Mesa Complex and the Mohave Generating Station would be a new conveyor belt, storage silo, and flood loader to serve the Black Mesa mining operation and loading of coal trains for the Black Mesa Mine facilities. At the Mohave Generating Station facilities a new rotary coal dumper, stacker, and reclaim facilities would be required, as would a conversion of the Mohave Generating Station to allow the burning of dry coal.

6.0 COST ESTIMATES

The capital costs and annual operating and maintenance (O&M) costs associated with the transportation of coal from the Black Mesa Complex to the Mohave Generating Station are based upon the following:

- All costs are in 2006 U.S. dollars.
- Unit prices for railroad track, facilities, and rolling stock reflect current U.S. railroad industry costs.
- Annual O&M cost estimates include all labor and non-labor (parts, materials, supplies, contracts, rentals, leases, insurance, shipping, fees, etc.) associated with railroad operations and maintenance for the transportation of coal from the Black Mesa Complex to the Mohave Generating Station. Annual O&M costs for the Black Mesa Complex and the Mohave Generating Station are not included.

6.1 APPROACH FOR DEVELOPING THE COST ESTIMATE

The cost estimates provided in this technical memorandum are based upon the best data that were available within the time and resources allocated. The unit costs used in this technical memorandum are the same as those used on other similar recent railroad projects.

Realizing that the project is in the Draft EIS stage and that only conceptual engineering (conceptual planning) would be available, the concept for developing the railroad cost estimate included the following considerations:

- The topography and sensitive environment encountered along the route in Arizona and Nevada will make new construction more expensive than if it were built in existing railroad right-of-way;
- Of the total route mileage (466 miles for the eastern approach or 483 miles for the western approach to the Mohave Generating Station), new construction would be required for 199 miles (east approach) or 187 miles (west approach);
- The existing BNSF segment is double track with CTC signaling with an average of almost 100 trains per day – which is essentially the capacity of the line;
- Current BNSF main line track design and standards would be used;
- Unit costs would be based upon current railroad and railroad contractor costs; and
- The new construction would be performed by qualified track and signal contractors rather than by BNSF forces due to the extent of the trackage and the fact that it would not become BNSF track once it was constructed.

A review of the 1993 phase two study (USDI 1993) produced very little detail for the basis of the capital and annual operating cost estimates. Major cost categories were simply listed as a dollar cost in tables with little or no detail as to what items or quantities were actually included in the cost. In other instances, data such as average train speed were based on two mid-western coal hauls rather than on the conditions that exist over the BNSF route in Arizona. Therefore, it is not possible to know exactly what was, or was not, included in the estimated costs other than a few quantities and unit costs for major cost categories. It

also must be noted that the 2006 cost estimate is based on extending the rail line for approximately an additional 3 miles to the Black Mesa Mine loadout area rather than just to Cow Springs as contained in the 1993 study. Given inflation over the 13 years between the 1993 phase two study and this 2006 Technical Memorandum, it should be expected that capital costs would increase significantly. This becomes even more pronounced if the 1993 cost estimates were low in some cases (e.g., the amount of track and cut and fill, number of bridges, or the fee per ton mile as mentioned on page A-95 of the 1993 Phase Two Study), if conditions have changed (e.g., traffic over the Santa Fe increased significantly since the merger with BNSF which it has), which now requires additional capacity improvements, or if some cost items were inadvertently left out of the estimate (e.g., spare rolling stock, servicing and maintenance facilities, and railroad signaling).

The Association of American Railroad (AAR) Railroad Facts, 2004 Edition was used for developing annual operating cost. The book contains various statistics for the railroad industry for 2003. The average operating expense and operating revenue for the BNSF were used to establish a cost per ton-mile estimate for the Black Mesa Project. Based upon the BNSF data shown on page 70 of the AAR Facts Book, a cost of \$0.0153 per ton-mile was calculated for operating expenses and \$0.0032 per ton-mile was calculated for revenue for the BNSF for their portion of the haul. From the AAR Railroad Facts Book, operating expense includes transportation (train crews, fuel, etc.), equipment (maintenance of such as locomotives and cars), way and structures (maintenance of track, bridges, signaling, etc.), and general and administrative expenses.

The calculations resulting in the requirement for three train sets are based on the number of trains per year, operating days per year, and the total round trip time. Please note, too, that four locomotives were used for trains of 125 cars rather than three locomotives per 100-car train stated in the 1993 report.

The pipeline costs are current and were provided by Peabody from data calculated for the EIS.

The implied 9.4429 is the annualized factor for an expected project life of 16 years and a 7 percent inflation factor in accordance with the Federal Transit Authority annualization factors revised as of January 21, 2005.

The estimate of 24 percent for design, construction management, etc., and other such costs reflect total engineering (preliminary and final) costs, bid-related costs, construction management, contractor mobilization, permitting, environmental evaluations, and owner-related costs for the design and construction process. A contingency factor of 20 percent reflects the fact that very little engineering has been done for the project. Typically, these costs can range from 20 percent to 50 percent for project estimates. A Class 1 railroad project would normally incur less cost because the design would proceed to final engineering quickly and the design and construction management would be accomplished in-house.

The \$1,056,000 per mile (\$200 per track foot) for new track construction is based on heavy-haul track including 12 inches of crushed rock sub-ballast, 12 inches of crushed rock ballast, concrete ties, and 141# rail section. This estimate is compatible with recent estimates approved or provided by Class 1 western railroads for new construction (e.g., \$900,000 per mile for track with 136# rail section). The estimate excludes turnouts, which were priced separately for the project. The unit costs for turnouts also were provided by the Class 1 western railroads.

The \$792,000 per mile (\$150 per track foot) for new CTC signaling includes switch machines, communications, a new or modified dispatching center, wayside signal masts, signal aspects, track circuits, bungalows, and all other CTC related hardware and systems except for control points and

interlockings. The cost for the installation of new control points and interlockings varies depending on the complexity of the train operations involved.

The estimates for the bridges are based on various estimates for recent Class 1 railroad and Amtrak projects. Because no engineering was available and because the cost of bridges varies depending on the length and height, the estimates used represent a “rule of thumb” cost. These unit costs for bridges are commonly used by the engineering consultant industry for planning and EIS studies.

The earthwork estimates were made without benefit of engineering drawings. Given the tendency for flash flooding in Arizona, the slopes for cut and fill will be important. The unit cost of \$1,000,000 per mile for earthwork for a single track is equivalent to approximately \$190 per track foot or the moving of approximately 9 to 12 cubic yards of material per track foot at \$15 to \$20 per cubic yard. The \$15 to \$20 per cubic yard for earthwork is based on a Class1 western railroad project in mountainous desert topography. (See Figure E-1 for a profile of the railroad elevations at key locations along the route.)

The average cost per mile for various segments of this project ranges from \$0.3 million per mile over existing BNSF trackage to \$6.8 million per mile for new construction in the vicinity of the Mohave Generating Station. The overall average for the project is \$2.6 million per mile for the eastern approach and \$2.3 million per mile for the western approach. These costs appear to be reasonable in light of the above costs and the fact that the cost for rail and signaling has increased significantly in the last 5 years.

The cost for coal facilities including loading, unloading, and conversion to dry coal, were provided by Peabody and SCE. The cost for coal facilities is independent of the route for the coal movement as such facilities are located at the mine and the generating station.

6.2 CAPITAL COST ESTIMATES

The estimated capital costs including design, construction, and contingency related costs associated with new railroad construction, the existing BNSF Railway trackage, and the railroad locomotives and coal cars are shown in the subsections below. Right-of-way and financing costs are not included.

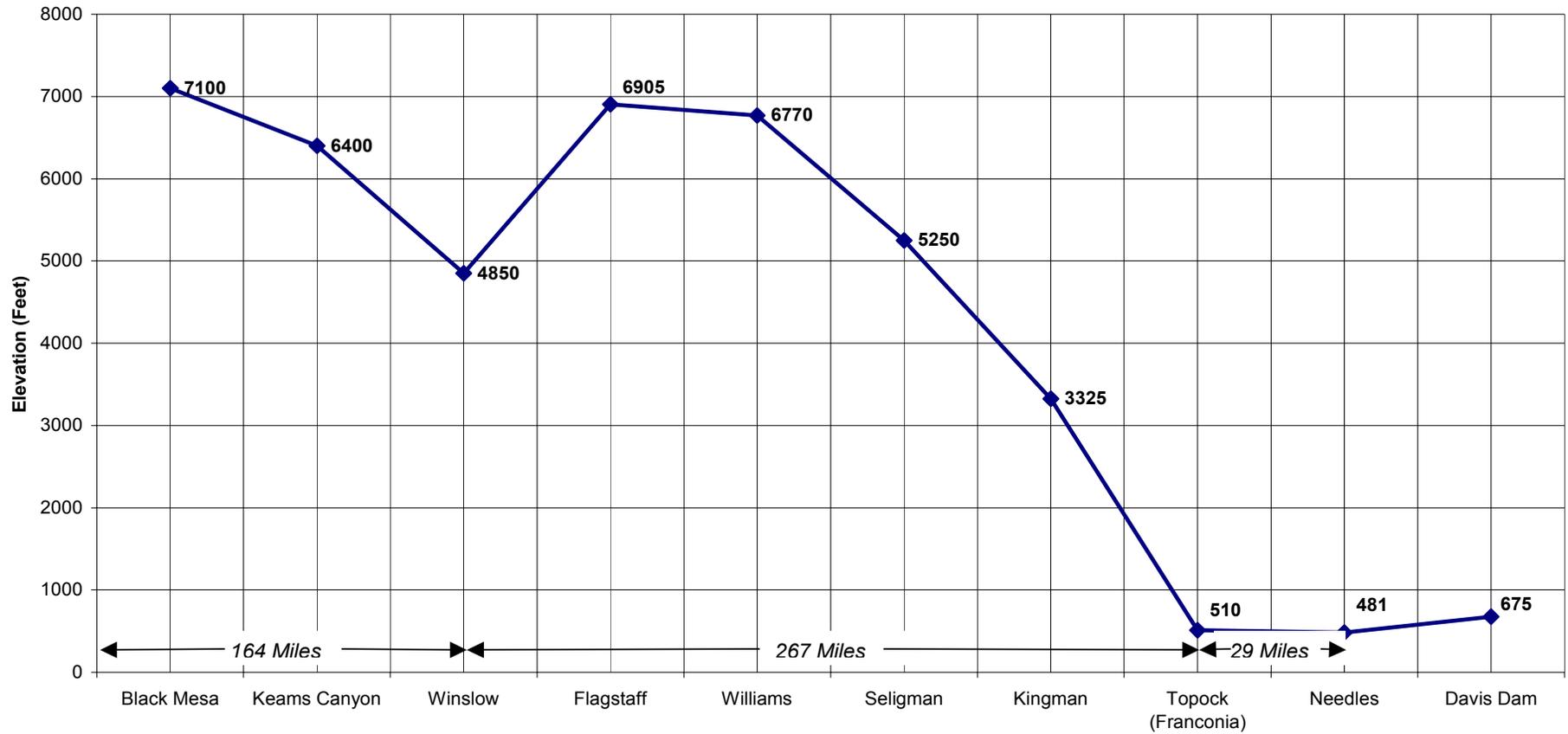
6.2.1 New Railroad Construction

The capital cost estimates including design, construction, and contingency related costs for new railroad construction include the alternative segments between the Black Mesa Complex and the BNSF at Winslow, Arizona; the BNSF at Franconia, Arizona, and the Mohave Generating Station from the east; and the BNSF at Franconia, Arizona, and the Mohave Generating Station from the west by way of Needles, California. A summary of the estimated capital cost for each of these alternatives is outlined in Table E-3.

Table E-3 Estimated Capital Cost for Each Alternative

Alternative Segment	Route Miles	Capital Cost (millions)	Average Cost per Mile (millions)
Black Mesa Complex to BNSF at Winslow	164	\$ 821.1	\$ 5.0
BNSF at Franconia to Mohave Generating Station from the east	35	\$230.1	\$ 6.6
BNSF at Franconia to Mohave Generating Station via Needles and the west	23	\$156.6	\$6.8

Figure E-1: Black Mesa Project EIS Railroad Elevations



The details for each of the capital cost estimates are shown in the applicable rows of Tables 1 through 3 in the Appendix.

6.2.2 Existing BNSF Railway

The estimated capital costs including design, construction, and contingency related costs for the alternative segments of the existing BNSF Railway Company include the line between Winslow and Franconia and Franconia and a point 3 or 4 miles west of Needles. A summary of the estimated capital cost for each of these alternatives is described in Table E-4.

Table E-4 Estimated Capital Cost for Each Alternative

Alternative Segment	Route Miles	Capital Cost (millions)	Average Cost per Mile (millions)
BNSF at Winslow to Franconia	267	\$141.0	\$0.5
BNSF at Franconia to west of Needles	29	\$9.7	\$0.3

The details for each of the capital cost estimates are shown in the applicable rows of Tables 4 and 5 of the Appendix.

6.2.3 Railroad Rolling Stock

The estimated capital cost for the locomotives and coal cars required to transport coal from the Black Mesa Complex to the Mohave Generating Station are described in Table E-5. Contingency and other related costs are normally not added to the basic cost of rolling stock.

Table E-5 Estimated Capital Cost

Rolling Stock	Quantity	Unit Price	Total Cost (millions)
Diesel Locomotives	12	\$2,500,000	\$30.0
Coal Gondolas	375	\$100,000	\$37.5
Total			\$67.5
<i>Less salvage value at 16 years of 25 year life</i>		\$12.5	\$55.0

6.2.4 Coal Facilities

The estimated capital costs for new coal loading and unloading facilities are taken from the Peabody Corporation Mohave Power Plant Coal Conversion Study, March 2003, by Burns & McDonnell and SCE (personal communication with L. Johnson, September 19, 2005). The capital cost estimates for the conversion of the Mohave Generating Station to dry coal are from the Southern California Edison Company provided on February 3, 2006. The cost estimates, including design, construction management, etc. and contingency related costs are:

- \$50.0 million for coal loading facilities at the Black Mesa mining operation
- \$95.1 million for coal unloading facilities at Mohave Generating Station
- \$99.1 million for conversion to dry coal
- \$145.1 million for design, construction management, contingency, etc.
- **\$389.3 million total**

Use of dry coal at the Mohave Generating Station is not allowed under the station's existing Title V air quality permit and would require the facility to undergo New Source Review under the Clean Air Act. This could result in a change in operations or the installation of additional air-pollution-control equipment to meet Best Achievable Control Technology Standards. The cost of any such additional air-pollution-control equipment or changes in operations required by air permitting activities have not been included in these cost estimates.

6.2.5 Total Estimated Capital Cost Summary

The capital costs can be combined into the total estimated cost for each of two railroad alternatives. One alternative involves access to the Mohave Generating Station from the east and one alternative involves access to the Mohave Generating Station from the west. The estimated capital cost for each of the two combinations of alternative segments are summarized in Table E-6.

Table E-6 Estimated Capital Cost for Each Alternative

Alternative Segment	Route Miles	Capital Cost (millions)	Average Cost per mile (millions)
Black Mesa Complex to Mohave Generating Station from the east	466		
Excluding rolling stock and coal facilities		\$1,192.2	\$2.6
Including rolling stock, excluding coal facilities		\$1,247.2	\$ 2.7
Including rolling stock and coal facilities		\$1,636.5	\$3.5
Black Mesa Complex to Mohave Generating Station from the west	483		
Excluding rolling stock and coal facilities		\$1,128.4	\$2.3
Including rolling stock, excluding coal facilities		\$1,183.4	\$2.5
Including rolling stock and coal facilities		\$1,572.7	\$3.3

6.3 ANNUAL OPERATING COST ESTIMATES

The estimated annual operating and maintenance costs for each of the two potential alternatives are based upon BNSF cost data from the AAR Railroad Facts Book, 2004 Edition, page 70, as follows:

- Annual operating expense of \$0.015 per revenue ton-mile
- Annual operating revenue to BNSF of \$0.0032 per revenue ton-mile (operating revenue of \$0.0185 per ton-mile minus operating expense of \$0.0153 per ton-mile).

6.3.1 Black Mesa Complex to Mohave Generating Station via Franconia and from the East

For this alternative, the pertinent annual operating statistics are as follows:

- 2,518,730,000 revenue ton-miles (376 trains times 466 miles times 14,375 tons per train)
- 1,443,135,000 revenue ton-miles (376 trains times 14,375 tons per train times 267 miles on BNSF)

The annual O&M cost for this alternative is estimated to be:

- \$38.5 million for operations expense
- \$4.6 million for BNSF coal transportation revenue
- **\$43.1 million total**

6.3.2 Black Mesa Complex to Mohave Generating Station via Franconia and from the West

For this alternative, the pertinent annual operating statistics are as follows:

- 2,610,615,000 revenue ton-miles (376 trains times 14,375 tons per train times 483 miles)
- 1,599,880,000 revenue ton-miles over BNSF (376 trains times 14,375 tons per train times 296 miles over BNSF)

The annual O&M cost for this alternative is estimated to be:

- \$39.9 million for operations expense
- \$5.1 million for BNSF coal transportation revenue
- **\$45.0 million total**

6.4 ANNUALIZED COST PER TON OF COAL

The annualized cost per ton of coal is calculated from the annualized capital and O&M costs divided by the annual coal tonnage. The annualization factors are based upon the 16-year life expectancy of the coal operation and annualized factors used by the Federal Transit Administration. The details for the annualized cost per ton of coal are shown in Table 6 (in the Appendix) for the east approach alternative to the Mohave Generating Station and Table 7 (in the Appendix) for the west approach alternative to the Mohave Generating Station. The annualized cost per ton of coal for each of the two alternatives is as follows:

- \$40.07 for the east approach alternative
- \$39.18 for the west approach alternative

APPENDIX
ANNUALIZED COST PER TON OF COAL
TABLES

TABLE 1

RAILROAD LINE: Black Mesa Mine to BNSF at Winslow					164	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
1	New track, 115# CWR, Wood Ties		Mile	\$580,800	\$0	
2	New track, 141# CWR, Conc. Ties	179	Mile	\$1,056,000	\$189,024,000	164 main + 12 siding + 3 loop
3	Upgrade track to Class 3 (60 mph)		Mile	\$264,000	\$0	
4	Upgrade track to Class 4 (79 mph)		Mile	\$528,000	\$0	
5					\$0	
6					\$0	
7	Line and surface track		Mile	\$6,000	\$0	
8	Grind rail head contour		Mile	\$12,000	\$0	
9	New turnout, #10		Each	\$125,000	\$0	
10	New turnout, #20	9	Each	\$200,000	\$1,800,000	4 sidings on coal line + loop
11	New turnout, #24	1	Each	\$250,000	\$250,000	BNSF connection at Winslow
12	#24 Universal Crossover	1	Each	\$1,000,000	\$1,000,000	Pair of crossovers (4 turnouts)
13					\$0	
14	New railroad diamond crossing		Each	\$500,000	\$0	
15	Rebuild turnout or diamond		Each	\$75,000	\$0	
16					\$0	
17	New railroad interlocking	1	Each	\$1,000,000	\$1,000,000	At Winslow
18	Modify railroad interlocking	1	Mile	\$700,000	\$700,000	At Winslow
19	New CTC signaling system		Mile	\$792,000	\$0	
20	Upgrade railroad signal system		Mile	\$500,000	\$0	
21					\$0	
22	New highway crossing, quad gates		Each	\$250,000	\$0	
23	New highway crossing w/ gates	5	Each	\$150,000	\$750,000	
24	New highway crossing w/ flashers	43	Each	\$100,000	\$4,300,000	
25	New highway crossing w/crossbucks	82	Each	\$2,500	\$205,000	Also includes stop signs
26	Upgrade/modify highway crossing		Each	\$75,000	\$0	
27					\$0	
28	Highway/railroad grade separation		Each	\$8,000,000	\$0	
29	New bridge, stl/conc, over 300'		Trk Ft	\$5,000	\$0	
30	New bridge, stl/conc, 200' to 300'	2400	Trk Ft	\$4,500	\$10,800,000	11 bridges
31	New bridge, stl/conc, 100' to 199'	3000	Trk Ft	\$4,000	\$12,000,000	29 bridges
32	New bridge, stl/conc, up to 99'	1500	Trk Ft	\$3,000	\$4,500,000	29 bridges
33	Rehabilitate existing bridge		Trk Ft	\$1,500	\$0	
34					\$0	
35	New culvert	656	Each	\$15,000	\$9,840,000	Estimated at 4 per mile
36	Clean and rehabilitate culvert		Each	\$5,000	\$0	
37					\$0	
38	Earthwork, 1 track, basic		Mile	\$500,000	\$0	
39	Earthwork, 1 track, significant		Mile	\$1,000,000	\$0	
40	Earthwork, 1 track, major		Mile	\$1,500,000	\$0	
41					\$0	
42	Earthwork, 2 tracks, basic		Mile	\$750,000	\$0	
43	Earthwork, 2 tracks, significant	179	Mile	\$1,800,000	\$322,200,000	Approx 600,000 CY / mile
44	Earthwork, 2 tracks, major		Mile	\$2,500,000	\$0	
45					\$0	
46	Retaining wall, 1 side up to 10' high	28354	LF	\$200	\$5,670,800	Est. at 3% of items 39 and 43
47	Retaining wall, 1 side, 11' to 20' high		LF	\$500	\$0	Est. at 5% of items 40 and 44
48					\$0	
49					\$0	
50					\$0	
Subtotal and average cost per mile					\$564,039,800	\$3,439,267

TABLE 1 Continued

RAILROAD LINE: Black Mesa Mine to BNSF at Winslow					164	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
51	Coal Loadout/Silo Facility		LS		\$0	At Black Mesa Mine load-out
52	Conveyor Belt System		LS		\$0	Black Mesa Mine to load-out
53	Rotary Dump Facility		LS		\$0	At Mohave Generating Station
54	Coal Stack/Reclaim Facility		LS		\$0	At Mohave Generating Station
55	Conversion to burn dry coal		LS		\$0	At Mohave Generating Station
56	Running Inspection/Service Facility		SF	\$400	\$0	
57	Maintenance and Repair Facility		LS	\$500	\$0	
58					\$0	
59	Right-of-way allowance	1197	Acre	\$1,000	\$1,197,000	7.3 acres / mile (60' wide)
60					\$0	
61	Environmental mitigation	33	Mile	\$100,000	\$3,300,000	20% of rail miles
62					\$0	
63	Utilities allowance	17	Mile	\$100,000	\$1,700,000	10% of rail miles
64					\$0	
65					\$0	
66					\$0	
67					\$0	
68					\$0	
69					\$0	
70					\$0	
Subtotal and average cost per mile					\$6,197,000	\$37,787
Total and Average Cost per Mile					\$570,236,800	\$3,477,054
71	Design, Construction Management, Etc.		24%		\$136,856,832	
72	Contingency		20%		\$114,047,360	
73						
Subtotal and average cost per mile					\$250,904,192	\$1,529,904
74	New Locomotive		Each	\$2,500,000	\$0	
75	New Coal Gondola (rotary dump)		Each	\$100,000	\$0	
76					\$0	
77					\$0	
Subtotal and average cost per mile					\$0	\$0
Grand Total and Average Cost per Mile					\$821,140,992	\$5,006,957

TABLE 2

RAILROAD LINE: BNSF- Franconia to Mohave Generating Station from East					35	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
1	New track, 115# CWR, Wood Ties		Mile	\$580,800	\$0	
2	New track, 141# CWR, Conc. Ties	44	Mile	\$1,056,000	\$46,464,000	35 main + 6 siding + 3 loop
3	Upgrade track to Class 3 (60 mph)		Mile	\$264,000	\$0	
4	Upgrade track to Class 4 (79 mph)		Mile	\$528,000	\$0	
5					\$0	
6					\$0	
7	Line and surface track		Mile	\$6,000	\$0	
8	Grind rail head contour		Mile	\$12,000	\$0	
9	New turnout, #10		Each	\$125,000	\$0	
10	New turnout, #20	4	Each	\$200,000	\$800,000	2 sidings on coal line
11	New turnout, #24	1	Each	\$250,000	\$250,000	BNSF connection at Franconia
12	#24 Universal Crossover	1	Each	\$1,000,000	\$1,000,000	Pair of crossovers (4 turnouts)
13					\$0	
14	New railroad diamond crossing		Each	\$500,000	\$0	
15	Rebuild turnout or diamond		Each	\$75,000	\$0	
16					\$0	
17	New railroad interlocking	1	Each	\$1,000,000	\$1,000,000	At Franconia
18	Modify railroad interlocking		Mile	\$700,000	\$0	
19	New CTC signaling system		Mile	\$792,000	\$0	
20	Upgrade railroad signal system		Mile	\$500,000	\$0	
21					\$0	
22	New highway crossing, quad gates		Each	\$250,000	\$0	
23	New highway crossing w/ gates	16	Each	\$150,000	\$2,400,000	
24	New highway crossing w/ flashers		Each	\$100,000	\$0	
25	New highway crossing w/crossbucks	12	Each	\$2,500	\$30,000	Also includes stop signs
26	Upgrade/modify highway crossing		Each	\$75,000	\$0	
27					\$0	
28	Highway/railroad grade separation	2	Each	\$8,000,000	\$16,000,000	I-40 and Hwy 95
29	New bridge, stl/conc, over 300'	500	Trk Ft	\$5,000	\$2,500,000	Colorado River bridge
30	New bridge, stl/conc, 200' to 300'	200	Trk Ft	\$4,500	\$900,000	1 bridge
31	New bridge, stl/conc, 100' to 199'	500	Trk Ft	\$4,000	\$2,000,000	5 bridges
32	New bridge, stl/conc, up to 99'	2250	Trk Ft	\$3,000	\$6,750,000	45 bridges
33	Rehabilitate existing bridge		Trk Ft	\$1,500	\$0	
34					\$0	
35	New culvert	140	Each	\$15,000	\$2,100,000	Estimated at 4 per mile
36	Clean and rehabilitate culvert		Each	\$5,000	\$0	
37					\$0	
38	Earthwork, 1 track, basic		Mile	\$500,000	\$0	
39	Earthwork, 1 track, significant		Mile	\$1,000,000	\$0	
40	Earthwork, 1 track, major		Mile	\$1,500,000	\$0	
41					\$0	
42	Earthwork, 2 tracks, basic		Mile	\$750,000	\$0	
43	Earthwork, 2 tracks, significant	44	Mile	\$1,500,000	\$66,000,000	Approx 500,000 CY / mile
44	Earthwork, 2 tracks, major		Mile	\$2,500,000	\$0	
45					\$0	
46	Retaining wall, 1 side up to 10' high	6970	LF	\$200	\$1,394,000	Est. at 3% of items 39 and 43
47	Retaining wall, 1 side, 11' to 20' high		LF	\$500	\$0	Est. at 5% of items 40 and 44
48					\$0	
49					\$0	
50					\$0	
Subtotal and average cost per mile					\$149,588,000	\$4,273,943

TABLE 2 Continued

RAILROAD LINE: BNSF- Franconia to Mohave Generating Station from East					35	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
51	Coal Loadout/Silo Facility		LS		\$0	At Black Mesa Mine load-out
52	Conveyor Belt System		LS		\$0	Black Mesa Mine to load-out
53	Rotary Dump Facility		LS		\$0	At Mohave Generating Station
54	Coal Stacker/Reclaim Facility		LS		\$0	At Mohave Generating Station
55	Conversion to burn dry coal		LS		\$0	At Mohave Generating Station
56	Running Inspection/Service Facility	20000	SF	\$400	\$8,000,000	At Needles or Franconia
57	Maintenance and Repair Facility		LS	\$500	\$0	
58					\$0	
59	Right-of-way allowance	256	Acre	\$5,000	\$1,280,000	7.3 acres / mile (60' wide)
60					\$0	
61	Environmental mitigation	4.4	Mile	\$100,000	\$440,000	10% of rail miles
62					\$0	
63	Utilities allowance	4.4	Mile	\$100,000	\$440,000	10% of rail miles
64					\$0	
65					\$0	
66					\$0	
67					\$0	
68					\$0	
69					\$0	
70					\$0	
Subtotal and average cost per mile					\$10,160,000	\$290,286
Total and Average Cost per Mile					\$159,748,000	\$4,564,229
71	Design, Construction Management, Etc.		24%		\$38,339,520	
72	Contingency		20%		\$31,949,600	
73						
Subtotal and average cost per mile					\$70,289,120	\$2,008,261
74	New Locomotive		Each	\$2,500,000	\$0	
75	New Coal Gondola (rotary dump)		Each	\$100,000	\$0	
76					\$0	
77					\$0	
Subtotal and average cost per mile					\$0	\$0
Grand Total and Average Cost per Mile					\$230,037,120	\$6,572,489

TABLE 3

RAILROAD: BNSF- West Needles to Mohave Generating Station from West					23	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
1	New track, 115# CWR, Wood Ties		Mile	\$580,800	\$0	
2	New track, 141# CWR, Conc. Ties	32	Mile	\$1,056,000	\$33,792,000	23 main + 6 siding + 3 loop
3	Upgrade track to Class 3 (60 mph)		Mile	\$264,000	\$0	
4	Upgrade track to Class 4 (79 mph)		Mile	\$528,000	\$0	
5					\$0	
6					\$0	
7	Line and surface track		Mile	\$6,000	\$0	
8	Grind rail head contour		Mile	\$12,000	\$0	
9	New turnout, #10		Each	\$125,000	\$0	
10	New turnout, #20	4	Each	\$200,000	\$800,000	2 sidings on coal line
11	New turnout, #24	1	Each	\$250,000	\$250,000	BNSF connection at W Needles
12	#24 Universal Crossover	1	Each	\$1,000,000	\$1,000,000	Pair of crossovers (4 turnouts)
13					\$0	
14	New railroad diamond crossing		Each	\$500,000	\$0	
15	Rebuild turnout or diamond		Each	\$75,000	\$0	
16					\$0	
17	New railroad interlocking	1	Each	\$1,000,000	\$1,000,000	West of Needles
18	Modify railroad interlocking		Mile	\$700,000	\$0	
19	New CTC signaling system		Mile	\$792,000	\$0	
20	Upgrade railroad signal system		Mile	\$500,000	\$0	
21					\$0	
22	New highway crossing, quad gates		Each	\$250,000	\$0	
23	New highway crossing w/ gates	12	Each	\$150,000	\$1,800,000	
24	New highway crossing w/ flashers		Each	\$100,000	\$0	
25	New highway crossing w/crossbucks	9	Each	\$2,500	\$22,500	Also includes stop signs
26	Upgrade/modify highway crossing		Each	\$75,000	\$0	
27					\$0	
28	Highway/railroad grade separation	1	Each	\$8,000,000	\$8,000,000	Highway 95
29	New bridge, stl/conc, over 300'		Trk Ft	\$5,000	\$0	
30	New bridge, stl/conc, 200' to 300'		Trk Ft	\$4,500	\$0	
31	New bridge, stl/conc, 100' to 199'	600	Trk Ft	\$4,000	\$2,400,000	6 bridges
32	New bridge, stl/conc, up to 99'		Trk Ft	\$3,000	\$0	
33	Rehabilitate existing bridge		Trk Ft	\$1,500	\$0	
34					\$0	
35	New culvert	92	Each	\$15,000	\$1,380,000	Estimated at 4 per mile
36	Clean and rehabilitate culvert		Each	\$5,000	\$0	
37					\$0	
38	Earthwork, 1 track, basic		Mile	\$500,000	\$0	
39	Earthwork, 1 track, significant		Mile	\$1,000,000	\$0	
40	Earthwork, 1 track, major		Mile	\$1,500,000	\$0	
41					\$0	
42	Earthwork, 2 tracks, basic		Mile	\$750,000	\$0	
43	Earthwork, 2 tracks, significant	32	Mile	\$1,500,000	\$48,000,000	Approx 500,000 CY / mile
44	Earthwork, 2 tracks, major		Mile	\$2,500,000	\$0	
45					\$0	
46	Retaining wall, 1 side up to 10' high	5069	LF	\$200	\$1,013,800	Est. at 3% of items 39 and 43
47	Retaining wall, 1 side, 11' to 20' high		LF	\$500	\$0	Est. at 5% of items 40 and 44
48					\$0	
49					\$0	
50					\$0	
Subtotal and average cost per mile					\$99,458,300	\$4,324,274

TABLE 3 Continued

RAILROAD: BNSF- West Needles to Mohave Generating Station from West					23	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
51	Coal Loadout/Silo Facility		LS		\$0	At Black Mesa Mine load-out
52	Conveyor Belt System		LS		\$0	Black Mesa Mine to load-out
53	Rotary Dump Facility		LS		\$0	At Mohave Generating Station
54	Coal Stacker/Reclaim Facility		LS		\$0	At Mohave Generating Station
55	Conversion to burn dry coal		LS		\$0	At Mohave Generating Station
56	Running Inspection/Service Facility	20000	SF	\$400	\$8,000,000	At Needles
57	Maintenance and Repair Facility		LS	\$500	\$0	
58					\$0	
59	Right-of-way allowance	168	Acre	\$5,000	\$840,000	7.3 acres / mile (60' wide)
60					\$0	
61	Environmental mitigation	2.3	Mile	\$100,000	\$230,000	10% of rail miles
62					\$0	
63	Utilities allowance	2.3	Mile	\$100,000	\$230,000	10% of rail miles
64					\$0	
65					\$0	
66					\$0	
67					\$0	
68					\$0	
69					\$0	
70					\$0	
Subtotal and average cost per mile					\$9,300,000	\$404,348
Total and Average Cost per Mile					\$108,758,300	\$4,728,622
71	Design, Construction Management, Etc.		24%		\$26,101,992	
72	Contingency		20%		\$21,751,660	
73						
Subtotal and average cost per mile					\$47,853,652	\$2,080,594
74	New Locomotive		Each	\$2,500,000	\$0	
75	New Coal Gondola (rotary dump)		Each	\$100,000	\$0	
76					\$0	
77					\$0	
Subtotal and average cost per mile					\$0	\$0
Grand Total and Average Cost per Mile					\$156,611,952	\$6,809,215

TABLE 4

RAILROAD LINE: BNSF - Winslow to Franconia					267	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
1	New track, 115# CWR, Wood Ties		Mile	\$580,800	\$0	
2	New track, 141# CWR, Conc. Ties	30	Mile	\$1,056,000	\$31,680,000	Third main track
3	Upgrade track to Class 3 (60 mph)		Mile	\$264,000	\$0	
4	Upgrade track to Class 4 (79 mph)		Mile	\$528,000	\$0	
5					\$0	
6					\$0	
7	Line and surface track		Mile	\$6,000	\$0	
8	Grind rail head contour		Mile	\$12,000	\$0	
9	New turnout, #10		Each	\$125,000	\$0	
10	New turnout, #20		Each	\$200,000	\$0	
11	New turnout, #24		Each	\$250,000	\$0	
12	#24 Universal Crossover	4	Each	\$1,000,000	\$4,000,000	Pair of crossovers (4 turnouts)
13					\$0	
14	New railroad diamond crossing		Each	\$500,000	\$0	
15	Rebuild turnout or diamond		Each	\$75,000	\$0	
16					\$0	
17	New railroad interlocking	4	Each	\$1,000,000	\$4,000,000	At universal crossovers
18	Modify railroad interlocking		Mile	\$700,000	\$0	
19	New CTC signaling system	30	Mile	\$792,000	\$23,760,000	
20	Upgrade railroad signal system		Mile	\$500,000	\$0	
21					\$0	
22	New highway crossing, quad gates		Each	\$250,000	\$0	
23	New highway crossing w/ gates		Each	\$150,000	\$0	
24	New highway crossing w/ flashers		Each	\$100,000	\$0	
25	New highway crossing w/crossbucks		Each	\$2,500	\$0	Also includes stop signs
26	Upgrade/modify highway crossing	15	Each	\$75,000	\$1,125,000	Third main track, 1 per 2 miles
27					\$0	
28	Highway/railroad grade separation		Each	\$8,000,000	\$0	
29	New bridge, stl/conc, over 300'		Trk Ft	\$5,000	\$0	
30	New bridge, stl/conc, 200' to 300'		Trk Ft	\$4,500	\$0	
31	New bridge, stl/conc, 100' to 199'	300	Trk Ft	\$4,000	\$1,200,000	3 bridges for new third main
32	New bridge, stl/conc, up to 99'		Trk Ft	\$3,000	\$0	
33	Rehabilitate existing bridge		Trk Ft	\$1,500	\$0	
34					\$0	
35	New culvert		Each	\$15,000	\$0	Estimated at 4 per mile
36	Clean and rehabilitate culvert		Each	\$5,000	\$0	
37					\$0	
38	Earthwork, 1 track, basic		Mile	\$500,000	\$0	
39	Earthwork, 1 track, significant	30	Mile	\$1,000,000	\$30,000,000	
40	Earthwork, 1 track, major		Mile	\$1,500,000	\$0	
41					\$0	
42	Earthwork, 2 tracks, basic		Mile	\$750,000	\$0	
43	Earthwork, 2 tracks, significant		Mile	\$1,500,000	\$0	
44	Earthwork, 2 tracks, major		Mile	\$2,500,000	\$0	
45					\$0	
46	Retaining wall, 1 side up to 10' high	4752	LF	\$200	\$950,400	Est. at 3% of items 39 and 43
47	Retaining wall, 1 side, 11' to 20' high		LF	\$500	\$0	Est. at 5% of items 40 and 44
48					\$0	
49					\$0	
50					\$0	
Subtotal and average cost per mile					\$96,715,400	\$362,230

TABLE 4 Continued

RAILROAD LINE: BNSF - Winslow to Franconia					267	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
51	Coal Loadout/Silo Facility		LS		\$0	At Black Mesa Mine load-out
52	Conveyor Belt System		LS		\$0	Black Mesa Mine to load-out
53	Rotary Dump Facility		LS		\$0	At Mohave Generating Station
54	Coal Stacker/Reclaim Facility		LS		\$0	At Mohave Generating Station
55					\$0	
56	Running Inspection/Service Facility		SF	\$400	\$0	
57	Maintenance and Repair Facility		LS	\$500	\$0	
58					\$0	
59	Right-of-way allowance		Acre	\$1,000	\$0	7.3 acres / mile (60' wide)
60					\$0	
61	Environmental mitigation	6	Mile	\$100,000	\$600,000	20% of new track mileage
62					\$0	
63	Utilities allowance	6	Mile	\$100,000	\$600,000	20% of new track mileage
64					\$0	
65					\$0	
66					\$0	
67					\$0	
68					\$0	
69					\$0	
70					\$0	
Subtotal and average cost per mile					\$1,200,000	\$4,494
Total and Average Cost per Mile					\$97,915,400	\$366,724
71	Design, Construction Management, Etc.		24%		\$23,499,696	
72	Contingency		20%		\$19,583,080	
73						
Subtotal and average cost per mile					\$43,082,776	\$161,359
74	New Locomotive		Each	\$2,500,000	\$0	
75	New Coal Gondola (rotary dump)		Each	\$100,000	\$0	
76					\$0	
77					\$0	
Subtotal and average cost per mile					\$0	\$0
Grand Total and Average Cost per Mile					\$140,998,176	\$528,083

TABLE 5

RAILROAD LINE: BNSF - Franconia to West of Needles						29	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks	
1	New track, 115# CWR, Wood Ties		Mile	\$580,800	\$0		
2	New track, 141# CWR, Conc. Ties	2	Mile	\$1,056,000	\$2,112,000	New siding at Needles	
3	Upgrade track to Class 3 (60 mph)		Mile	\$264,000	\$0		
4	Upgrade track to Class 4 (79 mph)		Mile	\$528,000	\$0		
5					\$0		
6					\$0		
7	Line and surface track		Mile	\$6,000	\$0		
8	Grind rail head contour		Mile	\$12,000	\$0		
9	New turnout, #10		Each	\$125,000	\$0		
10	New turnout, #20		Each	\$200,000	\$0		
11	New turnout, #24		Each	\$250,000	\$0		
12	#24 Universal Crossover	2	Each	\$1,000,000	\$2,000,000	Pair of crossovers (4 turnouts)	
13					\$0		
14	New railroad diamond crossing		Each	\$500,000	\$0		
15	Rebuild turnout or diamond		Each	\$75,000	\$0		
16					\$0		
17	New railroad interlocking		Each	\$1,000,000	\$0		
18	Modify railroad interlocking	2	Mile	\$700,000	\$1,400,000	At new Needles siding	
19	New CTC signaling system		Mile	\$792,000	\$0		
20	Upgrade railroad signal system		Mile	\$500,000	\$0		
21					\$0		
22	New highway crossing, quad gates		Each	\$250,000	\$0		
23	New highway crossing w/ gates		Each	\$150,000	\$0		
24	New highway crossing w/ flashers		Each	\$100,000	\$0		
25	New highway crossing w/crossbucks		Each	\$2,500	\$0	Also includes stop signs	
26	Upgrade/modify highway crossing		Each	\$75,000	\$0		
27					\$0		
28	Highway/railroad grade separation		Each	\$8,000,000	\$0		
29	New bridge, stl/conc, over 300'		Trk Ft	\$5,000	\$0		
30	New bridge, stl/conc, 200' to 300'		Trk Ft	\$4,500	\$0		
31	New bridge, stl/conc, 100' to 199'		Trk Ft	\$4,000	\$0		
32	New bridge, stl/conc, up to 99'		Trk Ft	\$3,000	\$0		
33	Rehabilitate existing bridge		Trk Ft	\$1,500	\$0		
34					\$0		
35	New culvert		Each	\$15,000	\$0	Estimated at 4 per mile	
36	Clean and rehabilitate culvert		Each	\$5,000	\$0		
37					\$0		
38	Earthwork, 1 track, basic	2	Mile	\$500,000	\$1,000,000	New siding at Needles	
39	Earthwork, 1 track, significant		Mile	\$1,000,000	\$0		
40	Earthwork, 1 track, major		Mile	\$1,500,000	\$0		
41					\$0		
42	Earthwork, 2 tracks, basic		Mile	\$750,000	\$0		
43	Earthwork, 2 tracks, significant		Mile	\$1,500,000	\$0		
44	Earthwork, 2 tracks, major		Mile	\$2,500,000	\$0		
45					\$0		
46	Retaining wall, 1 side up to 10' high		LF	\$200	\$0	Est. at 3% of items 39 and 43	
47	Retaining wall, 1 side, 11' to 20' high		LF	\$500	\$0	Est. at 5% of items 40 and 44	
48					\$0		
49					\$0		
50					\$0		
Subtotal and average cost per mile					\$6,512,000	\$224,552	

TABLE 5 Continued

RAILROAD LINE: BNSF - Franconia to West of Needles					29	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
51	Coal Loadout/Silo Facility		LS		\$0	At Black Mesa Mine load-out
52	Conveyor Belt System		LS		\$0	Black Mesa Mine to load-out
53	Rotary Dump Facility		LS		\$0	At Mohave Generating Station
54	Coal Stacker/Reclaim Facility		LS		\$0	At Mohave Generating Station
55					\$0	
56	Running Inspection/Service Facility		SF	\$400	\$0	
57	Maintenance and Repair Facility		LS	\$500	\$0	
58					\$0	
59	Right-of-way allowance		Acre	\$1,000	\$0	7.3 acres / mile (60' wide)
60					\$0	
61	Environmental mitigation		Mile	\$100,000	\$0	
62					\$0	
63	Utilities allowance	2	Mile	\$100,000	\$200,000	
64					\$0	
65					\$0	
66					\$0	
67					\$0	
68					\$0	
69					\$0	
70					\$0	
Subtotal and average cost per mile					\$200,000	\$6,897
Total and Average Cost per Mile					\$6,712,000	\$231,448
71	Design, Construction Management, Etc.		24%		\$1,610,880	
72	Contingency		20%		\$1,342,400	
73						
Subtotal and average cost per mile					\$2,953,280	\$101,837
74	New Locomotive		Each	\$2,500,000	\$0	
75	New Coal Gondola (rotary dump)		Each	\$100,000	\$0	
76					\$0	
77					\$0	
Subtotal and average cost per mile					\$0	\$0
Grand Total and Average Cost per Mile					\$9,665,280	\$333,286

Table 6 - Black Mesa Project: Railroad Alternative - Black Mesa Mine to Mohave Generating Station From East

Annualized Capital and Operating Cost Category		Annual Coal Tonnage: 5,400,000				Total Capital Cost Incl. Contgcy (\$mil)	Railroad Annualized Cost (\$mil)
Cost Category	Useful Life (yr)	Annualization Factor	Railroad Total Cost (\$mil)	Contingency 44% (\$mil)			
RAILROAD							
Track	16	0.1059	\$276.268	\$121.558	\$397.826		\$42.130
Bridges and structures	16	0.1059	\$60.590	\$26.660	\$87.250		\$9.240
Train Control/Crossing Signals	16	0.1059	\$55.270	\$24.319	\$79.589		\$8.428
Eathwork/Utilities,Environment	16	0.1059	\$433.295	\$190.650	\$623.945		\$66.076
Right-of-way	16	0.1059	\$2.477	\$1.090	\$3.567		\$0.378
Subtotal			\$827.900	\$364.276	\$1,192.176		\$126.251
Rolling Stock	16	0.1059	\$55.000	\$0.000	\$55.000		\$5.825
Subtotal					\$1,247.176		
Coal Facilities	16	0.1059	\$244.200	\$145.100	\$389.300		\$41.227
Subtotal					\$1,636.476		
Capital Cost			\$1,127.100	\$509.376	\$1,636.476		\$173.303
Annual O&M Cost							\$43.100
Total Capital and O&M Cost							\$216.403
Annualized Cost per Ton of Coal							\$40.07

Notes:

1. Annualized Cost per Ton of Coal = Annualized Cost divided by Annual Coal Tonnage.

Table 7 - Black Mesa Project: Railroad Alternative - Black Mesa Mine to Mohave Generating Station From West

Annualized Capital and Operating Cost						
Category	Annual Coal Tonnage:		5,400,000		Total Capital	Railroad
Cost Category	Useful Life (yr)	Annualization Factor	Railroad Total Cost (\$mil)	Contingency 44% (\$mil)	Cost Incl. Contgcy (\$mil)	Annualized Cost (\$mil)
RAILROAD						
Track	16	0.1059	\$267.708	\$117.792	\$385.500	\$40.824
Bridges and structures	16	0.1059	\$50.120	\$22.053	\$72.173	\$7.643
Train Control/Crossing Signals	16	0.1059	\$48.062	\$21.147	\$69.209	\$7.329
Eathwork/Utilities,Environment	16	0.1059	\$415.695	\$182.906	\$598.601	\$63.392
Right-of-way	16	0.1059	\$2.037	\$0.896	\$2.933	\$0.311
Subtotal			\$783.622	\$344.794	\$1,128.416	\$119.499
Rolling Stock	16	0.1059	\$55.000	\$0.000	\$55.000	\$5.825
Subtotal					\$1,183.416	
Coal Facilities	16	0.1059	\$244.200	\$145.100	\$389.300	\$41.227
Subtotal					\$1,572.716	
Capital Cost			\$1,082.822	\$489.894	\$1,572.716	\$166.551
Annual O&M Cost						\$45.000
Total Capital and O&M Cost						\$211.551
Annualized Cost per Ton of Coal						\$39.18

Notes:

1. Annualized Cost per Ton of Coal = Annualized Cost divided by Annual Coal Tonnage.

APPENDIX F



Appendix F

Biological Resources

- F-1 Noxious Weeds and Invasive Plant Species
- F-2 Culturally Important Native Plants of the Hopi and Navajo
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Table F-1 Noxious Weeds and Invasive Plant Species

Common Name	Listed as Noxious Weed				Known or Likely Occurrence ^a					
	Arizona State List	Kaibab National Forest Species Rank	BLM	Nevada State List ^b	Black Mesa Complex	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignment
African mustard (<i>Brassica tournefortii</i>)			X						X	X
Bull thistle (<i>Cirsium vulgare</i>)		20	X		X			X	Potential	Potential
Camelthorn (<i>Alhagi pseudalhagi</i>)	Restricted Prohibited	4	X	A		X	X	X	X	X
Common purslane (<i>Portulaca oleracea</i>)	Prohibited Regulated				X	Potential	Potential	Potential	Potential	Potential
Dalmation toadflax (<i>Linaria genistifolia</i> ssp. <i>dalmatica</i>)		18	X	A					X	X
Diffuse knapweed (<i>Centaurea diffusa</i>)	Prohibited Restricted	9	X	B	X			X	X	X
Field bindweed (<i>Convolvulus arvensis</i>)	Regulated Prohibited		X		X	Potential	Potential	X	X	X
Halogeton (<i>Halogeton glomeratus</i>)	Restricted Prohibited	Unassigned	X			X	X	X		
Musk thistle (<i>Carduus nutans</i>)		8	X	B	X	X		X		
Puncture vine (<i>Tribulus terrestris</i>)	Prohibited Regulated		X	C	Potential	X	X	X		
Russian knapweed (<i>Acroptilon repens</i>)	Prohibited Restricted	5	X	B	X	X	X	X	X	X
Russian olive (<i>Elaeagnus angustifolia</i>)		12	X			X	X	X	X	X
Scotch thistle (<i>Onopordum acanthium</i>)	Restricted Prohibited	11	X	B	Potential	Potential	X	X	X	X
Spotted knapweed (<i>Centaurea maculosa</i>)	Restricted Prohibited	10	X	A			X		X	X
Tamarisk (<i>Tamarix</i> spp.)		13	X	C	X	X	X		X	X

SOURCES: Bureau of Land Management 2000; California Information Node 2005; ESCO Associates 2003; Nevada Department of Agriculture 2005; Peabody Western Coal Company 2004; U.S. Forest Service 2003; U.S. Geologic Survey 2004

NOTES: ^a X = Present; Potential = Known from general vicinity or habitat; may occur.

^b Nevada State List definitions: A = weeds of limited distribution that are actively eradicated when found; B = weeds in scattered populations, actively eradicated where possible; C = weeds currently established and widespread, actively eradicated from nurseries—abatement at discretion of state quarantine officer.

Table F- 2 Culturally Important Native Plants of the Hopi and Navajo

Scientific Name	Common Name	Navajo Name	Hopi Name	Navajo Uses ¹	Hopi Uses ¹
Trees, Shrubs, and Cacti					
<i>Amelanchier utahensis</i>	Serviceberry			F, M, R	U
<i>Artemisia filifolia</i>	Sand sage		Hovaqpi	R	R, M
<i>Artemisia frigida</i>	Mountain sagebrush		Kuungya	R, U	R
<i>Artemisia ludoviciana</i>	Wormwood		Paakungya	M	R, M, F
<i>Artemisia tridentata</i>	Big sagebrush	Gah biłakani, Ts'ah, Tse'eziih, Tsetah ts'ah, Ma'iilizhin natoh	Wi:'kwapi	M, R, U	M
<i>Artemisia sp.</i>			Tavotqa	M, R	M
<i>Atriplex canescens</i>	Fourwing saltbush	Díwózhiitbái, Díwózhiit bái	Suwvi, Suwaftsoki, Suwafqölo	F, U, R, M	R, U, M, F
<i>Atriplex confertifolia</i>	Saltbush, shadscale	Díkóózh, Díkóózh sízílíni, Díkóózh bihosh lání	Znga'toki, Ki'tsvi	F, M, U	F, M
<i>Baccharis emoryi</i>	Emory baccharis		Awtangavi, Masiqwhavi		R
<i>Baccharis sarathoides</i>	Desertbroom		Siváapi, Siváptoski, Qahavi		M
<i>Berberis fremontii</i>	Holly grape		Hoongavi, Hoongwi	M	R, M, F
<i>Ceratoides lanata</i> (=Krascheninnikovia lanata)	Winter fat, white sage	Gahtsohdáá'	Tavotqa, Wutaq'vala, Masvi	M	R, M
<i>Cercocarpus montanus</i>	Mountain mahogany			M, R, U	U
<i>Chrysothamnus spp.</i>	Rabbit brush, chamisa	Ts'iilyésiitso	Siva'pi, Masi'siva'pi	M, U	U, R
<i>Chrysothamnus nauseosus</i> (=Ericameria nauseosa)	Rubber rabbit brush, chamiso	K'iiltsoi	Masi'siv'áapi, Siváapi, Sivá'pa	M, U	M, R, U
<i>Chrysothamnus viscidiflorus</i>	Douglas rabbit brush	Tc'iltiilyésiitshoh		M, R	M, R
<i>Echinocereus spp.</i>	Hedgehog cactus		Pöna	F, M	R
<i>Echinocereus triglochidiatus</i>	Hedgehog cactus		Pöna	F	R
<i>Ephedra torreyana</i>	Torrey's jointfir, Mormon tea		Ösvi, Ösaptsoki, Masi'ösvi	F, M	M, U
<i>Ephedra viridis</i>	Mountain jointfir, Mormon tea			F, M, U	F, M
<i>Fallugia paradoxa</i>	Apache plume		Moopovi, Mo'povi, Mongpuwvi		R, M, F
<i>Gutierrezia sarothrae</i>	Snakeweed	ch'ildiilyésii	Maa'övi, Tsaatsakw'maa'övi	M	R, M, U
<i>Juniperus monosperma</i>	Oneseed juniper		Hohu, Hotski, Ngömaapi, Leposi	F, R, M, U	R, J, U

Table F- 2 Culturally Important Native Plants of the Hopi and Navajo

Scientific Name	Common Name	Navajo Name	Hopi Name	Navajo Uses ¹	Hopi Uses ¹
<i>Lycium pallidum</i>	Pale desertthorn, tomatillo, wolfberry	Haashch'édáá'	Kyeeve, Kyeftsoki, Kyevefsi	F, M, R	F, M, R
<i>Mammillaria spp.</i>	Ball cactus, pincushion cactus, fishhook cactus		Pöna, Yöngötspölö	F	R
<i>Opuntia erinacea</i>	Mohave prickly pear		Yöngö		R, M, F, U
<i>Opuntia phaeacantha</i>	Prickly pear		Naavu	F, M	M, U
<i>Opuntia polyacantha</i>	Plains prickly pear			F, U	
<i>Opuntia sp.</i>	Prickly pear, cholla, nopales	Tit chin pixwoc, Hosh, Hosh'atiniit'oo iih, Hosh'ineebijeeh, Hosh libaíí	Yöngö, Ösö	F, M	M
<i>Opuntia whipplei</i>	Whipple cholla		Ösö	M	R, M, F, U
<i>Parryella filifolia</i>	Dunebroom		Kotoksulvi, Siwi		R, M, F, U
<i>Pinus edulis, Pinus monophyla</i>	Two-needle piñon, singleleaf piñon	Deestsiin, Bijech, Cha'ot	Tuve'e	F, M, R, U	R, F, U
<i>Pinus ponderosa</i>	Ponderosa pine	Nídishchíí'	lzqz	R, M	U
<i>Populus fremontii, Populus spp.</i>	Fremont cottonwood	T'iis	Söhövi, Söhövtsoiki, Heesöoliwma	U	R, F, U
<i>Populus tremuloides</i>	Quaking aspen	T'iis báí	tzvo'vi	R	R
<i>Prunus virginiana</i>	Chokecherry			F, M, R, U	
<i>Pseudotsuga menziesii</i>	Douglas fir	'Azee ts'óóz, Ch'óh deeníní	Salavi	R, M, U	R
<i>Purshia stansburiana (Cowania mexicana)</i>	Cliff rose	awééts'áál	Hunvi, Hunaptsoki	M, U, R	R, M, U
<i>Purshia tridentata</i>	Antelope bitter brush	'Awééts'áál, K'injijí'ahí		U, M	
<i>Quercus gambelii</i>	Gambel oak	tséch'il	Kwingvi, Kwingvituva	F, M, R, U	R, F, U
<i>Rhus sp., Rhus trilobata</i>	Squaw bush		Suuví, Suvaptsoki, Suvifsi, Suvipsi	F, M	R, M, F, U
<i>Sarcobatus vermiculatus</i>	Greasewood, chico	Díwózhii, Díwózhiiłzhiin	Teeve, Teptsoki	F, M, R, U	R, U
<i>Salix exigua</i>	Coyote willow		Maisqwhavi, Palaqwhavi	M	R
<i>Salix sp.</i>	Willow		Qahavi, Masiqwhavi, Palawhavi	U	R, U
<i>Tamarix chinensis</i>	Fivestamen tamarisk			M, U	

Table F-2 Culturally Important Native Plants of the Hopi and Navajo

Scientific Name	Common Name	Navajo Name	Hopi Name	Navajo Uses ¹	Hopi Uses ¹
<i>Tessaria sericea</i>	Desert arrowweed		Hoongavi, Sanavi		U
<i>Vitis arizonica</i>	Wild grape		Oova, Ova'uyi		F
<i>Yucca angustissima</i>	Narrow-leaved yucca	Tsá'ászi'ts'óóz, Tsa'laguoc, Ni doodlöhii, Nteestijiin	Moohu, Mooho, Piitö	F, M, U	R, U, M, F
<i>Yucca baccata</i>	Banana yucca		Samowa, Saahu	R, U	R, F, U
<i>Yucca spp.</i>	Yucca	Tsá'ászi', Tsá'ászi'niteeli, Tsá'ászi'ts'óóz	Moohu, Mooho, Piitö	R	R
Forbs					
<i>Abronia elliptica</i>	Sand verbena		Tòökilsí, Poliisi		R, M
<i>Acanthochiton wrightii</i>	Greens		Wiiwa		F
<i>Adiantum capillus-veneris</i>	Maidenhair fern		Paatusaqa		R, M
<i>Amaranthus spp.</i>	Pigweed	Naazkaadii		F, M	F
<i>Asclepias spp.</i>	Milkweed	Ch'il abe'étsoh		F, M, R	
<i>Aster sp.</i>	Purple aster		Tootim, Íslöhavu, Walapope	R	R, M
<i>Astragalus sabulorum</i>			Patoto		M, U
<i>Calochortus spp.</i>	Mariposa lily			F, M	F
<i>Castilleja chromosa, C. applegatei</i>	Indian paintbrush	Dahiitíhídáá, Na'ashjé'iidáá'		M	
<i>Castilleja sp.</i>	Indian paintbrush		Palamansi		R, M, F
<i>Castilleja spp.</i>	Indian paintbrush	Dahiitíhídáá'		M	
<i>Chenopodium album</i>	Lamb's quarters	tl'oh deii, tl'oh deii tsoh, tl'oh deii náálgai, díkóózh	Si'swa, Hzhz'la	F, M	F
<i>Chenopodium spp.</i>	Goosefoot, lamb's quarters	T'ohedii	Höhöla, Kutuki, Sirwa, Öngarki	F, M, U	F
<i>Cirsium sp.</i>	Thistle	Azeehókánii	Tsi'ninra	M	M
<i>Cleome serrulata</i>	Rocky Mountain bee weed		Tumi	F, M, U	R, F, M, U
<i>Cryptantha spp.</i>	Cryptantha	'Azec'libáíí		M	
<i>Cucurbita foetidissima</i>			Mösiftanga		M
<i>Cycloloma sp.</i>			Kutuki		M, F, U
<i>Datura meteloides</i>	Sacred datura		Tsimona, Tsimonmana		R, M
<i>Descurainia sp.</i>	Tansy mustard		Aasa	F	F, U
<i>Erigeron concinnus</i>	Navajo fleabane		Na'palnga		M
<i>Erigeron utahensis</i>	Fleabane		Tiiqatsmansi		R, M
<i>Eriogonum rotundifolium</i>	Roundleaf wild buckwheat	Wóláchíí'dáá'		M	

Table F-2 Culturally Important Native Plants of the Hopi and Navajo

Scientific Name	Common Name	Navajo Name	Hopi Name	Navajo Uses ¹	Hopi Uses ¹
<i>Eriogonum spp.</i>	Wild buckwheat	Xóchóódzí ch'il líbái, Wóláchíí'dáá'	Powa'wi	M, R	M
<i>Eriogonum umbellatum</i>	Sulfur-flower buckwheat			R	
<i>Gaura coccinea</i>	Scarlet beeblossom	'Azee'bilátaħ fíhíí'ígí, 'Azee'libái, na'ashje'iidáá', iiníziin ch'il		M, R	
<i>Ipomopsis aggregata</i>	Scarlet gilia	Dahyííhídáá, Dloziłgai bich'il	Pala'ka'tsi	M, R	U
<i>Helianthus annuus, Helianthus anomalous, Helianthus petiolaris</i>	Sunflower, common sunflower, annual sunflower, western sunflower, prairie sunflower	dz'o'xonaa'ai bina toħ, nídíyilii tsoħ	Aqawsí	F, M, R, U	R, F, U, M
<i>Lappula occidentalis, Lappula redowskii</i>	Western stickseed	'Itjiihíh, Ch'il bohoshí		M	
<i>Lithospermum spp</i>	Stoneseed			M, R	M
<i>Lupinus pusillus</i>	Lupine		Íslöħavu, Katsin'nakvu		R, M
<i>Lupinus spp.</i>	Lupine	Azeediilch'ítii		M, R	M
<i>Lesquerella intermedia</i>	Bladderpod	tóneinilii binákee'atíí	hohoi'yáwnga	M, R	
<i>Machaeranthera canescens</i>	Purple aster		Tsorsi, Tsorosi		R, M
<i>Medicago sativa</i>	Alfalfa	Tł'oh waa'í, Dine'é ch'il		M	
<i>Melilotus indica</i>	Annual yellow sweetclover	'Azee'bilátaħ hal tsoi		M	
<i>Mentha spicata</i>	Spearmint		Hot'öqlangnga		M, F
<i>Mentzelia sp.</i>	Stickleaf		Sililtiaqa	F, M, R	R, M, F
<i>Mimulus cardinalis</i>	Monkey flower		Palamansi, Mansi, Oattsi		R, M
<i>Mirabilis multiflora</i>	Colorado four o'clock	K'íneetlíciidáá', Tł'ée'yigáahii, Tsé dídééh, Tsé dídééh tsoħ		F, M, U	M, R
<i>Nicotiana attenuata</i>	Tobacco		Piiva, Hopiviva	R	R, M
<i>Oenothera caespitosa</i>	Tufted evening primrose	Tł'ée'ii gahí, 'Azee'litsoi, 'Azee'łabáhi, Tł'ée'yigáahii tsoħ		M, R	
<i>Oenothera pallida</i>	Evening primrose		Políisi, Leemansi		R, M
<i>Oenothera spp.</i>	Evening primrose	Tł'ée'yigáahii tsoħ, 'Azee'łaatilt'ihíh		M	M

Table F- 2 Culturally Important Native Plants of the Hopi and Navajo

Scientific Name	Common Name	Navajo Name	Hopi Name	Navajo Uses ¹	Hopi Uses ¹
<i>Oxytropis lambertii</i>	Lambert locoweed	Dibé'nát'oh, Dibe'haich'iidii, tádídíín dootl'izh nitsáá gíí	sita'ngwi	R, M, U	
<i>Pectis angustifolia</i>	Lemonscent		Tu'itsma		M, F
<i>Penstemon barbatus</i>	Scarlet bugler		pala'kasti	F	
<i>Petalostemon oligophyllum</i>	White prairie clover		Tawasi		R, M
<i>Phacelia crenulata</i> var. <i>ambigua</i>	Purplestem phacelia	'Azee'nichii'ii	Wiítsorosi, Wi'tsorosi	U	M
<i>Plantago patagonica</i>	Woolly plantain	'Azec'it'it, Yiitjih, Ts'aa'xalts'aa'	Hahai'nga	F	
<i>Plantago</i> sp.	Plantain		Hahay'inga, Tsukunga	M	M
<i>Portulaca oleracea</i>	Purslane		Pihala	F, M	F
<i>Rumex crispus</i>	Curly dock			M, R	
<i>Rumex hymenosepalus</i>	Wild rhubarb			F, U	
<i>Senecio flaccidus</i>	Groundsel, threadleaf ragwort	'Azee'hááldzidi	Masi'muyi'tka	M	M
<i>Senecio spartioides</i> (= <i>S. multicapitatus</i>)	Groundsel		Muyi'tka		U
<i>Senecio</i> spp.				M	
<i>Solanum</i> sp.	Wild potato		Tumna, Aatsivosi, Kawayngahu		R, M, F
<i>Salsola iberica</i>	Russian thistle		Koti, Kuuta, Pahanatuusaqa		F
<i>Sphaeralcea coccinea</i>	Scarlet globemallow	'Azéé'hókánii		M	
<i>Sphaeralcea</i> spp., <i>Sphaeralcea groossulariaefolia</i>	Globemallow		Kopona, Leetofmansi, Yaqaspi	M, R	R, M, F
<i>Stanleya pinnata</i>	Desert prince's plume	'Azee'haagái, Tshetc'oc'azee', Ts'ahbììh, 'Azéé'ta'iitsóhii, Tsé'éya hataaí	Kwiivi	F, M	R, F, M
<i>Symphotrichum ericoides</i> , <i>Aster ericoides</i>	White health aster		To:tim, Ho'n'ngapi		M
<i>Symphotrichum</i> spp. (= <i>Aster</i> spp.)	Aster	Atsá halchinii		R	
<i>Thelesperma megapotamicum</i>	Indian tea			F, M	F, M, U
Grasses					
<i>Agropyron smithii</i>	Western wheatgrass			M	
<i>Aristida</i> sp.	Three-awn		Hahhay'I qalmongwa		U

Table F- 2 Culturally Important Native Plants of the Hopi and Navajo

Scientific Name	Common Name	Navajo Name	Hopi Name	Navajo Uses ¹	Hopi Uses ¹
<i>Bouteloua barbata</i>	Six-weeks grama grass		Harus'hö, Puvùwpi		F
<i>Bouteloua gracilis</i>	Blue grama	tł'oh nástasí	haru shu	M, R	U
<i>Bromus tectorum</i>	Cheatgrass	ghe'iats'osii		U, R	
<i>Equisetum hiemale</i>	Scouring rush		Mumuri, Mururu, Paasölöli, Pona	M	R, M, F, U
<i>Juncus sp.</i>	Bulrush		Pas'hö	M	R, M, F
<i>Hilaria jamesii</i>	Galleta grass		Söhö		U
<i>Muhlenbergia asperifolia</i>	Scratchgrass		Tsa'tsakw'wuusi, Wuusi, Wu'si		R, M, F
<i>Muhlenbergia pungens,</i>	Sand muhly		Wuusi		R, F, U
<i>Munroa squarrosa</i>	False buffalo grass	tł'oh shoh dak'áá nii	kwai'pz'hz	R, F	
<i>Oryzopsis hymenoides</i>	Indian ricegrass	ntititih	Leehu, Letski	F	R, F, U
<i>Phragmites australis</i>	Reed		Paaqavi	M, U	R, M, U
<i>Pleuraphis jamesii (Hilaria jamesii)</i>	Galleta grass	tł'oh fichíí, tł'ohtshá híh	sz hz	M, U, F	U
<i>Sporobolus airoides</i>	Alkali sacaton	tł'oh tsahii, tł'ohtsózhitso	Nöönö		F, U
<i>Sporobolus contractus</i>	Spike dropseed		Mokiwkwaakwi, Kwaakwi		R, F
<i>Sporobolus cryptandrus</i>	Sand dropseed	tł'ohts'óozih	Mokiwkwaakwi, Mokiwkawki	F	R, F
<i>Sporobolus giganteus</i>	Giant dropseed		Kwaakwi, Kwawki, Kwaawi		R, F
<i>Sporobolus sp.</i>	Dropseed		Kwaakwi, Kwawki, Kwaawi		R, U
<i>Stipa comata</i>	Needle and thread grass	tł'ohdef'chíní	Hooki	U	R
<i>Stipa speciosa</i>			Hooki		U
<i>Typha angustifolia</i>	Narrow leaf cattail		Wipho, Wifho		R, M, F, U
<i>Xanthium strumarium</i>	Cocklebur		Paatsotso, Paatso		R, F, U

SOURCES: Begay 1979; Dunmire and Tierney 1997; Lomaomvaya, Ferguson, and Yeatts 2001; Mayes and Lacy 1989; Rainey and Adams 2004

NOTES: ¹Uses: F= Food, M= Medicinal, R= Ritual, U= Other uses.

Table F-3 Endangered, Threatened, and Other Special Status Plant Species Potentially Present along the Coal-Slurry Pipeline: Existing Route and Realignment

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignment
Federally Listed Plant Species				
Fickeisen plains cactus (<i>Pediocactus peeblesianus</i> var. <i>fickeiseniae</i>)	C, BLM, USFS, NESL3, HS, S1, S2	Exposed layers of Kaibab limestone on canyon margins or hills of Navajoan desert at elevations ranging between 4,000 and 5,000 feet.	Likely	Likely
Welsh's milkweed (<i>Asclepias welshii</i>)	LT, NESL3, HS, S1	Active sand dunes from Navajo sandstone in sagebrush, juniper, and ponderosa pine.	Potential	Potential
Other Special Status Plant Species				
Arizona bugbane (<i>Cimicifuga arizonica</i>)	USFS, HS, S2	Canyons and lower canyon slopes in association with Douglas fir, white fir, maple, and sometimes aspen. Some populations are found on mountain seeps and springs, in drainages, and on shaded north slopes. Grows in moist, loamy soil of ecotones between coniferous forest and riparian habitat. Elevations ranging from 4,700 to 8,800 feet. Range includes the Kaibab National Forest, tributaries to Oak and West Clear Creeks, Workman Creek, and Cold Springs Canyon.	No	No
Beath milkvetch (<i>Astragalus beathii</i>)	NESL4, S2	Great Basin desertscrub in dry washes and disturbed sites at elevations ranging from 4,380 to 5,481 feet.	Potential	Potential
Cameron water-parsley (<i>Cymopterus megacephalus</i>)	USFS, S3	Found in Great Basin desertscrub and desert grassland from elevations ranging from 4,440 to 5,170 feet. McDougall (1973) reports elevation ranges from 4,500 to 7,000 feet. In Yavapai County, collected on Canotia hillsides with limey soils. It is endemic to northern Arizona from eastern Coconino County, north and south of Cameron, and north of Gray Mountain, northeast of Flagstaff.	No (for Forest Service land)	No (for Forest Service land)
Parish's alkali grass (<i>Puccinellia parishii</i>)	NESL4, HS, S2	Alkaline seeps, springs, and seasonally wet areas such as washes.	Potential	Potential
Peeble's blue-star (<i>Amsonia peeblesii</i>)	NESL4, S3	Plains grassland, Great Basin shrub-grassland, and Great Basin desertscrub communities. Substrate types range from strongly alkaline sedimentary conglomerates to volcanic cinders at elevations ranging from 4,000 to 5,600 feet.	Likely	Likely
Round dunebroom/ roundleaf errazurizia (<i>Errazurizia rotundata</i>)	NESL4, BLM, SR, S2	Known from several types of outcrops ranging from sandy soils in sandstone, gravelly soils in calcareous outcrops, to deep, alluvial cinders in sandstone breaks. Generally in exposed habitats in the semi-arid environment of the Great Basin desertscrub. On the Navajo Reservation, populations are known from sandy pockets between outcroppings of Moenave Sandstone at elevations ranging from 4,800 to 5,200 feet.	Potential	Potential

Table F-3 Endangered, Threatened, and Other Special Status Plant Species Potentially Present along the Coal-Slurry Pipeline: Existing Route and Realignment

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignment
Tusayan rabbitbrush (<i>Chrysothamnus molestus</i>)	USFS, S3	Prefers a limestone-derived soil substrate in piñon/juniper woodland and associated grassland and shrubland, generally above 5,500-foot elevation. Species confined to 21 remaining populations on the Coconino Plateau of northern Arizona.	Present	Present
Two-color beardtongue (<i>Penstemon bicolor</i> spp. <i>roseus</i>)	BLM, SR, S2	Occurs in Black Mountains, in dry washes and mountainside sites in volcanic hills in the Mohave Desert.	Potential	Potential
Chalk liveforever (<i>Dudleya pulverulenta</i> spp. <i>arizonica</i>)	Vulnerable (Nevada Heritage Program)	Dry, granitic, or limestone outcrops, rock crevices and desert slopes with <i>Mammillaria</i> and creosotebush (Kartesz 1988).	Potential	Potential

SOURCES: Arizona Game and Fish Department 2001-2005 (species accounts); Arizona Rare Plant Committee 1994; Bureau of Land Management 1993; Center for Plant Conservation 2005; Detsoi 2005; Kartesz 1988; Miskow 2005; Navajo Natural Heritage Program 2005

NOTES: Status: LT = Listed as threatened; C = Candidate; BLM = BLM sensitive; USFS = Forest Service sensitive; NESL3 = Species likely to become endangered on the Navajo Reservation; NESL4 = No significant information on the Navajo Reservation; S1 = Very rare Arizona Natural Heritage Program state rank); S2 = Rare; S3 = Uncommon or restricted; HS = Highly safeguarded under the Arizona Native Plant Act; SR = Salvage restricted under the Arizona Native Plant Act.

Potential for Occurrence:

Present = Known occurrence

Likely = Suitable habitat present, not documented but likely to occur; or known to occur within 1 mile

Potential = Potentially present based on general habitat and range

No = No suitable habitat and/or outside known range

Table F-4 Endangered, Threatened, and Other Special Status Plant Species Potentially Present in the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas

Species	Status ¹	Habitat	Potential for Occurrence ²				
			C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Federally Listed Plant Species							
Welsh's milkweed (<i>Asclepias welshii</i>)	LT, NESL3, HS, S1	Active sand dunes from Navajo sandstone in sagebrush, juniper, and ponderosa pine, 4,700-6,250-foot elevation.	Not applicable.	No	No	Potential	Not applicable.
Peebles Navajo cactus (<i>Pediocactus peeblesianus</i> var. <i>peeblesianus</i>)	LE, HS, S1	Gravelly soils of the Shinarump conglomerate of the Chinle Formation.	Not applicable.	No	No	No	Not applicable.
Navajo sedge (<i>Carex specuicola</i>)	LT, NESL3, HS, S2	Silty soils at shady seeps and springs at elevations ranging between 5,700 and 6,000 feet. Designated critical habitat is on the Navajo Reservation near Inscription House Ruins. Found at seep springs on vertical cliffs of pink-red Navajo sandstone.	No	No	No	No	Potential
Other Special Status Plant Species							
Parish's alkali grass (<i>Puccinellia parishii</i>)	NESL4, HS, S2	Alkaline seeps, springs, and seasonally wet areas such as washes. Restricted to alkaline or salty moist soils with a white crust. A geographically widespread but rare plant.	Potential	No	Potential	Potential	Potential
Round dunebroom/roundleaf errazurizia (<i>Erazzurizia rotundata</i>)	NESL4, BLM, SR, S2	Known from several types of outcrops ranging from sandy soils in sandstone, gravelly soils in calcareous outcrops, to deep, alluvial cinders in sandstone breaks. Generally in exposed habitats in the semiarid environment of the Great Basin deserts scrub. On the Navajo Reservation, populations are known from sandy pockets between outcroppings of Moenave Sandstone at elevations ranging from 4,800 to 5,200 feet.	Not applicable.	No	Potential	Potential	Not applicable.

SOURCES: Arizona Game and Fish Department 2001-2005 (species accounts); Arizona Rare Plant Committee 1994; Center for Plant Conservation 2005; Detsoi 2005; Miskow 2005; Navajo Natural Heritage Program 2005

NOTES: ¹Status: LE = Listed as endangered; LT = Listed as threatened; BLM = BLM sensitive; NESL3 = Species likely to become endangered on the Navajo Reservation; NESL4 = No significant information on the Navajo Reservation; HS = Highly safeguarded under the Arizona Native Plant Act; S1 = Very rare (Arizona Natural Heritage Program State rank); S2 = Rare; SR = Salvage restricted under the Arizona Native Plant Act.

²Potential for Occurrence:

Potential = Potentially present based on general habitat and range

No = No suitable habitat and/or outside known range

Table F-5 Common Bird Species Present at the Black Mesa Complex

	Piñon/Juniper Woodland	Sagebrush/Mixed Shrub	Riparian (Moenkopi Wash)
Species	Bewick's wren (<i>Thryomanes bewickii</i>)	Sage sparrow (sagebrush) (<i>Amphispiza belli</i>)	Rock wren (<i>Salpinctes obsoletus</i>)
	Plain titmouse (<i>Parus inornatus</i>)	Horned lark (sagebrush) (<i>Eremophila alpestris</i>)	White-crowned sparrow (<i>Zonotrichia leucophrys</i>)
	Mountain chickadee (<i>Parus gambeli</i>)	Brewer's sparrow (sagebrush and greasewood) (<i>Spizella breweri</i>)	Dark-eyed junco (<i>Junco hyemalis</i>)
	Black-throated gray warbler (<i>Dendroica nigrescens</i>)	Rock wren (greasewood) (<i>Salpinctes obsoletus</i>)	House finch (<i>Carpodacus mexicanus</i>)
	Gray flycatcher (<i>Empidonax wrightii</i>)	Say's phoebe (greasewood) (<i>Sayornis saya</i>)	Northern mockingbird (<i>Mimus polyglottos</i>)
	Ash-throated flycatcher (<i>Myiarchus cinerascens</i>)	Black-throated sparrow (greasewood) (<i>Amphispiza bilineata</i>)	Killdeer (<i>Charadrius vociferous</i>)
	Piñon jay (<i>Gymnorhinus cyanocephalus</i>)	House finch (greasewood) (<i>Carpodacus mexicanus</i>)	Various warblers
	White-breasted nuthatch (<i>Sitta carolinensis</i>)		

SOURCES: BIOME Ecological and Wildlife Research 2003; Peabody Western Coal Company 2004

Table F-6 Occurrence of Federally Listed Threatened or Endangered Animal Species at the Black Mesa Complex

Species	Status	Habitat	Black Mesa Complex
Birds			
Bald eagle (<i>Haliaeetus leucocephalus</i>)	LT, USFS, WSC, S2,S3B, S4N	Large trees in forests, river bottoms, or near canyon rims, usually within a few miles of ponds, lakes, and rivers with adequate prey. In Arizona, perch in large riparian trees, pines, or on cliffs.	Occasional during migration or winter.
California condor (<i>Gymnogyps californianus</i>)	LE, WSC, SX, S1	High desert canyonlands and plateaus at various elevations. Nesting sites are in various rock formations, including caves, crevices, and potholes in isolated regions. Flights follow route over foothills and mountains. Roosting is usually on rock cliffs, snags, or in live conifer stands.	May occur occasionally during foraging; nesting is 50 or more miles away.
Mexican spotted owl (<i>Strix occidentalis lucida</i>)	LT, USFS, NESL3, WSC, S3, S4	Occurs in varied habitat, consisting of mature montane forest and woodland, shady wood canyons, and steep canyons. They also can be found in mixed conifer and pine-oak vegetation types at elevations from 4,100 to 9,000 feet.	Potential occurrence during foraging at north end of complex. Nesting occurs about 2 miles north of leasehold; no observations or nesting habitat in mine leasehold area.
Southwestern willow flycatcher (<i>Empidonax trailli extimus</i>)	LE, USFS, NESL2, WSC, S1	Cottonwood/willow and tamarisk vegetation communities along rivers and streams at elevations below 8,500 feet.	Occasional during migration in tamarisk scrub.
Mammals			
Black-footed ferret (<i>Mustela nigripes</i>)	LE, USFS, NESL2, WSC, S1	Grassland plains generally found in association with prairie dogs.	Not present; potentially suitable habitat.

SOURCES: Arizona Game and Fish Department 2001-2005 (species abstracts); Arizona Partners in Amphibian and Reptile Conservation 2005; BIOME Ecological and Wildlife Research 2004; Corman and Wise-Gervais 2005; Detsoi 2005; Hoffmeister 1986; Miskow 2005; Navajo Fish and Wildlife Department 2005; Peabody Western Coal Company 2004

NOTES:

Status: LE = Listed as endangered by U.S. Fish and Wildlife Service; LT = Listed as threatened by U.S. Fish and Wildlife Service; USFS = Forest Service sensitive; NESL2 = Endangered on the Navajo Reservation; NESL3 = Threatened on the Navajo Reservation; WSC = Wildlife of special concern in Arizona (Arizona Game and Fish Department); S1 = Very rare (Arizona Natural Heritage Program state rank); S2 = Rare; S3 = Uncommon or restricted; S4 = Apparently secure; SB = State breeding; SN = State nonbreeding.

**Table F-7 Occurrence of Other Special Status
Animal Species at the Black Mesa Complex**

Species	Status	Habitat	Black Mesa Complex
Birds			
Ferruginous hawk (<i>Buteo regalis</i>)	NESL3, WSC, S2B, S4N	Nest in badlands, flat or rolling desert grassland, and desertscrub. Habitat surrounding nest site must support populations of their preferred prey items of cottontails, jackrabbits, prairie dogs, ground squirrels, and gophers.	Occasional; no nesting documented, though suitable nesting habitat is available.
Golden eagle (<i>Aquila chrysaetos</i>)	NESL3	Most habitats including piñon/juniper woodlands, grassland, chaparral, and sagebrush shrubland. Nest on cliffs, tall trees, junipers, and rock outcrops.	Present; observed foraging. No known nests.
Mountain plover (<i>Charadrius montanus</i>)	NESL4, USFS, S1B, S2N	Includes short-grass prairie (vegetation less than 4 inches tall). Dry land, cultivated farms, and prairies dog towns. Habitat-defining characteristics: short vegetation, bare ground, and a flat topography. Breeding birds documented in Apache County. Wintering birds documented in Yuma, Pima, Cochise, Pinal, and Apache Counties.	Potential; southeast portion of complex is suitable habitat. No known nesting populations. Species has not been recorded on Black Mesa.
Northern goshawk (<i>Accipiter gentilis</i>)	NESL4, USFS, WSC, S3	Typically nests in drainages, canyon bottoms, or north-facing forested slopes with ponderosa pine stands (also mixed-species, spruce-fir, and aspen stands) composed of large, mature trees and high canopy closure.	Potentially present in extreme northern part of Black Mesa Complex. Nests in vicinity; no confirmed nesting in Black Mesa Complex. A female was observed approximately 2 miles north of the leasehold in Yellow Water Canyon in 2001.
Peregrine falcon (<i>Falco peregrinus</i>)	NESL4, USFS, WSC, S4	Nests on steep cliffs in a scrape on sheltered ledges or potholes. Foraging habitat quality is important factor; often, but not always, extensive wetland and/or forest habitat is within the falcon's hunting range of 30 to 60 miles. Found at elevations between 3,500 and 9,000 feet.	Occasional; during foraging.
Western burrowing owl (<i>Athene cunicularia hypugaea</i>)	BLM, S3, NESL4	In Arizona, Great Basin shrubsteppe, Chihuahuan desertscrub, Mohave desertscrub, annual grassland; open well-drained areas, often associated with burrowing mammals, 650 to 6,600 feet.	Potential; no nesting records or observations; potentially suitable habitat in prairie dog towns.
Mammals			
Navajo mountain Mexican vole (<i>Microtus mexicanus navaho</i>)	NESL4, USFS, WSC, S1	Sagebrush, drainage bottoms with tamarisk	Present.
Pale Townsend's big-eared bat (<i>Plecotus townsendii pallescens</i> / <i>Corynorhinus t.p.</i>)	NESL4, S3, S4	Desertscrub, oak woodland, oak/pine, piñon/juniper, and coniferous forests, 550 to 7,520 feet, primarily 3,000 to 7,520 feet.	Likely present.
Pronghorn (<i>Antilocapra americana</i>)	NESL3	Found in grassland or desertscrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees like juniper and sagebrush.	Not present; no observations on leasehold.
Spotted bat (<i>Euderma maculatum</i>)	BLM, WSC, S1, S2	Found from low desert in southwestern Arizona to high desert and riparian habitats in northwestern Arizona and Utah, and coniferous forests in northern Arizona.	Potentially present.

**Table F-7 Occurrence of Other Special Status
Animal Species at the Black Mesa Complex**

Species	Status	Habitat	Black Mesa Complex
Kit fox (<i>Vulpes macrotis</i>)	NESL4	Desertscrub and desert grassland	Not likely to be present.
Reptiles and Amphibians			
Milk snake (<i>Lampropeltis triangulum</i>)	NESL4	Occurs primarily in plains grassland habitat in Arizona, and with snakeweed and rabbitbrush.	Potentially present; suitable habitat present.
Northern leopard frog (<i>Rana pipiens</i>)	NESL2, USFS, WSC, S2	Grassland, brushland, woodland, and forest; usually in permanent waters with rooted aquatic vegetation. Also ponds, canals, marshes, springs, and streams, 4,500 to 10,000 feet.	Unlikely; no documented occurrences; potentially suitable habitat exists at the water impoundments.

SOURCES: Arizona Game and Fish Department 2001-2005 (species abstracts); Arizona Partners in Amphibian and Reptile Conservation 2005; BIOME Ecological and Wildlife Research 2004; Corman and Wise-Gervais 2005; Detsoi 2005; Hoffmeister 1986; Miskow 2005; Navajo Fish and Wildlife Department 2005; Peabody Western Coal Company 2004

NOTES:

Status: BLM = BLM sensitive; USFS = Forest Service sensitive; NESL2 = Endangered on the Navajo Reservation ; NESL3 = Threatened on the Navajo Reservation; NESL4 = Any species or subspecies for which the Navajo Fish and Wildlife Division does not currently have sufficient information to support their listing as G2 or G3 but has reason to consider them. The Navajo Fish and Wildlife Division is actively seeking information to determine if they warrant inclusion in a different group or removal from the list. They are not protected under tribal code but should be considered in project planning.
WSC = Wildlife of special concern in Arizona (Arizona Game and Fish Department); S1 = Very rare (Arizona Natural Heritage Program state rank); S2 = Rare; S3 = Uncommon or restricted; S4 = Apparently secure; SB = State breeding; SN = State nonbreeding.

**Table F-8 Occurrence of Federally Listed Threatened or Endangered
Animal Species along the Coal-Slurry Pipeline: Existing Route and Realignment**

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Alignment Realignments
Birds				
Bald eagle (<i>Haliaeetus leucocephalus</i>)	LT, USFS, WSC, S2,S3B, S4N	Large trees in forests, river bottoms, or near canyon rims, usually within a few miles of ponds, lakes, and rivers with adequate prey. In Arizona, perch in large riparian trees, pines, or on cliffs.	Occasional during migration or winter.	Occasional during migration or winter.
California brown pelican (<i>Pelecanus occidentalis californicus</i>)	LE, USFS, S1N	Coastal areas, with nesting occurring on islands. Species found occasionally along Arizona's lakes and rivers.	Occasional along Colorado River.	Occasional along Colorado River.
California condor (<i>Gymnogyps californianus</i>)	LE, WSC, SX, S1	High desert canyonlands and plateaus at various elevations. Nesting sites are in various rock formations, including caves, crevices, and potholes in isolated regions. Flights follow route over foothills and mountains. Roosting is usually on rock cliffs, snags, or in live conifer stands.	May occur occasionally during foraging; nesting is 50 or more miles away.	May occur occasionally during foraging; nesting is 50 or more miles away.
Mexican spotted owl (<i>Strix occidentalis lucida</i>)	LT, USFS, NESL3, WSC, S3, S4	Occurs in varied habitat, consisting of mature montane forest and woodland, shady wood canyons, and steep canyons. They can also be found in mixed conifer and pine-oak vegetation types at elevations from 4,100 to 9,000 feet.	Not present; no habitat.	Not present; no habitat.
Southwestern willow flycatcher (<i>Empidonax traillii extimus</i>)	LE, USFS, NESL2, WSC, S1	Cottonwood/willow and tamarisk vegetation communities along rivers and streams at elevations below 8,500 feet.	Occasionally or regularly present during migration in tamarisk scrub along Moenkopi Wash and at crossing of Little Colorado River.	Occasionally or regularly present during migration in tamarisk scrub along Moenkopi Wash and at crossing of Little Colorado River.
Mammals				
Black-footed ferret (<i>Mustela nigripes</i>)	LE, USFS, NESL2, WSC, S1	Grassland plains generally found in association with prairies dogs at elevations below 10, 500 feet.	Unlikely, although alignment is about 1.4 miles from Aubrey Valley reintroduction area near Seligman and much of route is within historic range; suitable habitat is not present along the pipeline alignment.	Same as existing alignment.
Hualapai Mexican vole Microtus mexicanus hualapaiensis	LE WSC S1	Associated with woodland forest types containing grasses and grass-sedge associates. Only known to occur in Hualapai Mountains in Mohave County.	Not present; no habitat on alignment; nearest occupied habitat about 6 miles away.	Not present; no habitat on alignment; nearest occupied habitat about 6 miles away.

**Table F-8 Occurrence of Federally Listed Threatened or Endangered
Animal Species along the Coal-Slurry Pipeline: Existing Route and Realignment**

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Alignment Realignments
Reptiles and Amphibians				
Mohave desert tortoise (<i>Gopherus agassizii</i>) (Mohave population)	LT, WSC, S2	Mohave deserts scrub north and west of the Colorado River at elevations between 500 to 5,100 feet. Habitat ranges from flatlands to rocky slopes and bajadas. Prefers sandy loam to rocky soils in valleys, bajadas, and hills.	Potentially present on Nevada portion of route.	Potentially present on Nevada portion of route.
Fish				
Bonytail chub (<i>Gila elegans</i>)	LE, NESL1, WSC, S1	Warm, swift, turbid mainstream rivers of the Colorado River basin, reservoirs in lower basin.	Present in Colorado River.	Present in Colorado River.
Razorback sucker (<i>Xyrauchen texanus</i>)	LE, NESL2, WSC, S1	Riverine and lacustrine areas, generally not in fast moving water and may use back water.	Present in Colorado River.	Present in Colorado River.

SOURCES: Arizona Game and Fish Department 2001-2005 (species abstracts); Arizona Partners in Amphibian and Reptile Conservation 2005; Corman and Wise-Gervais 2005; Detsoi 2005; Entrix 2002; Hoffmeister 1986; Miskow 2005; Navajo Fish and Wildlife Department 2005

NOTES:

Status: LE = Listed as endangered by U.S. Fish and Wildlife Service; LT = Listed as threatened by U.S. Fish and Wildlife Service; USFS = Forest Service sensitive; NESL1 = No longer occurring on the Navajo Reservation (Navajo Endangered Species List); NESL2 = Endangered on the Navajo Reservation; NESL3 = Threatened on the Navajo Reservation; WSC = Wildlife of special concern in Arizona (Arizona Game and Fish Department); S1 = Very rare (Arizona Natural Heritage Program state rank); S2 = Rare; S3 = Uncommon or restricted; S4 = Apparently secure; SN = State nonbreeding; SX = State extirpated or extinct.

Table F-9 Other Special Status Species Potentially Occurring Along the Coal-Slurry Pipeline: Existing Route and Realignment

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignments
Birds				
Ferruginous hawk <i>(Buteo regalis)</i>	NESL3, WSC, S2B, S4N	Nest in badlands, flat or rolling desert grassland, and desertscrub. Habitat surrounding nest site must support populations of their preferred prey items of cottontails, jackrabbits, prairie dogs, ground squirrels, and gophers.	Likely nests along alignment; documented nesting north of vicinity of Seligman; suitable nesting habitat is available. Also present in winter.	Likely, same as existing alignment.
Golden eagle <i>(Aquila chrysaetos)</i>	NESL3	Most habitats including piñon/juniper woodland, grassland, chaparral, and sagebrush shrubland. Nest on cliffs, tall trees, junipers, and rock outcrops.	Present; nests documented or likely in suitable habitat along alignment.	Same as existing alignment.
Peregrine falcon <i>(Falco peregrinus)</i>	NESL4, USFS, WSC, S4	Nests on steep cliffs in a scrape on sheltered ledges or potholes. Foraging habitat quality is important factor; often, but not always, extensive wetland and/or forest habitat is within the falcon's hunting range of 30 to 60 miles. Found at elevations between 3,500 to 9,000 feet.	May occur during foraging by nesting or wintering/migrating birds, unlikely nesting.	Same as existing alignment.
Western burrowing owl <i>(Athene cunicularia hypugaea)</i>	BLM, S3, NESL4	In Arizona, Great Basin shrubsteppe, Chihuahuan desertscrub, Mohave desertscrub, annual grassland; open well-drained areas, often associated with burrowing mammals, including ground squirrels, kangaroo rats, and prairie dogs 650 to 6,600 feet.	Potentially present in suitable habitat along much of the alignment. Documented nesting east of Kingman.	Potentially present in suitable habitat along much of the alignment.
Mammals				
Allen's big-eared bat <i>(Idionycteris phyllotis)</i>	BLM, S2, S3	Ponderosa pine, piñon/juniper, Mexican woodland, and riparian areas. Also Mohave desertscrub. 1,320 to 9,800 feet, mostly 3,500 to 7,500 feet.	Reported to occur in Black Mountains and near Kingman. May occur on BLM land in Cerbat Mountains and from Black Mountains west to the Colorado River.	May occur on BLM lands south of Kingman and from the Black Mountains west to the Colorado River.
Arizona myotis <i>(Myotis occultus)</i>	BLM, S3	Known from the Mogollon Rim from Alpine northwest to near Flagstaff. In summer, found in ponderosa pine and oak-pine woodland near water. Also found along permanent water or in riparian forest in some desert areas. Most common at higher elevations (6,000 to 9,200 feet).	Reported to occur in Hualapai Mountains southeast of Kingman. Unlikely to occur on existing alignment.	Same as existing alignment.

Table F-9 Other Special Status Species Potentially Occurring Along the Coal-Slurry Pipeline: Existing Route and Realignment

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignments
Cave myotis (<i>Myotis velifer</i>)	BLM	Sonoran Desert, with creosote, paloverde, brittlebrush, and cacti, but within several miles of a water source.	Reported to occur near Hualapai Mountains. May occur on BLM land from the Black Mountains to the Colorado River.	Reported to occur near Hualapai Mountains. May occur on BLM land south of Kingman and from the Black Mountains to the Colorado River.
Fringed myotis (<i>Myotis thysanodes</i>)	BLM	Occur in habitats ranging from chaparral to ponderosa pine woodland, most common in oak and piñon.	Not likely to occur where alignment crosses BLM land, but likely to occur elsewhere.	May occur on BLM land on eastern part of Kingman re-route.
Greater Western mastiff/bonneted bat (<i>Eumops perotis californicus</i>)	WSC, S1, S2	Mostly Sonoran desertscrub, 420 to 7,520 feet.	Reported to occur in project vicinity in several locations from Milepost 220 to 266.	Same as existing alignment.
Long-legged myotis (<i>Myotis volans</i>)	BLM, S3, S4	Coniferous trees or riparian and desert habitats. 6,600 to 10,000 feet. Typically occurs in forested mountains, including areas of piñon and juniper.	Reported to occur in Hualapai Mountains. May occur elsewhere in piñon/juniper woodland habitat on existing alignment, but there is no suitable habitat on BLM land along the alignment.	Reported to occur near east end of Kingman re-route, where suitable habitat may be present on BLM land. May occur elsewhere in piñon/juniper woodland habitat on existing alignment, on non-BLM land.
Pale Townsend's big-eared bat (<i>Plecotus townsendii pallascens/ Corynorhinus t.p.</i>)	NESL4, S3, S4	Desertscrub, oak woodland, oak-pine, piñon/juniper, and coniferous forests. Roosts in abandoned mines, 550 to 7,520 feet; primarily 3,000 to 7,520 feet.	Reported to occur within 3 miles in Kingman area and near Black Mountains. Potentially present elsewhere in piñon/juniper and desertscrub habitat.	Same as existing alignment.
Pocketed free-tail bat (<i>Nyctinomops femorosaccus</i>)	BLM, S2, S3	Arid lowlands, usually around high cliffs and rugged outcrops. 190 to 7,520 feet.	Reported to occur in Hualapai Mountains southeast of Kingman. May occur on existing alignment in and near Cerbat and Black Mountains.	Reported to occur in Hualapai Mountains near east end of Kingman re-route. May also occur in and near Black Mountains.
Pronghorn (<i>Antilocapra americana</i>)	NESL3	Found in grassland or desertscrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees such as juniper and sagebrush.	Likely to occur west of Cameron on Navajo Reservation. Also occurs in grasslands west of where it is not special status.	Same as existing alignment.
Spotted bat (<i>Euderma maculatum</i>)	WSC, S1, S2	Found from low desert in southwestern Arizona to high desert and riparian habitats in northwestern Arizona and Utah, and coniferous forests in northern Arizona.	Potentially present in suitable habitat.	Potentially present in suitable habitat.

Table F-9 Other Special Status Species Potentially Occurring Along the Coal-Slurry Pipeline: Existing Route and Realignment

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignments
Western small-footed myotis (<i>Myotis ciliolabrum</i>)	BLM, S3	Deserts, oaks, chaparral and riparian areas. Winters in central Mohave County, 4,360 to 8,670 feet.	Reported to be present in Hualapai Mountains near Kingman. Potentially present in area west of Kingman.	Similar to existing alignment; may occur along Kingman re-route and west of Kingman.
Wupatki Arizona pocket mouse (<i>Perognathus amplus cineris</i>)	USFS, S3	Cacti, creosotebush, rabbitbrush, paloverde, mesquite, greasewood and sometimes juniper. Subspecies limited to area from Echo Cliffs to Wupatki National Monument, 3,900 to 5,420 feet (AGFD 2004).	Potentially present near Little Colorado River and Cameron (AGFD 2004).	Same as existing alignment.
Kit fox (<i>Vulpes macrotis</i>)	NESL4	Desertscrub and desert grassland.	Potentially present on much of the alignment on the Navajo Reservation. Likely to be present on western portion of alignment, where it is not special status.	Same as existing alignment.
Amphibians and Reptiles				
Banded Gila monster (<i>Heloderma suspectum</i>)	BLM, S4	In Arizona, primarily Sonoran Desert and extreme western edge of Mohave Desert. Also desert grassland and rarely oak woodland. Undulating rocky foothills, bajadas, and canyons. Less often open sandy plains. To 4,100 feet.	Present; suitable habitat from about Milepost 237 west to Bullhead City.	Present, suitable habitat from about Milepost 230 west to Bullhead City.
Common chuckwalla (<i>Sauromalus ater</i>)	NESL4, BLM, S4	Desertscrub, grassland, piñon/juniper, and coniferous forests. Predominantly found near cliffs, boulders or rocky slopes where they use rocks as basking site and rock crevices for shelter. In Arizona, found in western part of state, including canyons of the Colorado River in northern Arizona. Range in Navajo land not well know.	High potential of occurrence through the Black Mountains.	High potential of occurrence along the Kingman area reroute (wherever boulders are present).
Milk snake (<i>Lampropeltis triangulum</i>)	NESL4	Occurs primarily in plains grassland habitat in Arizona, and with snakeweed and rabbitbrush.	There are records of occurrence near Seligman (AGFD 2003b). May occur in grassland and desertscrub elsewhere on alignment.	Same as existing alignment.
Sonoran desert tortoise (<i>Gopherus agassizii</i>) (Sonoran population)	WSC, S4	(Sonoran population, which includes part of Mohave Desert.) Sonoran and Mohave desertscrub, juniper woodland, and desert grassland, especially paloverde-mixed cacti associations. 510 to 1,615 feet.	Present; Mileposts 238-243 near Kingman and 256-270 from the Black Mountains to Bullhead City are in Category III Tortoise Habitat (BLM 1993).	Present; Mileposts 230-241 southeast of Kingman Milepost 257-271 on preferred alignment are in Category III Tortoise Habitat (BLM 1993).

Table F-9 Other Special Status Species Potentially Occurring Along the Coal-Slurry Pipeline: Existing Route and Realignment

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignment
Northern leopard frog (<i>Rana pipiens</i>)	NESL2, USFS, WSC, S2	Grassland, brushland, woodland, and forest; usually in permanent waters with rooted aquatic vegetation. Also ponds, canals, marshes, springs, and streams. 4,500 to 10,000 feet.	Documented occurrence near Cameron and Little Colorado River (AGFD 2002c). May occur in limited areas along other portions of the alignment.	Same as existing alignment.
Fish				
Flannelmouth sucker (<i>Catostomus latipinnis</i>)	USFS, S2	Primarily large and moderately large rivers. Larvae inhabit shallow, slow flowing near shore areas. 1,540 to 3,160 feet.	Present in Colorado River.	Same as existing alignment.
Invertebrates				
Maricopa tiger beetle (<i>Cinindela oregona maricopa</i>)	BLM, USFS, S3	Central highlands below Mogollon Rim. Sandy streambanks or gravels and clays along streambanks. Also seeps and reservoirs. 1,092 to 6,940 feet.	Potentially present; documented occurrence south of alignment near U.S. 40, east of Kingman (AGFD 2001c).	Same as existing alignment.
Navajo Jerusalem cricket (<i>Stenopelmatus navajo</i>)	BLM, USFS	Sand dunes and sandy washes, in Great Basin desertscrub with greasewood and Mormon tea. Occurs from Moenkopi to Petrified Forest National Park (AGFD 2003d).	May occur along alignment from Moenkopi to Cameron.	Same as existing alignment.

SOURCES: Arizona Game and Fish Department 2001-2005 (species abstracts); Arizona Partners in Amphibian and Reptile Conservation 2005; Corman and Wise-Gervais 2005; Detsoi 2005; Entrix 2002; Hoffmeister 1986; Miskow 2005; Navajo Fish and Wildlife Department 2005

NOTES:

Status: BLM = BLM sensitive; USFS = Forest Service sensitive; NESL2 = Endangered on the Navajo Reservation; NESL3 = Threatened on the Navajo Reservation; NESL4 = Any species or subspecies for which the Navajo Fish and Wildlife Division does not currently have sufficient information to support their listing as G2 or G3 but has reason to consider them. The Navajo Fish and Wildlife Division is actively seeking information to determine if they warrant inclusion in a different group or removal from the list. They are not protected under tribal code but should be considered in project planning.
 WSC = Wildlife of special concern in Arizona (Arizona Game and Fish Department); S1 = Very rare (Arizona Natural Heritage Program state rank); S2 = Rare; S3 = Uncommon or restricted; S4 = Apparently secure; SB = State breeding; SN = State nonbreeding.

Table F-10 Forest Service Management Indicator Species

Species	Vegetation Characteristic	Applicability to Coal-Slurry Pipeline ^a
Cinnamon teal <i>Anas cyanoptera</i>	Late-seral wetlands	Not applicable.
Lucy's warbler <i>Vermivora luciae</i>	Later-seral, low elevation (less than 7,000 feet riparian)	Not applicable.
(Merriam's) turkey <i>Meleagris gallopavo</i>	Late-seral ponderosa pine	Not applicable.
Plain (juniper) titmouse <i>Baeolophus ridgwayi</i>	Late-seral piñon/juniper, and snags in piñon/juniper	Likely present.
Yellow-breasted chat <i>Icteria virens</i>	Late-seral, low elevation (less than 7,000 feet riparian)	Not applicable.
Aquatic macroinvertebrates (e.g., mayflies, stoneflies, caddisflies)	Riparian	Not applicable.
Elk <i>Cervus elaphus</i>	Early-seral ponderosa pine, mixed conifer, spruce-fir	Not applicable.
Mule deer <i>Odocoileus hemionus</i>	Early-seral aspen and piñon/juniper	Present.
Pronghorn antelope <i>Antilocapra americana</i>	Early and late-seral grassland	Likely present.

SOURCE: Bennetson 2005

NOTE: ^a Habitat present on land administered by the Forest Service in the vicinity of the coal-slurry pipeline.

Table F-11 Common Wildlife Species by Habitat

Habitat	Mammals	Birds	Reptiles and Amphibians
All habitats (except urban)	Mule deer Coyote Gray fox Badger Spotted skunk Bobcat Desert cottontail Rock squirrel Botta's pocket gopher Big brown bat White-throated woodrat	Mourning dove Turkey vulture Red-tailed hawk American kestrel Great horned owl Ash-throated flycatcher Common raven Rock wren Northern mockingbird House finch	
Plains and Great Basin grassland	Pronghorn Black-tailed jackrabbit White-tailed antelope Ground squirrel Gunnison's prairie dog Western harvest mouse Ord's kangaroo rat	Golden eagle Burrowing owl Common nighthawk Say's phoebe Horned lark Vesper sparrow Lark sparrow Western meadowlark	Lesser earless lizard Western terrestrial garter snake Great Plains toad Plains spadefoot
Great Basin desertscrub	Pronghorn Black-tailed jackrabbit desert cottontail White-tailed antelope Ground squirrel Spotted ground squirrel Gunnison's prairie dog Ord's kangaroo rat Western pocket mouse	Common nighthawk Piñon jay Gray flycatcher Say's phoebe Loggerhead shrike Horned lark Lark sparrow Western meadowlark	Sagebrush lizard Leopard lizard Collared lizard Northern side-blotched lizard Whiptails Fence lizards Great basin gopher snake Wandering garter snake Rattlesnakes
Great Basin conifer woodland	Elk Mountain lion Gray fox Porcupine Western harvest mouse Piñon mouse	Golden eagle Cooper's hawk Common poorwill Black-chinned hummingbird Northern flicker Gray flycatcher Cassin's kingbird Gray vireo Plumbeous vireo Western scrub jay Piñon jay Plain titmouse Bushtit Bewick's wren Spotted towhee Chipping sparrow Black-throated Gray warbler Black-headed grosbeak Scott's oriole	Plateau striped whiptail sagebrush lizard

Table F-11 Common Wildlife Species by Habitat

Habitat	Mammals	Birds	Reptiles and Amphibians
Semidesert grassland	Kit fox Black-tailed jack rabbit Harris' antelope ground squirrel Merriam's kangaroo rat Ord's kangaroo rat Cactus mouse	Golden eagle Gamble's quail Roadrunner Burrowing owl Lesser nighthawk Common poorwill Western kingbird Ladder-backed woodpecker Western kingbird Ash-throated flycatcher Say's phoebe Canyon towhee Black-throated sparrow Scott's oriole	Rattlesnakes Great Plains toad Tiger whiptail
Mohave desertscrub	Desert bighorn sheep Kit fox Black-tailed jackrabbit Harris' antelope ground squirrel Round-tailed ground squirrel Merriam's kangaroo rat Desert woodrat Cactus mouse	Gamble's quail Roadrunner Costa's hummingbird Say's phoebe Loggerhead shrike Verdin Curve-billed thrasher Phainopepla Black-throated sparrow	Zebra-tailed lizard Western shovel-nosed snake Tiger whiptail banded gecko Rattlesnakes Eastern collared lizard Long-nosed leopard lizard Chuckwalla Desert tortoise Desert iguana Gila monster California kingsnake Coachwhip
Urban	House mouse Norway rat	Mourning dove House sparrow European starling Rock dove Northern mockingbird House finch Great-tailed grackle	
In or near streams and ponds (intermittent and perennial)	Striped skunk Raccoon	Mallard Killdeer	Great plains toad Red-spotted toad Mexican spadefoot toad Canyon treefrog Western terrestrial garter snake Tiger salamander

SOURCES: Arizona Partners in Amphibian and Reptile Conservation 2005; Brown 1982; Corman and Wise-Gervais 2005; Hoffmeister 1986

**Table F-12 Occurrence of Federally Listed Threatened or Endangered
Animal Species in the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas**

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Birds							
Bald eagle (<i>Haliaeetus leucocephalus</i>)	LT, USFS, WSC, S2, S3B, S4N	Large trees in forests, river bottoms, or near canyon rims, usually within a few miles of ponds, lakes, and rivers with adequate prey. In Arizona, perch in large riparian trees, pines, or on cliffs.	Occasional during migration or winter in riparian areas.	Unlikely, during migration or winter.	Unlikely during migration or winter.	Unlikely during migration or winter.	Occasional during migration or winter in riparian areas.
Mexican spotted owl (<i>Strix occidentalis lucida</i>)	LT, USFS, NESL3, WSC, S3, S4	Occurs in varied habitat, consisting of mature montane forest and woodland, shady wood canyons, and steep canyons. They also can be found in mixed conifer and pine-oak vegetation types at elevations from 4,100 to 9,000 feet.	Not applicable.	Not present; no habitat.	Not present; no suitable habitat.	Potential occurrence; known nesting areas within 1 to 3 miles, Mileposts 103 to 134.	Not applicable.
Southwestern willow flycatcher (<i>Empidonax traillii extimus</i>)	LE, USFS, NESL2, WSC, S1	Cottonwood/willow and tamarisk vegetation communities along rivers and streams at elevations below 8,500 feet.	Likely to occur in riparian habitat along lower Clear Creek, lower Chevelon Creek, and the Little Colorado River; breeding not documented.	Not present; no habitat.	Occasional during migration in tamarisk scrub.	Occasional during migration in tamarisk scrub.	Likely to occur in major washes; breeding not documented.
Mammals							
Black-footed ferret (<i>Mustela nigripes</i>)	LE, USFS, NESL2, WSC, S1	Grassland plains generally found in association with prairies dogs at elevations below 10,500 feet.	Not applicable.	Not present; potentially suitable habitat, in historic range.	Not present; potentially suitable habitat, in historic range.	Not present; potentially suitable habitat, in historic range.	Not applicable.

**Table F-12 Occurrence of Federally Listed Threatened or Endangered
Animal Species in the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas**

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Reptiles and Amphibians							
Chiricahua leopard frog (<i>Rana chiricahuensis</i>)	LT, USFS, WSC, S3	Streams, rivers, backwaters, ponds, and stock tanks that are mostly free from introduced fish, crayfish, and bullfrogs from 3,300 to 8,900 feet in elevation.	Not present, out of range.	Not present, out of range.	Not present; not in known range.	Not present; not in known range.	Not present, out of range.
Fish							
Bonytail chub (<i>Gila elegans</i>)	LE, NESL1, WSC, S1	Warm, swift, turbid mainstream rivers of the Colorado River basin, reservoirs in lower basin.	Not present, out of range.	Not present; not in known range, no suitable habitat.	Not present; no habitat.	Not present; no habitat.	Not present, no suitable habitat.
Gila Chub (<i>Gila intermedia</i>)	PE, USFS, WSC, S2	Pools, springs, cienegas, and streams.	Not present, out of range.	Not present, not in range, no suitable habitat.	Not present; no habitat.	Not present; no habitat.	Not present, no suitable habitat.
Humpback chub (<i>Gila cypha</i>)	LE, NESL2, WSC, S1	Large warm turbid rivers especially canyon areas with deep fast water.	Not present, not in range.	Not present ; not in known range, no suitable habitat.	Not present; no habitat.	Not present; no habitat.	Not present, no suitable habitat.
Little Colorado spinedace (<i>Lepidomeda vittata</i>)	LT, WSC, S1, S2	Moderate to small streams in pools and riffles with water flowing over gravel and silt.	Present in lower Chevelon Creek; potentially present in lower Clear Creek. Not observed since 1960. Could occur occasionally, but not likely to persist.	Not present, no suitable habitat.	Not present; no habitat.	Not present; no habitat.	Not present, no suitable habitat.
Razorback sucker (<i>Xyrauchen texanus</i>)	LE, NESL2, WSC, S1	Riverine and lacustrine areas, generally not in fast-moving water and may use back water.	Not present, not in range.	Not present, no suitable habitat .	Not present; no habitat.	Not present; no habitat.	Not present, no suitable habitat.

**Table F-12 Occurrence of Federally Listed Threatened or Endangered
Animal Species in the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas**

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Invertebrates							
Page springsnail (<i>Pyrgulopsis morrisoni</i>)	C, BLM, USFS, S1	Occur in springs, seeps, marshes, spring pools, outflows, and diverse lotic waters. The most common habitat is a spring emerging from the ground as a free-flowing stream at an elevation around 3,500 feet. Range includes the Upper Verde River drainage of central Arizona. All populations are known within a complex of streams within a 1-mile area along the west side of Oak Creek.	Not present, out of range.	Not present, out of range, no suitable habitat.	Not present; no habitat.	Not present; no habitat.	Not present, out of range.

SOURCES: Arizona Game and Fish Department 2001-2005 (species abstracts); Arizona Partners in Amphibian and Reptile Conservation 2005; BIOME Ecological and Wildlife Research 2004; Corman and Wise-Gervais 2005; Detsoi 2005; Hoffmeister 1986; Miskow 2005; Navajo Fish and Wildlife Department 2005; Peabody Western Coal Company 2004

NOTES:

Status: LE = Listed as endangered by U.S. Fish and Wildlife Service; LT = Listed as threatened by U.S. Fish and Wildlife Service; PE = Proposed as endangered by U.S. Fish and Wildlife Service; C = Candidate for listing by U.S. Fish and Wildlife Service; BLM = BLM sensitive; USFS = Forest Service sensitive; NESL1 = No longer occurring on the Navajo Reservation (Navajo Endangered Species List); NESL2 = Endangered on the Navajo Reservation; NESL3 = Threatened on the Navajo Reservation; WSC = Wildlife of special concern in Arizona (Arizona Game and Fish Department); S1 = Very rare; (Arizona Natural Heritage Program state rank); S2 = Rare; S3 = Uncommon or restricted; S4 = Apparently secure; SB = State breeding; SN = State nonbreeding.

Table F-13 Occurrence of Other Special Status Animal Species within the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Birds							
Ferruginous hawk (<i>Buteo regalis</i>)	NESL3, WSC, S2B, S4N	Nest in badlands, flat or rolling desert grassland, and desertscrub. Habitat surrounding nest site must support populations of their preferred prey items of cottontails, jackrabbits, prairie dogs, ground squirrels, and gophers.	Not applicable.	Wintering range; no known nests.	Wintering range; no known nests.	Wintering range; no known nests.	Not applicable.
Golden eagle (<i>Aquila chrysaetos</i>)	NESL3	Most habitats including piñon/juniper woodlands, grassland, chaparral, and sagebrush shrubland. Nest on cliffs, tall trees, junipers, and rock outcrops.	Not applicable.	Present; nesting reported within 1 mile.	Present; nesting reported within 1 mile.	Present; nesting reported within 1 mile.	Not applicable.
Mountain plover (<i>Charadrius montanus</i>)	NESL4, USFS, S1B, S2N	Includes short-grass prairie (vegetation less than 4 inches tall). Dry land, cultivated farms, and prairies dog towns. Habitat-defining characteristics: short vegetation, bare ground, and a flat topography.	Not applicable.	Not present; not known to occur in project vicinity.	Potentially present from Black Mesa to Little Colorado River.	Potentially present from Black Mesa to Little Colorado River.	Not applicable.
Northern goshawk (<i>Accipiter gentiles</i>)	NESL4, USFS, WSC, S3	Typically nests in drainages, canyon bottoms, or north-facing slopes of ponderosa pine stands (also mixed species, spruce-fir, and aspen) composed of large, mature trees and high canopy closure.	Not applicable.	Not present; no habitat.	Not present; no habitat.	Present within 1 mile on northern part of route by Shonto Plateau and Black Mesa.	Not applicable.

Table F-13 Occurrence of Other Special Status Animal Species within the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Peregrine falcon (<i>Falco peregrinus</i>)	NESL4, USFS, WSC, S4	Nests on steep cliffs in a scrape on sheltered ledges or potholes. Foraging habitat quality is important factor; often, but not always, extensive wetland and/or forest habitat is within the falcon's hunting range of 30 to 60 miles. Found at elevations between 3,500 and 9,000 feet.	Occasional use by foraging birds.	Occasional use by foraging birds.	Occasional use by foraging birds.	Occasional use by foraging birds.	Occasional use by foraging birds.
Western burrowing owl (<i>Athene cunicularia hypugaea</i>)	BLM, S3 NESL4	In Arizona, Great Basin shrubsteppe, Chihuahuan desertscrub, Mohave desertscrub, annual grassland; open, well-drained areas, often associated with burrowing mammals. 650 to 6,600 feet.	Not applicable.	Possible; no recent nesting records.	Likely; nesting records in vicinity of alignment (Corman and Wise-Gervais 2005).	Likely; nesting records in vicinity of alignment.	Not applicable.
Mammals							
Pale Townsend's big-eared bat (<i>Plecotus townsendii pallescens/ Corynorhinus t.p.</i>)	NESL4, S3, S4	Desertscrub, oak woodland, oak/pine, piñon/juniper, and coniferous forests, 5,500 to 7,520 feet, primarily 3,000 to 7,520 feet.	Not applicable.	Potential; generally suitable habitat.	Potential; generally suitable habitat.	Potential; generally suitable habitat.	Not applicable.
Pronghorn (<i>Antilocapra americana</i>)	NESL3	Found in grassland or desertscrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees like juniper and sagebrush.	Not applicable.	Potential.	Potential; may occur in southern portion of alignment.	Potential; may occur in southern portion of alignment.	Not applicable.

Table F-13 Occurrence of Other Special Status Animal Species within the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Kit fox (<i>Vulpes macrotis</i>)	NESL4	Deserts scrub and desert grassland.	Not applicable.	Potentially present.	Potentially present.	Potentially present.	Not applicable.
Reptiles and Amphibians							
Milk snake (<i>Lampropeltis triangulum</i>)	NESL4	Occurs primarily in plains grassland habitat in Arizona, and with snakeweed and rabbitbrush (AGFD 2003b).	Not applicable.	Potentially present.	Potentially present; records of occurrence at southern end of alignment (AGFD 2003b).	Potentially present; records of occurrence at southern end of alignment (AGFD 2003b).	Not applicable.
Northern leopard frog (<i>Rana pipiens</i>)	NESL2, USFS, WSC, S2	Grassland, brushland, woodland, and forest; usually in permanent waters with rooted aquatic vegetation. Also ponds, canals, marshes, springs, and streams, 4,500 to 10,000 feet.	Potentially present.	Unlikely; no suitable habitat in well field.	Unlikely; no record of occurrence.	Unlikely; no record of occurrence.	Potentially present.
Fish							
Bluehead sucker (<i>Catostomus discobolus</i>)	NESL4, USFS, S3	Occurs in a wide variety of areas, from headwater streams to large rivers; prefers riffle areas with rocky substrates.	Present in Clear Creek, Chevelon Creek, and Little Colorado River	Not present, no habitat.	Not present.	Not present.	Not present, no habitat.
Flannelmouth sucker (<i>Catostomus latipinnis</i>)	USFS, S2	Primarily large and moderately large rivers. Larvae inhabit shallow, slow-flowing near shore areas, 1,540 to 3,160 feet.	Not present, out of range.	Not present, no habitat.	Not present.	Not present.	Not present, no habitat.

Table F-13 Occurrence of Other Special Status Animal Species within the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Roundtail chub (<i>Gila robusta</i>)	NESL2, USFS, WSC, S2	Occur in cool- to warm-water, mid-elevation rivers and streams throughout the Colorado River basin, often occupying open areas of the deepest rock pools and eddies of middle-sized to larger streams. They occasionally concentrate in relatively swift, turbulent waters below rapids, moving into less turbulent chutes in small groups.	Present in Clear Creek and Chevelon Creek.	Not present, no habitat.	Not present.	Not present.	Not present, no habitat.
Little Colorado River sucker (<i>Catostomus</i> sp. 3)	BLM, USFS, S2	Endemic to upper portion of Little Colorado River and its north-flowing tributaries; occurs in creeks, small to medium rivers, and impoundments.	Present in Clear Creek, Chevelon Creek, and Little Colorado River.	Not present, no habitat.	Not present.	Not present.	Not present, no habitat.
Invertebrates							
Navajo Jerusalem cricket (<i>Stenopelmatus navajo</i>)	BLM, USFS	Sand dunes and sandy washes in desertscrub.	Not applicable.	Unlikely	Potential; sandy habitats present.	Potential; sandy habitats may be present.	Not applicable.

SOURCES: Arizona Game and Fish Department 2001-2005 (species abstracts); Arizona Partners in Amphibian and Reptile Conservation 2005; BIOME Ecological and Wildlife Research 2004; Corman and Wise-Gervais 2005; Detsoi 2005; Hoffmeister 1986; Miskow 2005; Navajo Fish and Wildlife Department 2005; Peabody Western Coal Company 2004

NOTES:

Status: BLM = BLM sensitive; USFS = Forest Service sensitive; NESL2 = Endangered on the Navajo Reservation; NESL3 = Threatened on the Navajo Reservation; NESL4 = Any species or subspecies for which the Navajo Fish and Wildlife Division does not currently have sufficient information to support their listing as G2 or G3 but has reason to consider them. The Navajo Fish and Wildlife Division is actively seeking information to determine if they warrant inclusion in a different group or removal from the list. They are not protected under tribal code but should be considered in project planning.
 WSC = Wildlife of special concern in Arizona (Arizona Game and Fish Department); S1 = Very rare; (Arizona Natural Heritage Program state rank); S2 = Rare; S3 = Uncommon or restricted; S4 = Apparently secure; SB = State breeding; SN = State nonbreeding.

APPENDIX G



Appendix G

Land Use

- G-1 Hopi Tribe Grazing
- G-2 Navajo Nation Grazing
- G-3 Grazing on Arizona State Trust Land
- G-4 Grazing on Land Administered by the Forest Service (Kaibab National Forest)
- G-5 Grazing on Land Administered by BLM

Table G-1 Hopi Tribe Grazing

	Range Unit (Number or Name)	Total Acres within Range Unit	Number of Permittees	Total Carrying Capacity for Range Unit (AUs)	Component/ Route: Acreage within Range Unit ¹	Percent within Range Unit ¹
Kayenta Mining Operations (Permanent Permit Area)						
1	263	52,909	6	95	3,041	5.75
Black Mesa Mining Operations (Unpermitted Area)						
1	263	52,909	6	95	3,162	5.98
Coal-Haul Road						
1	263	52,909	6	95	20	< 1
Coal-Slurry Pipeline: Existing Route						
1	263	52,909	6	95	38	< 1
2	254 ²	28,204	NA	NA	NA	NA
3	261	26,830	3	49	17	< 1
4	260	24,473	4	54	5	< 1
5	252	43,658	0 ³	118	17	< 1
6	253	50,687	1	65	79	< 1
7	251	28,828	6	176	44	< 1
Coal-Slurry Pipeline: Eastern Route (Moenkopi Wash Realignment)						
1	263	52,909	6	95	70	< 1
2	261	26,830	3	49	33	< 1
3	260	24,473	4	54	21	< 1
4	253	50,687	1	65	15	< 1
C-Aquifer Water-Supply Pipeline: Eastern Route						
1	263	52,909	6	95	62	< 1
2	262	32,973	6	42	30	< 1
3	351	27,985	6	86	52	< 1
4	North Oraibi	52,430	12	82	80	< 1
5	South Oraibi	31,066	5	94	87	< 1
6	Shonto	37,598	23	131	62	< 1
7	553	35,553	4	90	40	< 1
8	555	35,674	5	36	9	< 1
9	554 ²	30,262	NA	NA	NA	NA
Water-Supply Pipeline: Eastern Route (Kykotsmovi Area Subalternatives)						
1	South Oraibi	31,066	5	94	17	< 1
2	North Oraibi	52,430	12	82	< 1	< 1

SOURCE: Hopi Office of Community Planning & Economic Development 2001

NOTES: Grazing is fee-based on Hopi land.

AU = The Hopi Tribe defines an animal unit as one cow is equal to four sheep.

Approximate acreage along the pipeline alignment was calculated at 65 feet.

¹ Numbers are approximate.

² Grazing is not permitted, based on rough terrain and wilderness designations within the Range Unit.

³ There are currently no grazing permittees using this range unit as of April 2006.

Table G-2 Navajo Nation Grazing

	Range District	Total Acres within Range Unit	Number of Permits	Total Sheep Units Permitted for Range Unit (AUs)	Component/Route: Acreage within Range District¹	Percent within Range District¹
Kayenta Mining Operations (Permanent Permit Area)						
2	4 ²	607,987	83	3,250	13,247	2
3	8 ²	1,472,048	695	30,363	27,403	2
Black Mesa Mining Operations (Unpermitted Area)						
2	2 ²	1,012,872	357	17,144	902	< 1
3	4 ²	607,987	83	3,250	5,904	1
4	8	1,472,048	695	30,363	8,918	1
Coal-Slurry Pipeline: Existing Route						
1	2 ²	1,012,872	357	17,144	5	< 1
2	3 ³	1,518,199	668	40,448	438	< 1
3	4 ²	607,987	83	3,250	54	< 1
Coal-Slurry Pipeline: Existing Route (Moenkopi Wash Realignment)						
1	2	1,012,872	357	17,144		< 1
2	4	1,007,987	83	3,250		< 1
C-Aquifer Water-Supply Pipeline: Eastern Route						
1	4 ²	607,987	83	3,250	147	< 1
2	5 ²	641,237	356	22,280	358	< 1
C-Aquifer Water-Supply Pipeline: Western Route						
1	1 ²	927,292	526	26,466	158	< 1
2	2 ²	1,012,872	357	17,144	147	< 1
3	3 ³	1,518,199	668	40,446	353	< 1
4	4 ²	607,987	83	3,250	15	< 1
5	5 ²	6,941,237	356	22,280	344	< 1
6	8 ²	1,472,048	695	30,363	83	< 1

SOURCE: Bureau of Indian Affairs 2005

NOTES: AU = The Navajo Nation defines an animal unit in sheep units as one cow is equal to four sheep, or one horse or one burro or one mule is equal to five sheep, or one goat is equal to one sheep.
Approximate acreage along the pipeline alignment was calculated at 65 feet.

¹ Numbers are approximate.

² AUs are not permitted within the Navajo Partitioned Land (NPL) in accordance to 25 CFR Part 161; therefore, data indicate permits outside the previously identified NPL boundary. However, grazing is known to occur on NPL land without permit.

³ District includes land owned by the Hopi Tribe; however, Hopi currently do not graze this land.

Table G-3 Grazing on Arizona State Trust Land

	Lease No.	Name	Acres	AUMs	Coal-Slurry Pipeline Route: Acreage within Allotment	Percent within Allotment
Coal-Slurry Pipeline (Existing Route)						
1	12	Aja Sheep Company, Inc.	3,062	571	8	<1
2	252	Babbitt Ranches LLC	81,314	22,060	42	<1
3	124	Blake Cattle Company	31,714	345	74	<1
4	132	Navajo Nation	238,034	35,620	52	<1
5	531	Gross Family Ltd Partnership	977	73	11	1
6	541	Seibert Land Company LLC	86,477	19,402	45	<1
7	624	JM Ranch LLC	10,454	1,567	8	<1
8	894	Michelback Livestock LLC	959	15	7	1
9	1045	Perrin Ranch LLC	15,090	4,169	16	<1
10	1161	Diamond 7 Ranch, LLC	30,867	5,458	39	<1
11	1423	WF Cattle Company	18,659	2,092	24	<1
12	1559	Yavapai 10000 LLC	26,049	3,195	28	<1
13	1641	Rudy Echeverria Et Al	16,631	2,802	24	<1
14	1702	JM Ranch LLC	7,329	1,567	9	<1
15	1703	Manterola Sheep Company	12,165	1,816	33	<1
16	2136	Hafley Family Ltd. Partnership	4,631	1,102	5	<1
17	2672	X-One Ranch, Inc.	48,310	582	16	<1
18	93762	Mike Oden Family Trust	14,478	2,170	22	<1
Coal-Slurry Pipeline (Kingman Reroute)						
1	908	Clay Overson	1,390	156	9	1
2	1423	WF Cattle Company	18,659	2,092	7	<1
3	489	Roger D Rolands	4,688	611	8	<1

SOURCES: Arizona State Land Department GIS data transfer on August 1, 2005; Stephen Williams 2005

NOTES: Numbers are approximate.

AUM = Animal unit month is defined by Arizona State Land Code, Title 37, as one animal unit grazing for one month.

AU = Animal unit is defined by the Arizona State Land Code, Title 37, as one weaned beef animal more than 6 months of age, or one horse, or five goats, or five sheep, or the equivalent (personal communication with Stephen Williams, July 22, 2005).

Grazing is fee-based on State land.

Table G-4 Grazing on Land Administered by the Forest Service (Kaibab National Forest)

	Name	Acres	AUMs	Coal-Slurry Pipeline Route: Acreage within Allotment	Percent within Allotment
Coal-Slurry Pipeline: Existing Route					
1	Smoot Lake	41,133	1,800	14	<1
2	Ebert	5,400	700	25	<1

SOURCES: Forest Service Kaibab National Forest Land Management Plan, as amended 1996; Higgins 2005

NOTES: Numbers are approximate.

AUM = An animal unit month is defined by the Forest Service as the quantity of forage required by one mature cow (1,000 pounds) or the equivalent for 1 month (Forest Service 1996).

Grazing is fee-based on land administered by the Forest Service.

Table G-5 Grazing on Land Administered by BLM

	Allotment	Name	Acres	Forage Availability¹	AUMs²	Coal-Slurry Pipeline Route: Acreage within Allotment	Percent within Allotment
Coal-Slurry Pipeline: Existing Route							
1	0010	Black Mountain	52,904	P/E	1,247 (1,735-suspended)	18.5	<1
2	0068	Thumb Butte	18,050	E	0	84	<1
3	0024	Cook Canyon	4,583	P/E	269	6	<1
4	0074	West Peacock	1,849	P	204	58	3
Coal-Slurry Pipeline: Existing Route (Kingman Reroute)							
1	0010	Black Mountain	52,904	P/E	1,247 (1,735-suspended)	7	<1
2	0047	Hualapai Peak	24,914	P	2,052 (432-suspended)	61	<1
3	0052	Lazy YU	12,852	P/E	941	22	<1
4	0074	West Peacock	1,849	P	204	14	1

SOURCES: Bureau of Land Management 1993 (supplemented with GIS grazing data 1999); Spears 2005

NOTES: Numbers are approximate.

Silver Creek Allotment is located within the Black Mesa Project Study Area near Bullhead City; however, the allotment has been closed.

AUM = An animal unit month is defined by the BLM as the amount of forage necessary for the sustenance of one cow or five sheep for 1 month (Bureau of Land Management 1993).

¹ P/E = Perennial/Ephemeral, P = Perennial only and E = Ephemeral only.

² Suspended animal unit months is defined as when the number of animal unit months an area can produce is reduced due to drought

or other reduction in forage production.

Grazing is fee-based on Bureau of Land Management-administered land.

APPENDIX H



Appendix H
Impact Assessment Methodology:
Water Resources (Hydrology)

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LIST OF ABBREVIATIONS AND ACRONYMS

ADWR	Arizona Department of Water Resources
af/yr	acre-feet per year
C aquifer	Coconino aquifer
cfs	cubic feet per second
CHIA	Cumulative Hydrologic Impact Analysis
D aquifer	Dakota aquifer
EIS	environmental impact statement
GeoTrans	HIS GeoTrans and Waterstore
LOM	life of mine
mg/L	milligrams per liter
N aquifer	Navajo aquifer
NTUA	Navajo Tribal Utility Authority
OSM	Office of Surface Mining Reclamation and Enforcement
Peabody	Peabody Western Coal Company
ppm	parts per million
R aquifer	Redwall aquifer
SSPA	S.S. Papadopulos and Associates
USGS	United States Geological Survey
2-D	two-dimensional
3-D	three-dimensional

Appendix H

Impact Assessment Methodology: Water Resources (Hydrology)

This appendix describes the rationale and impact factors applied to assessing changes to the water resources of the study area due to the proposed actions. Some of the alternatives include several subalternatives with impacts expected to be similar in type, varying only in degree. In order to reduce repetition in the text and improve readability factors, which apply to the analysis of all alternatives and subalternatives, are discussed in this appendix. This includes the definition of key hydrologic impacts and the rationale for assigning impacts. A section also is presented that describes the analytical tools that were available for quantifying impacts, where appropriate and possible.

HYDROLOGIC IMPACTS

Region of Influence

Groundwater

The primary region of influence from groundwater pumping is the area that would be impacted by the projected drawdown caused by that pumping. As a practical matter, the area might reasonably be defined as the area within the 0.1-foot drawdown contour under the maximum pumping scenario, as this is the lower limit of what is assumed to be potentially measurable (water levels are often measured to 0.01 foot; however, this is arguably within the measuring error of most commonly used equipment). Furthermore, ambient water-level fluctuations due to tides, barometric pressure, and temperature changes usually exceed 0.01 foot and even 0.1 foot, making it difficult if not impossible to measure changes relative to ambient conditions. However, the scoping process identified some areas of particular interest to the general public and to Federal and State agencies that lie outside the 0.1-foot drawdown contour. For the Coconino aquifer (C aquifer), these include critical habitat areas near Blue Springs on upper East Clear Creek and in lower Chevelon Creek. Therefore, the region of influence relative to the C-aquifer well field is from Blue Springs on the Little Colorado River near its confluence with the Colorado River on the north to upper East Clear Creek near the Mogollon Rim on the south, and from Flagstaff on the west to past Holbrook on the east (refer to Map 3-5 in Chapter 3).

For the Navajo aquifer (N aquifer), the region of influence includes the confined area of the aquifer and extends to the gages on measured streams and springs located in the unconfined portions of the aquifer. Gaged streamflow data are available for four washes that are supported by N-aquifer discharge— Moenkopi Wash, Laguna Creek, Dinnebito Wash, and Polacca Wash. Measured N-aquifer springs include Moenkopi School, Pasture Canyon, Burro, and the unnamed spring near Dennehotso (U.S. Geological Survey [USGS] 2005a). Location of the washes, springs, and other key features relative to the N-aquifer well field are shown on Map 3-4 (refer to Chapter 3).

Surface Water

The region of influence for surface water is the entire study area since the mines, coal-slurry pipeline, and C aquifer water-supply pipeline all involve construction activities in or near surface-water drainages.

Key Hydrologic Impacts

Based on the scoping process, hydrologic impacts can be summarized under three key types. These include:

- Impacts of drawdown on the aquifer and other water users;
- Diminution of stream and spring flow; and
- Changes in groundwater and surface-water quality.

Impact Levels

In assessing the principal hydrologic impacts it is necessary to assess the severity of an impact. This is accomplished through the assignment of an *impact level* to the identified impact. Impact levels for hydrology are defined below.

- *Major* – Adverse impacts: effects that result in a violation of water-quality standards or that economically, technically, or legally eliminate use of the resource. Beneficial impacts: those that would improve water quality or contribute to or restore water resources capability to the region, such as to greatly increase the potential for human or ecological use.
- *Moderate* – Effects that are outside of the random fluctuations of natural processes but do not cause a significant loss of the use of the resource. Moderate beneficial impacts would simply extend the beneficial use beyond natural variations about the current mean value.
- *Minor* – Changes that would affect the cost or quality but not the use of water or are similar to those caused by random fluctuations in natural processes.
- *Negligible* – Impacts of less magnitude, but still predictable under current technology (e.g., computer models) or measurable under commonly employed monitoring technology.
- *None* – Effects that are not predicted or cannot be measured.

Assignment of the impact levels is based on analysis and professional judgment. In general this study follows the impact evaluation criteria developed for Reclamation's Assessment of Western Navajo and Hopi Water Supply Needs, Alternatives and Impacts (HDR 2003). The analysis and determination of impact levels for each of the key hydrologic impacts are described below. It should be noted that the hydrologic impacts in this section focus on the quantity and quality of surface and ground water available for municipal, irrigation and industrial uses; it is understood, however, that other uses, such as for fish and wildlife are also important. Impacts on these uses have impact values developed separately (see Chapter 4.8)

Impacts of Drawdown on the Aquifer and Other Water Users

The impact of pumping is commonly measured by a projected lowering of the water level in the pumping wells and in wells located within the cone of depression created by the pumping well(s). The lowering of the water level creates five primary effects, as follows:

- Increase the cost of pumping by increasing the lift to get the water to the land surface.
- In unconfined aquifers a reduction in saturated thickness of the aquifer surrounding the well and consequently the transmissivity (ability of the aquifer to transmit water to the well). In severe cases, a well can cease to produce water or “go dry.”
- Lowering of aquifer water levels in the area of perennial streams and springs. Lowered aquifer water levels can result in a diminution of groundwater discharge and/or depletion of stream base flow and spring flow.
- Migration of man-caused or natural poor quality groundwater toward the well field.
- Extensive long-term pumping can increase the potential for subsidence in unconsolidated aquifer systems due to compression of fine-grained layers and, in some limestone aquifers, can foster sinkhole development due to removal of cavity filling material and dissolution of the limestone.

Cost of Pumping

The cost of pumping groundwater is given by the following equation (Campbell and Lehr 1974):

$$Cost / Hour = \frac{(pumping\ rate\ (gpm)) \times (Lift + friction\ (ft)) \times (0.746) \times (power\ (K/kW - hr))}{(3960) \times (pump\ efficiency) \times (motor\ efficiency)}$$

The cost of groundwater pumping in the study area was estimated by applying typical Arizona well values for the following parameters (HDR 2003):

- Power (\$0.07 kilowatt hour)
- Pump efficiency (75 percent)
- Motor efficiency (90 percent)

Wells that tap the confined portion of the N aquifer (where the greatest N-aquifer pumping impacts occur) are generally deep and limited to industrial (e.g., Peabody Western Coal Company [Peabody]) or municipal users. Based on modeling studies, Navajo Tribal Utility Authority (NTUA) Forest Lake Well #1 is projected to experience the greatest drawdown due to mine pumping (GeoTrans 2006). Depth to water in this well in 2001 (latest measurement available) was 1,163 feet below ground surface (USGS 2005b). Assuming the above unit cost factors and the 2003 average pumping rate of 10 acre-feet per year (af/yr), the cost per hour is \$0.4. Converting this to an annual power cost (at 85 percent usage) yields \$2,668 for the NTUA Forest Lake Well #1.

Community wells at Piñon produce more water, supplying about 316 af/yr in 2003 with a lift of 887 feet. Annual cost of power for these wells is estimated to be \$46,152. Wells at Piñon are farther from the mine than Forest Lake and will experience less drawdown and increased lift due to project pumping. For example, under the maximum proposed N-aquifer pumpage (6,000 af/yr), increased lift due to project pumping at Piñon is predicted to be 32.8 feet at the end of 2025 versus 75.8 feet at Forest Lake. This translates into an estimated increase in annual power cost of \$1,665 at Piñon and \$168 at Forest Lake, or a 3.7 and 6.5 percent increase, respectively. Given the higher percentage increase at Forest Lake, this well is used to assess impacts under the various proposed pumping options.

Most of the wells within the region of influence of the C-aquifer well field are stock-watering wells. For wells with electric pumps, an average annual pumping cost can be estimated using the above equation and unit cost factors. Using median values of well-pumping rates (15 gallons per minute) and depth to water,

or lift (240 feet) for wells within 10 miles of the well field, yields a cost per hour of \$0.07; converting this cost to dollars per acre-foot gives \$26. This is between \$78 and \$130 per year based on 3 to 5 af/yr for a stock well (Prosser 2005).

It should be noted that many C aquifer stock-watering wells have windmills and not electric pumps. For these wells, costs do not increase when the water level declines, as long as the decline does not require the pump to be set deeper. The pump setting depth in wells in the area is generally unknown. Assessing the impact of project pumping on these wells relies on available data on the height of the water column in the well (depth of the well minus the static water level) and is evaluated in the same manner as the potential reduction in aquifer saturated thickness, as described in the subsequent subsection, Impacts on Aquifer Thickness (Saturation).

The difference in annual well-pumping costs associated with the N and C aquifer well-field pumping is significant, with annual costs being much greater for N-aquifer municipal users based on higher pumping rates and greater pumping lift. A 10 percent increase in pumping cost at a C aquifer stock-water well is on the order of \$8 to \$10 per year whereas the same percent increase at Forest Lakes NTUA #1 and Piñon is \$267 and \$4,615, respectively. Therefore, different impact levels were established for each aquifer, as given in Table H-1 and Table H-2.

Table H-1 N-Aquifer Impact Levels, Increase in Pumping Cost Criteria

Impact Level	Percent Increase in Pumping cost
Major	>51
Moderate	26-50
Minor	11-25
Negligible	1-10
None	0

Table H-2 C-Aquifer Impact Levels, Increase in Pumping Cost Criteria

Impact Level	Percent Increase in Pumping Cost
Major	>201
Moderate	101-200
Minor	51-100
Negligible	1-50
None	0

Impacts on Aquifer Thickness (Saturation)

When water levels in the area of influence of the well fields are below (or fall below) the top of the aquifer, the aquifer is potentially subject to dewatering over time (so long as aquifer water levels decline). Dewatering reduces the aquifer's saturated thickness (amount of the aquifer that is full of water) and therefore its ability to yield water to wells (transmissivity) in the area of the well field. Theoretically, maximum well yield occurs at 100 percent of the drawdown, or when the water level is at the bottom of the aquifer. Ninety percent of the maximum well yield is obtained at 67 percent of the maximum drawdown (Driscoll 1986). In practice, however, the water level cannot be drawn down to the bottom of the aquifer. In addition, most wells exhibit some well loss (a function of the aquifer, well construction and pumping rate), resulting in the pumping water level inside the well being deeper than the water level in

the aquifer immediately outside the well. A conservative range of between 20 percent (negligible) and 50 percent (major) reduction in aquifer thickness criterion was selected for this study to account for these expected variations from the theoretical.

Within the region of influence, most of the potentially impacted C-aquifer wells are within the unconfined portion of the aquifer (Figure H-1). This is not the case in the N and D aquifers. In these aquifers almost all of the wells that are predicted to experience water-level declines due to project-related pumping are located in the confined portion of the aquifer and are not predicted to have their water levels lowered below the top of the aquifer (Figure H-2). In other words, the aquifer remains fully saturated and no reduction in saturated thickness or transmissivity is predicted for the N and D aquifers.

The criteria shown in Table H-3 are applied to assess the effect of aquifer dewatering on a well's ability to sustain its long-term yield.

Table H-3 Impact Levels, Reduction in Saturated Thickness Criteria

Impact Level	Percent Reduction in Saturated Thickness
Major	>51
Moderate	31-50
Minor	21-30
Negligible	1-20
None	0

Impacts on Stream and Spring Flow

Changes in the annual average flows in streams and springs due to mining activities and withdrawal of groundwater were identified as an issue during project scoping. Impacts on biological resources are discussed in Chapter 4, Sections 4.7 and 4.8 of this Draft Environmental Impact Statement (EIS) and are not addressed here.

The closest significant stream to the C-aquifer well field is Canyon Diablo, which drains approximately 1,200 square miles of watershed south of the Little Colorado River. Canyon Diablo is an ephemeral stream with few uses and it is not expected to be impacted by pumping at the well field due to the fact that groundwater in the well field is more than 200 feet below the bottom of the stream channel.

The nearest C aquifer perennial streams where the groundwater level is at or above the stream channel are upper East Clear Creek, lower Clear Creek, and lower Chevelon Creek, located approximately 41, 26, and 33 miles, respectively, south and southeast of the proposed C-aquifer well field (refer to Map 3-5 in Chapter 3).

The Arizona Department of Water Resources (ADWR) estimates that the average annual outflow of Clear and Chevelon Creeks at their confluence with the Little Colorado River, after all diversions, is 61,860 af/yr and 40,680 af/yr, respectively (ADWR 1994). Historic baseflow (1906-1972) in Chevelon Creek has ranged between 4 and 6 cfs; the gauged data for Clear Creek are less consistent due to up stream diversions (SSPA 2005). In June 2005, the USGS measured base flow at several locations in lower Clear and Chevelon Creeks. Measured base flow near the confluence with the Little Colorado River was 5.4 cubic feet per second (cfs) in Clear Creek and 2.7 cfs in Chevelon Creek. Converting this to af/yr yields 3,903 af/yr for Clear Creek and 1,951 af/yr for Chevelon Creek. Current base flow, as a percent of depleted average annual outflow, is approximately 5 to 6 percent for both creeks.

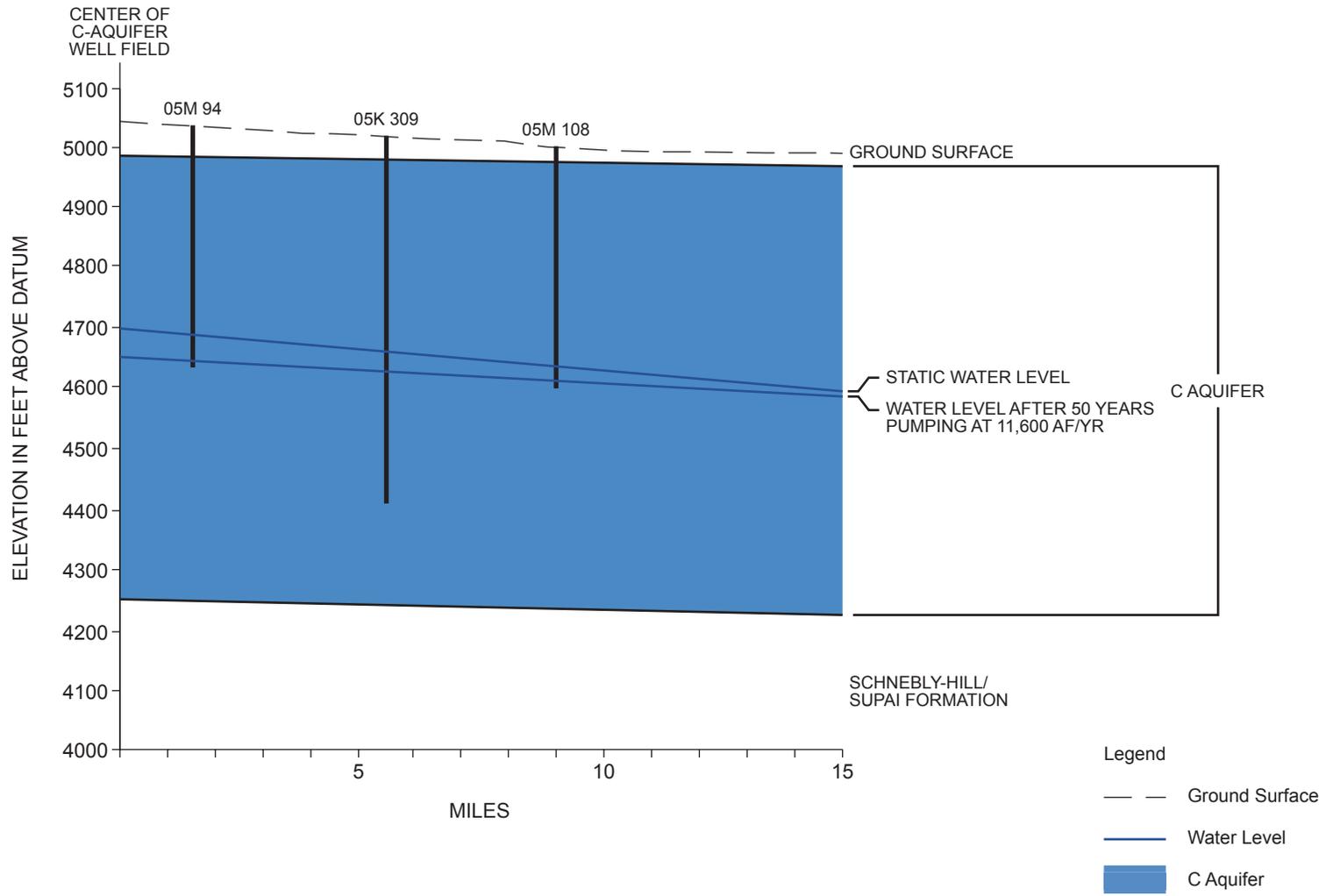
On an average annual streamflow basis, the loss of all the base flow would have no more than a moderate impact on the available supply. However, during the dry summer months, the water available for diversion is just the base flow component and whatever water can be released from storage reservoirs. Ignoring water available from storage adds a degree of conservatism to the estimation of impacts; therefore, the impact on existing and future users is measured against any reduction in summer base flow, as well as annual flow.

The USGS monitors streamflow in four washes (Moenkopi Wash, Laguna Creek, Dinnebito Wash, and Polacca Wash) that overlie the N aquifer. These washes (and others) were modeled by Peabody to assess potential changes in streamflow due to mine pumping. Of the monitored and modeled washes, Moenkopi Wash is predicted to experience the greatest, albeit small (13.3 af/yr or 0.02 cfs), depletion due to pumping from the N-aquifer well field under the maximum pumping alternative (GeoTrans 2006). (Begashibito Wash/Cow Springs is closest to the Peabody well field and is predicted by the model to have the greatest depletion, but flow in this wash is not monitored [refer to Table 4-8 in Chapter 4]). Streamflow in Moenkopi Wash near Tuba City has been measured since 1976. The wash is intermittent with zero flow during many of the summer months. Median annual flow has varied from approximately 1 to 5 cfs, with no long-term trend (USGS 2005a). Average annual streamflow for the period of record is 9.7 cfs (USGS 2005b). Maximum predicted depletion is about 0.2 percent of average annual flow.

Blue Springs is the major discharge point for the C aquifer, releasing over 164,000 af/yr into the Little Colorado River between river miles 3 and 15 upstream from its confluence with the main stem of the Colorado River. Water at the springs discharges from the Mauv and Redwall limestones (R aquifer), but originates in the overlying C aquifer, migrating downward through faults and fractures. Water from the springs is not potable (salinity is 3,000 parts per million [ppm]), but is of cultural significance to the Hopi and Navajo people and supports a critical habitat for the humpback chub. Blue Springs is approximately 77 miles north-northwest of the C-aquifer well field (refer to Map 3-5 in Chapter 3).

The USGS has been monitoring N-aquifer spring flow from four springs (Moenkopi School, Pasture Canyon Spring, Burro Spring, and an unnamed spring near Dinnehotso) for a minimum of 10 years (some springs have been monitored for much longer but not always at the same location). The closest USGS monitored spring (the unnamed spring near Dinnehotso) is more than 35 miles from the Black Mesa Complex. The USGS concludes that “for the consistent periods of record at all four springs, the discharges have fluctuated but long-term trends are not apparent” (USGS 2005a). It appears that pumping to-date has not measurably reduced the monitored N-aquifer spring flow. However, modeling of N-aquifer groundwater discharge suggests that as future non-mining related ground water pumping in close proximity to some of these springs increases, flows from springs could be impacted (GeoTrans 2006).

There are other N-aquifer springs that are not monitored and past changes to these springs, if any, are unknown. As discussed in a subsequent section of this appendix, numerical models of the N aquifer are not designed to simulate discharge from individual springs (Brown and Eychaner 1988; GeoTrans 1999). However, the GeoTrans model does simulate groundwater discharge to Begashibito Wash approximately 25 miles west of the leasehold. Cow Springs, located at the southwestern extent of Begashibito Wash, is an area of groundwater discharge as expressed by seeps and small springs. Cow Springs is the closest modeled area of seeps and springs to the mine and would therefore experience the greatest impact due to project pumping. Predicted reduction in groundwater discharge into Begashibito Wash/Cow Springs (combined) due to maximum project-related pumpage (6,000 af/yr) at the end of 2025 is estimated to be 14.9 af/yr, or 0.69 percent of the estimated 2005 groundwater discharge (refer to Table 4-8 in Chapter 4).

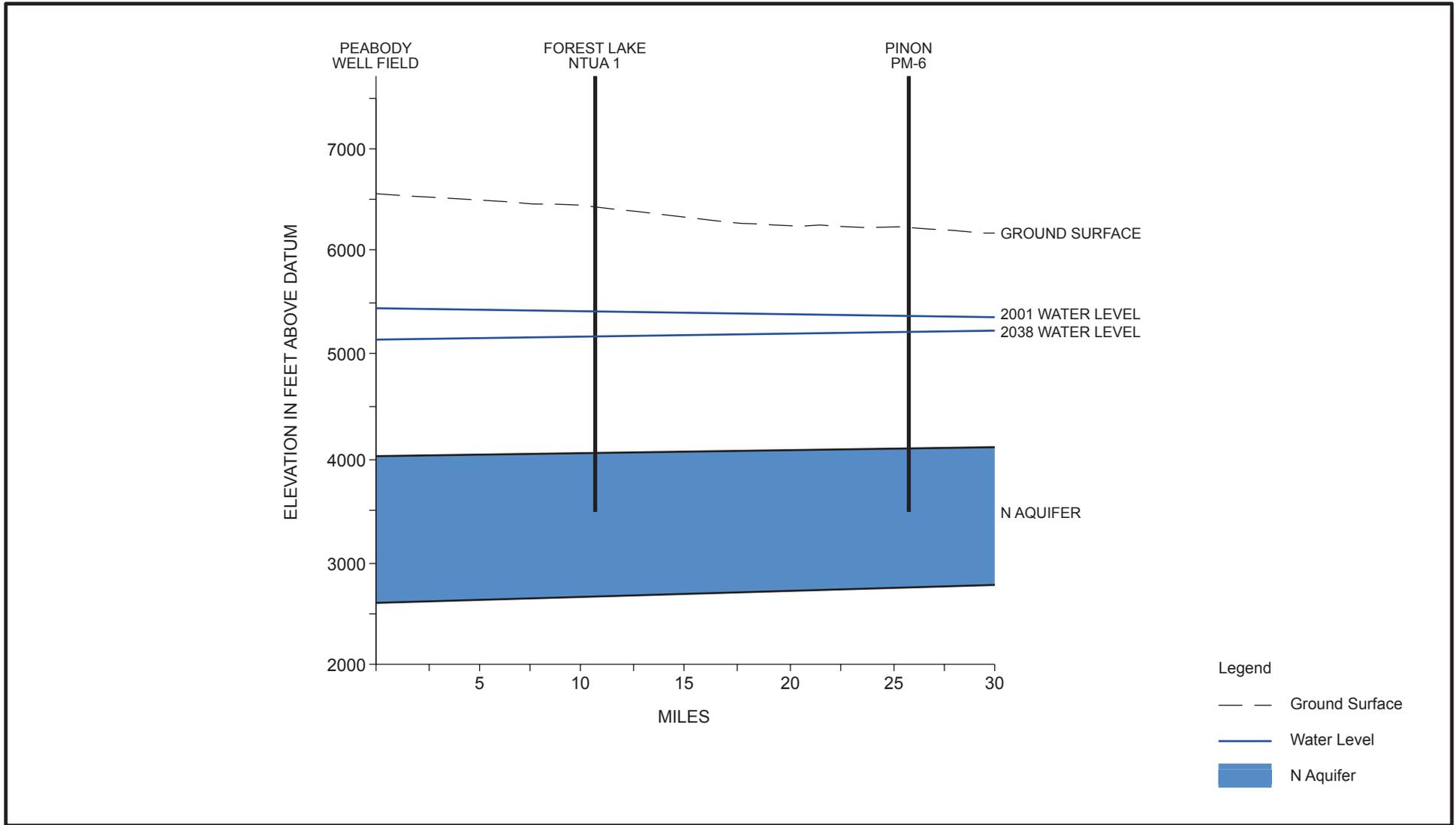


SOURCE: Southwest Ground-water Resources 2006

C Aquifer
 Relationship Between Maximum Project Pumping
 and Aquifer Saturated Thickness

Figure H-1





SOURCE: Southwest Ground-water Resources 2006

N Aquifer
 Relationship Between Maximum Project Pumping
 and Aquifer Saturated Thickness



Impact levels for the effects on surface water uses in washes, creeks, and springs are defined as shown in Table H-4.

Table H-4 Diminution of Groundwater Discharge (Base Flow) to Streams and Springs

Impact Level	Percent Reduction
Major	>31
Moderate	21-30
Minor	11-20
Negligible	<10
None	0

Migration of Poor Quality Groundwater

In some situations, extensive long-term groundwater pumping can cause poor quality groundwater to migrate toward a pumping center. Concerns have been raised that pumping from the N aquifer could cause poorer Dakota-aquifer (D aquifer) water to migrate downward into the N aquifer. Geochemical studies have shown that downward leakage from the D aquifer to the N aquifer has been occurring for thousands of years. Most natural leakage occurs in the southern portion of Black Mesa Basin where the intervening Carmel aquaclude is less than 120 feet thick and has a higher sand content than in other areas of the basin (Truini and Macy 2005). The areas of known leakage are located more than 20 miles from the Peabody wellfield. While leakage has occurred under natural conditions over a long period of time, water-quality monitoring of the N aquifer for more than 10 years during the period that mining-related and coal-slurry pumping has been occurring has shown no trend in water-quality degradation (USGS 2005a). Peabody monitors the quality of water produced from its production wells. Over the more than 20-year period that pumpage has occurred, there has been no discernible trend to suggest that water quality is declining. Total dissolved solids, sulfate, and chloride have all remained stable over the life of the wells. If leakage is occurring, it is too small to be detected in the concentration of these constituents.

Peabody conducted an analysis of potential leakage from the D aquifer to the N aquifer using the GeoTrans model and standard mixing calculations. Pumping from the N aquifer was similar to that proposed under the preferred alternative with the exception that some additional pumpage was simulated for wellfield maintenance (Scenario K). Results of this analysis indicated a maximum increase in N-aquifer sulfate concentration of 1 percent in 2039 in the eastern part of the aquifer (Peabody 1986, revised 2003, Table 23).

Under the three N-aquifer pumping options considered in this study, two would result in reduced pumpage in the future and consequently less drawdown than has occurred in the past and less potential for water-quality degradation. One option would result in a 33 percent increase in recent past (2004-2005) pumping over the life of the mine. While there is no known reason to suspect that water quality would deteriorate over the life of the mine, there is a level of uncertainty not associated with the other options. Any impact would not be sufficient to cause a loss of the resource; however, an impact level of minor is conservatively assigned.

Groundwater quality in the C-aquifer well field, while not as good as the N aquifer, is suitable for most drinking water and industrial uses. However, water quality declines to the northeast with total dissolved solid levels reaching 2,000 milligrams per liter (mg/L) approximately 10 miles from the center of the proposed well field. The potential for this water to migrate into the well field was evaluated using particle tracking methods. The capture area of the well-field pumping at the maximum rate (11,600 af/yr) does not

reach the 2,000 mg/L isopleth, although it does reach the 1,500 mg/L isopleth. Based on the modeling, it was concluded that water quality would remain suitable for drinking water purposes over the modeled period (S.S. Papadopoulos and Associates [SSPA] 2005). Some deterioration in water quality over the planning period cannot be ruled out, however. Given this uncertainty, a potential impact level of moderate is conservatively assigned.

Subsidence and Sinkholes

As discussed in Chapter 3, Section 3.4, the N and C aquifers are principally comprised of sandstone. These sandstones are indurated and are not subject to significant compaction and subsequent land subsidence. Studies of the lithology and compressibility of the Navajo Sandstone in the Black Mesa Complex indicate that it would be subject to compaction of less than 1 percent if the water level was drawn down to the top of the aquifer (GeoTrans 1993). None of the N-aquifer pumping scenarios result in the water level being lowered to the top of the aquifer within the Black Mesa Basin. No evidence of casing distress has been noted in any of the surveyed Peabody production wells as might be expected if significant compression of the Navajo Sandstone or overlying units had occurred (Office of Surface Mining Reclamation and Enforcement [OSM] 2006).

In 2003 land subsidence features in the form of sinkholes, cracks, and slumps were reported near Forest Lake, about 7 miles south of the Black Mesa Complex. After investigation by OSM, Navajo Nation Minerals Department, Navajo Nation Water Resources Department, and USGS, all of the subsidence features of concern were determined to be either in or adjacent to unconsolidated alluvial valley deposits and due to surface water entering and eroding desiccation features following an extended period of drought (OSM 2006). These features are unrelated to the mining or water production facilities on Black Mesa.

In the area of Snowflake, about 50 miles southeast of the proposed C-aquifer well field, there are numerous sinkholes in the Kaibab Limestone. These features may be associated with another structural feature referred to as the Holbrook anticline. The cause of the sinkholes is not well understood; however, they occur in the same general area as a natural plume of high-salinity groundwater. The source of the salinity is thought to be the solutioning and upwelling of water that has passed through halite and gypsum beds in the underlying Supai Formation (ADWR 1989). This same solutioning may cause the overlying Coconino Sandstone and Kaibab Limestone to subside or collapse, forming downwarps and sinkholes. There are no known sinkholes in the area of the proposed C-aquifer well field. Salinity in Coconino Sandstone at the well field site ranges from 600 to 800 ppm and is not as saline (>2,000 ppm) as in the area of known sinkholes, suggesting that significant solutioning in the Supai Formation has not occurred in the well-field area.

Subsidence and formation of sinkholes in the N- and C-aquifer well field areas are considered highly unlikely.

IMPACT ASSESSMENT TOOLS

Surface Water

The life-of-mine (LOM) permit application package provided detailed analysis of surface-water flow and water quality. The Final EIS, Proposed Permit Application, Black Mesa-Kayenta Mine, Navajo and Hopi Indian Reservations, Arizona (OSM 1990) provided data on impacts up to 1989. A Cumulative Hydrologic Impact Analysis (CHIA) was written by OSM in 1989 for Kayenta and Black Mesa mining operations (OSM 1989). At that time the impact area did not extend beyond the mines because no other

permitted or anticipated surface-mining activity existed. The groundwater impact area included all of the Black Mesa groundwater basin. The CHIA currently is being updated by OSM to include all pertinent LOM permitted facilities. OSM will complete the CHIA prior to making its decision on the LOM revision application.

The assessment of impacts on surface water in this EIS used data and analysis presented in the LOM Permit Application Package and included design drawings for typical sedimentation ponds, impoundments, and diversions, as permitted by OSM and tribal authorities. Runoff amounts were validated against gaging stations operated by either the USGS or Peabody. Other runoff volumes were estimated using the program SEDIMOT II. SEDIMOT II also was used to predict the suspended sediment concentration of water entering the major washes (Peabody 1986, revised 2005). Other water-quality impacts were evaluated using experience and literature review of typical Surface Mining Control and Reclamation Act-permitted coal-mining operations.

Data supplied by OSM also yielded pertinent information regarding surface water. The area of consideration for surface water extended to the mouth of Dinnebito and Moenkopi Washes. The analysis examined surface-water quantity and quality in the two washes, pre- and postmining (OSM 2006).

Groundwater

The effects of groundwater pumping for the Kayenta and Black Mesa mining operations on the shallow aquifers (Wepo and stream alluvium) and on the deeper C and N aquifers have been investigated in numerous studies. Evaluation of project effects on groundwater considered information available from these studies and models and are discussed below.

Wepo and Alluvial Aquifers

Potential groundwater impacts of the mining plan were assessed as part of the LOM permit application using a variety of methods. Inflow to the mining pit from the Wepo Formation (coal) aquifer was assessed using an analytical model based on the constant drawdown, variable-discharge formula for confined aquifers (Jacob-Lohman method, in Kruseman and de Ridder 1994). Other modeling was accomplished using the computer code TWODAN.

N Aquifer

In the 1989 CHIA, N-aquifer groundwater impacts were analyzed using a reconstructed version of the USGS groundwater MODFLOW model of Eychaner (1983). This model is a two-dimensional (2-D) model of the N-aquifer system (Brown and Eychaner 1988). Peabody commissioned HSI GeoTrans and Waterstone to develop a three-dimensional (3-D) groundwater flow model of the N and D aquifers (Peabody 1999). These models are described below.

- ***USGS Black Mesa Model.*** The USGS developed a finite-difference model of the N aquifer in 1983. This model was upgraded, including reformatting to the MODFLOW code, in 1988 by Brown and Eychaner and again in 2000 to reflect 1999 conditions. The model was designed to evaluate the impacts of current and future groundwater withdrawals for Peabody coal mining, as well as municipal withdrawals from surrounding Indian communities.

The model is 2-D and is comprised of one layer that represents the N aquifer. A general head boundary was used to simulate vertical flow between the D aquifer and N aquifer. The model was

calibrated to equilibrium conditions (pre-1965) and to transient conditions (1965-1984). The aquifer's response to pumping was predicted to 2051 for five pumping alternatives.

This model has undergone the most extensive peer review of the available models. It is generally recognized as providing a reasonable simulation of the N aquifer's response to pumping.

- ***GeoTrans D- and N-Aquifer Model.*** Peabody retained HSI GeoTrans and Waterstone to develop a finite-difference model of the D and N aquifers using the MODFLOW numerical code. This is a regional 3-D groundwater flow model developed to estimate the effects of pumping by Peabody and several Indian communities on the aquifers and on surface-water flows.

The GeoTrans model covers a slightly larger area than the USGS model. Additional hydrogeologic field data were collected and compiled as part of studies to develop the model. The model has seven layers and simulates the D aquifer, N aquifer, and intervening Carmel aquitard. Recharge is estimated through a complex function of precipitation, soils, and topography. Predevelopment water levels (1956) were used for steady-state calibration of the model. Initial transient calibration used 1956 to 1996 water levels and was subsequently updated to 2002 data. The model has undergone extensive sensitivity testing and validation. Evaluation of the model indicates that it successfully simulates historic water-level response to pumping in the N aquifer. It also produces N-aquifer drawdowns that are essentially the same as the USGS model.

Both the USGS and GeoTrans models estimate changes in groundwater levels and aquifer discharge over time. Aquifer discharge occurs primarily through discharge to streams and springs. Neither model attempts to simulate individual spring flows, however, which typically occur within a limited local area. This is due to (1) the regional nature of the models (including grid size); (2) the lack of detailed hydrogeologic information on individual springs, including measured spring flow; and (3) the limited drawdown in the unconfined area of the aquifer where springs occur (Peabody 1989, revised 2003). The models do, however, simulate groundwater discharge to streams on a regional scale where discharge occurs over many miles of stream reach. This discharge is essentially made up of multiple spring discharges, in that groundwater is moving into the stream channel or alluvium, such as at Begashibito Wash/Cow Springs, discussed previously. In an arid environment such as Black Mesa, not all of this groundwater discharge appears as stream flow; much of it is evapotranspired or becomes alluvial-aquifer subflow.

OSM independently reviewed the GeoTrans model and determined that the model satisfies the intended objectives and is the most comprehensive groundwater assessment tool for predictive impact evaluations necessary to address concerns related to Peabody's pumping of the N aquifer. For the following reasons, the GeoTrans model, rather than the USGS model, is used to describe the impacts (water-level and streamflow changes) due to N aquifer pumping scenarios evaluated in this EIS:

- It has a more comprehensive inclusion of hydrologic features and multiple aquifers;
- It has a finer grid spacing, which allows for a more accurate simulation of pumping effects near both the mine and adjacent communities;
- It incorporates more recent data on water levels and withdrawals;
- It examined a longer historical data period (beginning in 1956 rather than 1965);
- It provides a more detailed characterization and analysis of system recharge;
- It evaluates geologic structure that influences groundwater flow;

- It provides better model boundaries and increases the model extent; and
- It provides a more complex definition of the hydrologic system, using additional model layers to simulate the D-aquifer system.

C Aquifer

In response to issues associated with threatened and endangered species, three separate ground-water flow models have been developed over the past several years to assess potential streamflow depletion due to pumping in the area of Clear and Chevelon Creeks.

- ***Western Navajo and Hopi Water Supply Needs, Alternative and Impacts Study (HDR 2003)*** In 2003, under the Bureau of Reclamation's Western Navajo and Hopi Water Supply Needs, Alternative and Impacts Study, HDR developed a 3-D numerical flow model of the Clear and Chevelon Creek area (HDR 2003). The numerical model (MODFLOW) covered only a portion of the C aquifer and did not include all pumping centers. The area outside the numerical model was simulated with an analytical model. Head conditions along the numerical model boundaries were changed over time (in response to pumping) by the output of the analytical model. The analytical model was calibrated to historic water-level change. The numerical model was calibrated to streamflow in Clear and Chevelon Creeks and to water levels in the C aquifer.

When the numerical model was developed, the location of the C aquifer well field had not yet been identified. The well field was subsequently located on the northern boundary of the numerical model. This fact plus some concerns about the use of the analytical model to generate heads for the numerical model boundary led the C aquifer Technical Advisory Group to recommend the development of a new model of the entire C aquifer.

- ***USGS Superposition Model (Leake et al. 2005)***. The USGS was retained by the Bureau of Reclamation to develop a model of the entire C aquifer. Given the Black Mesa EIS schedule constraints, the USGS proposed to develop a simplified model of the C aquifer that addressed only pumpage from the proposed well field and its impact on Clear and Chevelon Creek streamflow. This "superposition" or change model is a 2-D MODFLOW numerical model designed to be conservative (greater flow depletion) in that the efficiency of the connection between the groundwater and surface water in the creeks was assumed to be high and the length of the perennial stream reaches is held constant. The model does not include any natural recharge or regional groundwater flow and was not calibrated to stream and spring flow or to historic water levels in wells. All water pumped from the proposed well field comes from aquifer storage or Clear and Chevelon Creeks and the Little Colorado River.
- ***SSPA Model (SSPA 2005)***. Given the limitations of the HDR and USGS models, SSPA was retained by the applicant, Southern California Edison Company, to develop a 3-D MODFLOW model of the entire C aquifer that would include recharge, regional flow, and all known pumping centers. The model was calibrated to spring discharges, measured flow in lower Clear and Chevelon Creeks and to water-level change in wells.

The three groundwater models were developed independently by different investigators. In general, the models relied on the same published and unpublished hydrogeologic data such as aquifer characteristics, precipitation, and water levels in wells. The only significant difference in available data is the fact that data from the C aquifer well-field test wells were not available for the HDR model. All numerical models used the same basic model code (MODFLOW). Differences between the models result largely from their

intended purposes and their calibration. Some difference in projected pumping, both from the C aquifer well field and by tribal and nontribal groundwater users, occurred between the HDR model (less well-field pumpage and more tribal and nontribal pumpage) and the subsequent USGS and SSPA models. The USGS and SSPA models used the same project well field pumping sets. The SSPA model used the most recent tribal and nontribal pumpage as developed by the C aquifer Technical Advisory Group. The USGS model did not simulate tribal and nontribal pumpage, only project pumping.

Model-predicted streamflow depletion due to project-only pumping in lower Clear Creek and lower Chevelon Creek at the confluence with the Little Colorado River at the end of the planning period is compared in Tables H-5 and H-6. The predicted value is the most likely value of streamflow depletion as generated by the model. The 90 percent upper bound level is a value that would not be exceeded, with 90 percent confidence, according to the statistical methods and is presented to provide an indication of the level of uncertainty in the estimates of streamflow depletion. However, the values are skewed to the high side because streamflow is bounded on the low side by zero. The predicted values should be used as the best estimates of computed depletion (USGS 2005).

Table H-5 Comparison of Model Predicted Stream Base Flow Depletion (cfs) in Lower Clear Creek, Project-only Pumping (2060)

Scenario	USGS		SSPA		HDR
	Predicted	90 Percent Upper Bound	Predicted	90 Percent Upper Bound	Predicted
Mine ¹	N/A	N/A	0.05	0.09	N/A ²
6,500 af/yr	0.4	1.0	0.05	0.13	N/A ²
11,600 af/yr	0.5	1.3	0.06	0.18	N/A ²

SOURCES: HDR 2003; Leake, S.A., J.P. Hoffman, and J.E. Dickinson 2005; S.S. Papadopoulos and Associates 2005

NOTES: ¹6,000 af/yr 2010-2025; 505 af/yr 2026-2028

²Flow in lower Clear Creek not simulated with C Aquifer well field pumping

Table H-6 Comparison of Model Predicted Stream Base Flow Depletion (cfs) in Lower Chevelon Creek, Project-only Pumping (2060)

Scenario	USGS		SSPA		HDR
	Predicted	90 Percent Upper Bound	Predicted	90 Percent Upper Bound ³	Predicted
Mine ¹	N/A	N/A	0.03	0.06	N/A
6,500 af/yr	0.05	0.10	0.03	0.06	0.01 ²
11,600 af/yr	0.07	0.13	0.04	0.07	0.01 ²

SOURCES: HDR 2003; Leake, S.A., J.P. Hoffman, and J.E. Dickinson 2005; S.S. Papadopoulos and Associates 2005

NOTES: ¹6,000 af/yr 2010-2025; 505 af/yr 2026-2028

²6,000 af/yr and 10,000 af/yr

³Maximum depletion occurs in 2045, as flow is near zero (0.3 cfs) after 2053 due to pumping by others

The USGS and SSPA models predict essentially the same streamflow depletion in lower Chevelon Creek. The USGS model predicts an order of magnitude greater depletion in lower Clear Creek. Both the USGS and SSPA models predict greater depletion in lower Chevelon Creek than the HDR model, due in part to the lower project pumpage assumed in the HDR model.

The SSPA model best simulates the physical conditions in the study area. It encompasses the entire C aquifer and, unlike the USGS model, it accounts for all the major hydrogeologic components of the flow system, is calibrated to spring discharge and streamflow in lower Clear and Chevelon Creeks and to water levels in wells. Results from the SSPA model are used to assess the impacts of pumping from the C aquifer well field on the surface-water and groundwater system, except for upper East Clear Creek.

The SSPA model does not simulate base flow in the upper East Clear Creek perennial streamflow area. While groundwater levels in the model may indicate a stream connection in this area, the lack of measured flow data, on which to calibrate the model, led to a decision not to attempt to simulate flow in this area. The HDR and USGS models did estimate streamflow reduction in this reach, however. For this study, the USGS model is considered to be the more conservative and was used to evaluate potential impacts on streamflow in upper East Clear Creek.

APPENDIX I



Appendix I

Scenic Quality Classes and Descriptions

- I-1 General Description of Scenic Quality Classes
- I-2 Black Mesa Complex
- I-3 Coal-Slurry Pipeline: Existing Route
- I-4 Coal-Slurry Pipeline: Kingman Reroute
- I-5 Well Field
- I-6 C-Aquifer Water-Supply Pipeline: Eastern Route
- I-7 C-Aquifer Water-Supply Pipeline: Western Route

**APPENDIX I
SCENIC QUALITY CLASSES AND DESCRIPTIONS**

INTRODUCTION

The BLM and Forest Service, as land-managing agencies concerned with visual characteristics of landscape, have developed methodologies to assess the scenic quality of landscapes to help determine a project’s effects on the surrounding environment. These methodologies were used for Federal land and were borrowed for use in assessing landscapes outside areas where formal guidelines apply. The BLM’s Visual Resource Management approach assigns classes to landscapes indicating aesthetic value based on defined characteristics. Classes derived from the BLM and Forest Service approaches were used to develop a consistent description of the scenic quality of the natural landscapes within the study area and a class was created for developed land. The description is a composite of separate components of visual resources and is further explained in Table I-1. Scenic quality classes assigned to the landscapes of each project component and a description of the character specific to each landscape follow in Tables I-2 through I-7 below. Also, these scenic quality classes are shown in Map 3-16. Landscape characteristics are described in Chapter 3, Section 3.14.

Table I-1 General Description of Scenic Quality Classes

Scenic Quality Class	General Description
Class A	Unique land of outstanding or distinctive diversity or interest, such as high relief mountains, escarpments, highly dissected canyons, monumental landforms, and scenic riverways.
Class B	Land of common or average diversity of interest, consisting of rolling vegetated hills and valleys, mesas, and buttes.
Class C	Highly common land and/or land of minimal diversity or interest, such as high desert plateaus or desert basin areas.
Class D	Landscapes that have a modified appearance and that exhibit human-made modifications as a result of development, including residential, commercial, and industrial land uses.

BLACK MESA COMPLEX

Table I-2 Black Mesa Complex

Landscape	Scenic Quality Class(es) Assigned and Specific Description
Black Mesa Complex (natural landscape)	Class B. The scenic quality of the natural landscape is characterized by woodlands, reclaimed mining areas (typically grassland), and rock outcroppings.
Black Mesa Complex (active mining operations)	Class D. The active mining operations were inventoried as developed-industrial landscape.

COAL-SLURRY PIPELINE

Table I-3 Coal-Slurry Pipeline: Existing Route

Landscape	Scenic Quality Class(es) Assigned and Specific Description
Coal-Slurry Pipeline: Existing Route (Navajo/Hopi Landscape Character Type)	<p>Class A. The Adeii Eechi Cliffs crossed within the Navajo/Hopi landscape exhibit prominent edges, contrasting colored rock striations, and domination of the surrounding landscape, resulting in high scenic quality.</p> <p>Class B. The pipeline also crosses through large swaths of natural landscape with varying degrees of landform dominance, distinctive colors, and moderate vegetation density. The eroded cliffs, terraces, plateaus, and dry washes give definition to the surrounding landscape.</p> <p>Class D. The disturbance of soil, removal of trees, and presence of industrial facilities within the Black Mesa Complex is developed-industrial landscape.</p>
Coal-Slurry Pipeline: Existing Route (Flagstaff and Grand Canyon Landscape Character Types)	<p>Class C. The majority of the natural landscape is commonly occurring grassland with sporadic rock and lava outcrops.</p> <p>Class B. The pipeline crosses some landscapes with a higher-density piñon/juniper woodlands, rolling terrain with scattered occurrences of grassland, and lava outcrops.</p> <p>Class D. The landscapes in the Town of Seligman, Arizona, and surrounding areas are characterized as developed or otherwise disturbed.</p>
Coal-Slurry Pipeline: Existing Route (Upper Tonto Landscape Character Types)	<p>Class B. The natural landscape includes notable areas of rolling piñon/juniper woodland, isolated areas of plains grassland, and the Juniper Mountains.</p> <p>Class C. The natural landscape passes through expansive dissected desert plains immediately west of the Juniper Mountains. The landscape in this area exhibits limited variation in color and texture, sparse vegetation, and relatively unvaried topography.</p>
Coal-Slurry Pipeline: Existing Route (Mohave Landscape Character Types)	<p>Class B. The natural landscape in the study area is typically characterized by varied topographic relief and distinctive natural appearance within the foothills of the Hualapai and Cerbat Mountains.</p> <p>Class D. The areas of Kingman, Arizona, and immediately surrounding are characterized as extensively modified and developed.</p>

Table I-4 Coal-Slurry Pipeline: Kingman Reroute

Landscape	Scenic Quality Class(es) Assigned and Specific Description
Coal-Slurry Pipeline: Kingman Reroute	<p>Class A and Class B. The Hualapai and Black Mountain ranges are very evident features in the landscape. However, the Kingman reroute is slightly offset from the dominant and unique portions of these mountain ranges, and would travel the foothills or the areas immediately adjacent to the mountains.</p> <p>Class C and Class D. The reroute would traverse the Sacramento Valley through developed or disturbed landscape devoid of unique or distinguishing vegetation, water features, or terrain.</p>

C-AQUIFER WATER SUPPLY SYSTEM

Table I-5 Well Field

Landscape	Scenic Quality Class(es) Assigned and Specific Description
C-Aquifer Water-Supply System: Well Field	Class C. The natural landscape is flat and has no water; sparse desertscrub vegetation and dispersed tufts of grass, red soils, and exposed sandstone provide some unique landscape characteristics.

Table I-6 C-Aquifer Water-Supply Pipeline: Eastern Route

Landscape	Scenic Quality Class(es) Assigned and Specific Description
Water-Supply Pipeline: Eastern Route	<p>Class B. The natural landscape is characterized by washes, desertscrub and grassland, and flat to rolling topography with occasional occurrences of less distinctive dissected plateaus and eroded mesas. Areas near the Little Colorado River and several mesas, washes, and valleys within the area provide some variety to the landscape, as well as do landscapes with moderate- or high-density piñon/juniper woodland.</p> <p>Class C. Areas at the beginning of the route and north to the community of Leupp, the area of Tolani Lake, and the Black Mesa Complex have the characteristic low topographic relief, including dissected plains, sandstone plains, and high desert plateaus.</p> <p>Class D. The developed areas of the Black Mesa Complex have little diversity of vegetation or are developed, industrial operations.</p>

Table I-7 C-Aquifer Water-Supply Pipeline: Western Route

Landscape	Scenic Quality Class(s) Assigned and Specific Description
Water-Supply Pipeline: Western Route	<p>Class A. The natural landscape that includes the Red Rock Cliffs, Adeii Eechii Cliffs, Ha Ho No Gey Canyon, Begabashito Canyon, and Coal Mine Canyon are outstanding landforms that exhibit a variety of unique elements and uncommon features such as eroded precipices, colorful contrasting rock striations, and narrow chasms within the canyons. The landforms also exhibit vivid warm and cool contrasting colors as well as the distinguishing textures of rock outcrops and exposed sandstone strata.</p> <p>Class B. The natural landscapes along the western route include the Little Colorado River, Painted Desert, Ward Terrace, Red River Valley, Kletha Valley, and many distinctive mesas (Tohnali, Newberry, Coal Mine, and Black Mesa). Plateau grassland, various mesas, and other unique landscapes mostly characterize this area; however, they are not uncommon features in the area.</p> <p>Class D. The western route begins north of the community of Leupp and the area of the Black Mesa Complex mining operation is characterized by unvaried terrain, with little spacial definition, vast expanses of sagebrush or plains grassland vegetation, and developed industrial areas.</p>

APPENDIX J



Appendix J

Visual Simulations

C Aquifer Water Supply System

Simulation 1: Well Collection Field and Proposed Water Storage Tank

Simulation 2: Proposed Tolani Lake Pump Station (#1)

Simulation 3: Proposed Oraibi Pump Station (#2)

Simulation 4: 69kV Transmission Line Along Indian Route 1

Simulation 5: 69kV Transmission Line Near Kykotsmovi

Simulation 6: Substation Near Leupp



Existing Conditions: View west from Milepost 0.5 of the water-supply pipeline route



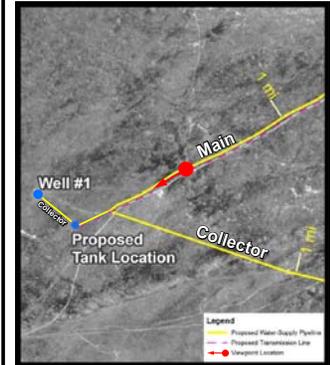
Simulation: Proposed water-storage tank and 24.9kV power line

Simulation 1 Well Collection Field and Proposed Water Storage Tank

Black Mesa Project EIS



Location Map



Vicinity Map

SOURCE:
URS Corporation 2005



Prepared By:
URS



Existing Conditions: View northeast along Indian Route 2 at Milepost 30 of the water-supply pipeline route



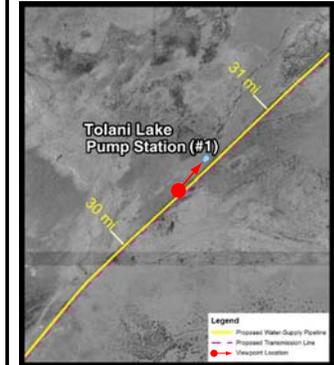
Simulation: Proposed Tolani Lake Pump Station (#1)

Simulation 2 Proposed Tolani Lake Pump Station (#1)

Black Mesa Project EIS



Location Map



Vicinity Map

SOURCE:
URS Corporation 2005



Prepared By:
URS



Existing Conditions: View southwest near Milepost 73 of water-supply pipeline



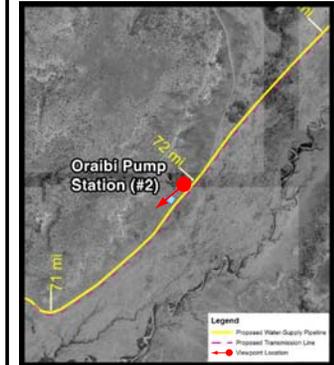
Simulation: Proposed Oraibi Pump Station (#2) and 24.9kV power line

Simulation 3 Proposed Oraibi Pump Station (#2)

Black Mesa Project EIS



Location Map



Vicinity Map

SOURCE:
URS Corporation 2005



Prepared By:
URS



Existing Conditions: View southwest along Indian Route 2 at milepost 45.5 of the water-supply pipeline route

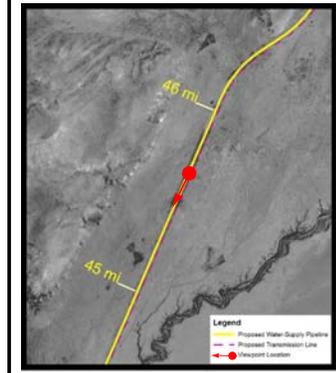


Simulation: Proposed 69kV (with 24.9kV underbuild) transmission line

Simulation 4 69kV Transmission Line Along Indian Route 2 Black Mesa Project EIS



Location Map



Vicinity Map

SOURCE:
URS Corporation 2005



Prepared By:
URS



Existing Conditions: View northwest along Route 264 east of Kykotsmovi



Simulation: Proposed 69kV (with 24.9kV underbuild) transmission line

Simulation 5 69kV Transmission Line Near Kykotsmovi

Black Mesa Project EIS



Location Map



Vicinity Map

SOURCE:
URS Corporation 2005



Prepared By:
URS



Existing Conditions: View west on State Route 99 at location of existing 230kV transmission line



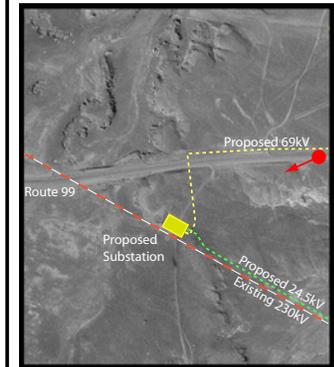
Simulation: Proposed substation with accompanying 69kV Corten single pole structures and 24.5kV wood pole structures

Simulation 6 Substation Near Luepp

Black Mesa Project EIS



Location Map



Vicinity Map

SOURCE:
URS Corporation 2005



Prepared By:
URS

APPENDIX K



Appendix K

Consultation and Coordination Letters

- Letter dated August 20, 2004, from OSM to invite agencies to serve as cooperators in preparation of the EIS
- Letter dated May 10, 2005, on behalf of OSM to initiate coordination with agencies
- Letter dated May 20, 2005, from OSM regarding cultural resources
- Letter dated May 20, 2005, from OSM to invite participation from tribes



IN REPLY REFER TO:

United States Department of the Interior

OFFICE OF SURFACE MINING
Reclamation and Enforcement
P.O. Box 46667
Denver, Colorado 80201-6667

August 20, 2004

Linda Beals, Manager
Arizona State Land Department
Rights-of-Way Section
1616 West Adams
Phoenix, AZ 85007

Subject: Request to Participate as Cooperating Agency in the Preparation of an Environmental Impact Statement for the Black Mesa and Kayenta Mines and C-aquifer Water Supply System

Dear Ms. Beals:

The Office of Surface Mining Reclamation and Enforcement (OSM) is preparing an Environmental Impact Statement (EIS) for the Black Mesa and Kayenta Mines and C-aquifer Water Supply System. The four components of the overall proposed project to be considered in the EIS are:

- Approvals of a Life-of-Mine Permit Revision and Changes to the Mining Plans for the Black Mesa and the Kayenta Mines on the Navajo and Hopi Reservations in northeastern Arizona
- Approval of a Permit Application for the Black Mesa Coal Slurry Preparation Plant
- Approvals associated with reconstruction of the Coal Slurry Pipeline from the Coal Slurry Preparation Plant to the Mohave Generating Station in Laughlin, Nevada
- Approvals associated with construction and operation of a new Coconino aquifer (C-aquifer) Water Supply System to be located on the Navajo Reservation and, possibly, on Hopi-owned lands adjacent to the Navajo Reservation and northwest of Winslow, Arizona

A brief description of each component of the proposed project is enclosed. We believe that the Williams Ranger District may have one or more actions associated with the proposal proposal (i.e., approval of additional rights-of-way for the Coal Slurry Pipeline). Therefore, we request your participation in the preparation of the subject EIS as a Cooperating Agency. Please advise us, in writing, of your decision and of any documentation that you may require to implement your participation as a Cooperating Agency. If you have any questions, please contact Peter Rutledge at 303-844-1400, ext. 1425.

Sincerely,

Allen D. Klein
Regional Director

Enclosure

[Similar letters were sent to the following recipients.]

Marjorie Blaine, Senior Project Manager
U.S. Army Corps of Engineers
Los Angeles District, Regulatory Branch
Arizona Section, Tucson Project Office
5205 East Comanche Street
Tucson, AZ 85707

Ron Walker, County Manager
County of Mohave County Manager's Office
PO Box 7000
Kingman, AZ 86402-7000

Elouise Chicharello, Regional Director
Bureau of Indian Affairs
Navajo Regional Office

City of Kingman
310 North 4th Street
Kingman, AZ 86401

Lisa Hanf, Director
U.S. Environmental Protection Agency
Region 9
Federal Activities Office (CMD-2)
75 Hawthorne Street
San Francisco, CA 94105

Tom Mutz, Lands and Minerals Specialist
U.S.D.A. Forest Service
Kaibab National Forest
Williams Ranger District
742 South Clover Road
Williams, AZ 86046

Wayne Nordwall, Regional Director
Bureau of Indian Affairs
Western Regional Office

Joe Shirley, Jr., President
Navajo Nation
PO Box 9000
Window Rock, AZ 86515

Wayne Taylor, Jr., Chairman
The Hopi Tribe
PO Box 123
Kykotsmovi, AZ 86039



May 10, 2005

Mr. Steve Spangle
Field Supervisor
U.S. Fish and Wildlife Service
Arizona Ecological Services Field Office
2321 W. Royal Palm Road, Suite 103
Phoenix, Arizona 85021

RE: Initiate Coordination of the Proposed Black Mesa Project Environmental Impact Statement

Dear Mr. Spangle:

I am writing to initiate coordination with you regarding the proposed Black Mesa Project. URS Corporation is under contract with Southern California Edison (SCE) on behalf of the Office of Surface Mining Reclamation and Enforcement (OSM) to prepare an Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA) to analyze the environmental impacts resulting from the approval of a permit application proposing numerous revisions to the life-of-mine plans for the Kayenta and Black Mesa Mines (LOM revision). Additional components to be addressed in the EIS include:

- Operation of the coal-slurry preparation plant located at the Black Mesa Mine.
- Reconstruction of the coal-slurry pipeline from the coal-slurry preparation plant to the Mohave Generating Station in Laughlin, Nevada. The 273-mile-long buried pipeline that conveys the coal in slurry (a 50/50 percent mixture of water and finely crushed coal) has been in operation since 1970 and has a 35-year design life. Pipeline reconstruction would involve decommissioning the existing pipeline and burying a new coal-slurry pipeline adjacent to the existing one. About 95 percent of the existing pipeline would be abandoned and left in place underground. A limited number of sections would require removal. A temporary right-of-way width of about 15 feet would be needed for construction activities in addition to the existing 50-foot-wide right-of-way for the majority of the alignment. Existing pumping stations (one at the coal-slurry preparation plant and three along the pipeline alignment) are expected to require only minor modification, if any. The pipeline would pass under the Colorado River at Laughlin, Nevada and under the Little Colorado River east of Cameron, Arizona.
- Construction and operation of a new water-supply system conveying water from a well field near Leupp, Arizona (completed in the Coconino [or "C"] aquifer) to the Black Mesa Mine primarily for the coal-slurry. Components include (1) A well field in the southwest part of the Navajo Reservation and possibly a well field on Hopi lands immediately south of the Navajo Reservation well field, (2) an approximately 108-mile-long main pipeline from the well field(s) north-northwest to the Black Mesa Mine following, to the extent practicable, existing roads, (3) an estimated three pump stations and associated facilities, and (4) a resizing of the pipeline delivery system. Under the alternative configuration, the main pipeline-delivery system would



be upsized to convey up to an additional 5,600 acre-feet and would include taps to allow connection of future spur pipelines to supply water to Navajo and Hopi communities for municipal and industrial uses.

In addition to any issues or concerns you want to identify for consideration in the EIS, we would appreciate a list of federally listed endangered, threatened, proposed, and candidate species that may be affected by this project. The list will be used to identify those species that have the potential to occur within the project area. We can fully appreciate the Service's work-load and standard response time for requests, but in order to maintain the project schedule, we would appreciate a list of species no later than **May 27, 2005**.

We look forward to working with you and your Flagstaff office staff to discuss issues, the planning process, and preliminary planning criteria, as well as to request relevant data. Enclosed is a map showing the project area. If you need more information, you are welcome to contact me by telephone at (520) 407-2856 or by electronic mail at barbara_garrison@urscorp.com. Or you may contact Danny Rakestraw, who can be reached by telephone at (702) 951-3285 or by electronic mail at danny_rakestraw@urscorp.com. Thank you in advance for your assistance.

Sincerely,

Barbara A. Garrison
Senior Biologist
URS Corporation

Enclosure: Map 2-1 Project Area

Cc: John Nystedt, Fish and Wildlife Biologist, Flagstaff Sub-Office

file



[Similar letters were sent to the following recipients.]

Mr. Steve Best
District Ranger
Williams Ranger District
Kaibab National Forest
742 South Clover Road
Williams, Arizona 86046

Mr. Glenn H. Clemmer
Program Manager
Nevada Natural Heritage Program
1550 East College Parkway, Suite 137
Carson City, Nevada 89706-7921

Ms. Rebecca Davidson
Project Evaluation Coordinator
Arizona Game and Fish Department
Habitat Branch
2222 West Greenway Road
Phoenix, Arizona 85023

Ms. Cynthia Martinez
Supervisor
U.S. Fish and Wildlife Service
Southern Nevada Field Office
4701 N. Torrey Pines Drive
Las Vegas, Nevada 89130

Mr. Wayne Taylor, Jr.
Chairman
Hopi Tribe
PO Box 123
Kykotsmovi, Arizona 86039

Ms. Gloria Tom
Director
Navajo Department of Fish and Wildlife
PO Box 1480
Window Rock, Arizona 86515

Rebecca Peck
Bureau of Land Management – Kingman
Kingman Field Office
2755 Mission Blvd.
Kingman, Arizona 86401



IN REPLY REFER TO:

United States Department of the Interior

OFFICE OF SURFACE MINING
Reclamation and Enforcement
P.O. Box 46667
Denver, Colorado 80201-6667

May 20, 2005

Mr. Alan Downer
Tribal Historic Preservation Officer
Navajo Nation
P.O. Box 4950
Window Rock, Arizona 86515

Dear Mr. Downer:

The Office of Surface Mining Reclamation and Enforcement is preparing an environmental impact statement (EIS) to evaluate potential impacts of the proposed Black Mesa Project. The project consists of the following components:

- Revision to Peabody Western Coal Company's life-of-mine plans for the Kayenta and Black Mesa surface coal mines.

The Kayenta Mine and Black Mesa Mine are on the Hopi and Navajo reservations on Black Mesa about 125 miles northeast of Flagstaff. The 44,073-acre Kayenta Mine supplies coal to the Navajo Generating Station in Page, Arizona, and the 18,849-acre Black Mesa Mine supplies coal to the Mohave Generating Station in Laughlin, Nevada.

- Continued operation of Black Mesa Pipeline's coal-slurry preparation plant at the Black Mesa Mine.

The plant prepares a 50 percent coal – 50 percent water mixture for shipment in the coal-slurry pipeline. Only minor modifications to the existing plant are proposed.

- Black Mesa Pipeline's reconstruction of the coal-slurry pipeline.

The 273-mile long coal-slurry pipeline originates at the coal-slurry preparation plant at the Black Mesa Mine and terminates at the Mohave Generating Station. The pipeline has a 35-year design life and needs to be replaced because it has been in operation since 1970. The replacement line would generally be immediately adjacent to the existing line, which would mostly be abandoned in place, but deviations from the existing line will be considered to avoid developed areas around Kingman, Arizona, and to avoid a few areas where erosion has become a problem.

- Southern California Edison Company's development of a new water supply system from the Coconino Aquifer.

Currently, the Kayenta and Black Mesa Mines pump water from the Navajo Aquifer for use at the mines and in preparing the coal and water slurry at the preparation plant. Use of Navajo-Aquifer water would be largely reduced through development of an alternate water supply in the Coconino Aquifer north of Interstate 40 in the vicinity of Leupp, Arizona. A water delivery pipeline (including pumping plants, storage tanks, power lines, and access roads) would be built from the well field to the coal-slurry preparation plant at the Black Mesa Mine. Two routes for

the pipeline are being considered: a 108-mile long corridor through the Navajo and Hopi reservations and a 140-mile long corridor through the Navajo reservation.

Enclosed is a map that shows the locations of the project components and land ownership in the project vicinity. For further details on the project and EIS, visit the Office of Surface Mining's Internet Web site at <http://www.wrcc.osmre.gov/bmk-eis/Default.htm>.

The Office of Surface Mining expects to issue a draft EIS for public review in late 2005 or early 2006 and to issue a final EIS and record of decision on the life-of-mine revision in mid-2006.

Cultural resource studies will be conducted to identify potential impacts so they can be described and addressed in the EIS and to provide data for evaluating alternatives. The studies also will support consultations pursuant to Section 106 of the National Historic Preservation Act. The Office of Surface Mining is contacting you at this time to initiate the Section 106 consultation process. We anticipate that a Section 106 Programmatic Agreement will be developed to address potential adverse effects on cultural resources.

Direct and indirect impacts on cultural resources will be assessed. The area of potential effects for construction impacts would be defined as those areas where ground-disturbing construction activities would occur. There appears to be relatively little potential for less-direct impacts on cultural resources that could result from factors such as modifications of visual settings, increased noise, and surface water impacts, but they also will be considered. We would appreciate your advice regarding the definition of the area of potential effects for other types of impacts that should be addressed.

The planned cultural resource studies will include:

- Records and literature reviews to compile information about prior cultural resource studies and previously recorded cultural resources,
- Intensive field surveys to identify and evaluate unrecorded archaeological and historical resources, and
- Studies of traditional cultural places and lifeways.

Many of the areas that would be affected by the Black Mesa Project are on the Hopi and Navajo reservations, and the Hopi Tribe and Navajo Nation are cooperating in the preparation of the EIS. The Hopi Cultural Preservation Office and Navajo Nation Archaeology Department will be conducting the cultural resource studies on their respective reservations. The one component of the project that extends well beyond the reservations is the coal slurry line, which crosses about 180 miles of private land, Arizona State Trust land, and Federal land managed by the Bureau of Land Management and the Kaibab National Forest. We would appreciate any advice you may have regarding the design of the cultural resource inventory strategy.

Many agencies and organizations are involved in the project, and we are organizing a cultural resources subcommittee to provide advice and review as the EIS is prepared. A tentative list of members is enclosed.

We are aware that several tribes have traditional cultural affiliations with the project area and OSM is initiating consultations in a government-to-government framework with the tribes identified on the enclosed list. We would appreciate your advice about whether additional tribes or other potentially interested parties should be contacted.

We look forward to your comments and collaboration as the planning for this challenging project continues. If you have any questions, please contact Foster Kirby, Archeologist, by telephone at 303-844-1400, extension 1467, or by e-mail at fkirby@osmre.gov.

Sincerely,

Peter A. Rutledge, Chief
Program Support Division

Enclosures

Black Mesa Project
Cultural Resource Subcommittee – Contact List
(preliminary – 11 May 2005)

Office of Surface Mining

Foster Kirby, Archaeologist
Office of Surface Mining
P.O. Box 46667
Denver, Colorado 80210-6667
street: 1999 Broadway, Suite 3320
Denver, Colorado 80202-5733
303-844-1400 x1467
303-844-1545 fax
fkirby@osmre.gov

Bureau of Reclamation

Jon Czaplicki, Archaeologist
Phoenix Area Office
P.O. Box 81169
Phoenix, Arizona 85069-1169
street: 2222 W. Dunlap Street, Suite 100
Phoenix, AZ 85021-2801
602-216-3862
602-216-4006 fax
jczaplicki@lc.usbr.gov

Bureau of Indian Affairs – Western Region

Garry Cantley, Regional Archaeologist
Western Regional Office
Bureau of Indian Affairs
P.O. Box 10
Phoenix, Arizona 85001
street: 400 N. 5th Street, 14th Floor
Phoenix, AZ 85004-3904
602-379-6750
602-379-3833 fax
(no e-mail)

Bureau of Indian Affairs – Navajo Region

Don Simonis, Regional Archaeologist
Navajo Regional Office
Bureau of Indian Affairs
P.O. Box 1060
Gallup, New Mexico 87305
street: 301 W. Hill Street
Gallup, New Mexico 87305
505-863-8415
505-863-8324 fax
(no e-mail)

U.S. Forest Service, Kaibab National Forest

John Hanson, Archaeologist
Kaibab National Forest
800 S. 6th Street
Williams, Arizona 86046
928-635-8272
928-635-2728 fax
“John A. Hanson” <jahanson@fs.fed.us>

Bureau of Land Management-Kingman

Craig Johnson
Kingman Field Office
Bureau of Land Management
2755 Mission Boulevard
Kingman, Arizona 86401
928-718-3731
928-718-3761 fax
craig_j_johnson@blm.gov

Environmental Protection Agency

Jeanne Geselbracht
Environmental Scientist
Environmental Protection Agency, Region 9
75 Hawthorn Street
San Francisco, California 94105
415-972-3853
415-947-8026 fax
geselbracht.jeanne@epa.gov

U.S. Army Corps of Engineers

D. Steve Dibble, Senior Archaeologist
Environmental Resources Branch
Los Angeles District
U.S. Army Corps of Engineers
P.O. Box 532711
Los Angeles, California 90053-2325
street: 911 Wilshire Blvd.
Los Angeles, California 90017
213-452-3849
213-452-4204 fax
David.S.Dibble@spl01.usace.army.mil

Navajo Tribal Historic Preservation Officer

Ron Maldonado
Historic Preservation Department
Navajo Nation
P.O. Box 4950
Window Rock, Arizona 86515
(street: Navajo Boulevard W008-247)
928-871-6437/928-871-7139
928-871-7886 fax
ronpmaldonado@navajo.org

Hopi Tribe

Michael Yeatts
Cultural Preservation Office
Hopi Tribe
P.O. Box 123
Kykotsmovi, Arizona 86039
street: Hohnanhi Building, Main Street
928-523-6573
928-734-3629 fax
michael.yeatts@nau.edu

Arizona State Historic Preservation Officer

Matthew Biltsbarrow
State Historic Preservation Office
Arizona State Parks
1300 W. Washington St
Phoenix, Arizona 85007
602-542-7137
mbiltsbarrow@pr.state.az.us

Nevada State Historic Preservation Officer

Rebecca Lynn Palmer
Historic Preservation Specialist
Department of Cultural Affairs
Nevada State Historic Preservation Office
100 N. Stewart Street
Carson City, Nevada 89701-4285
775-684-3443
? fax
rlpalmer@clan.lib.nv.us

Arizona State Land Department

Stephen K. Ross
Cultural Resources Manager
Arizona State Land Department
1616 W. Adams Street
Phoenix, Arizona 85007
602-542-2767
602-542-2590 fax
sross@land.az.gov

Arizona State Museum?

Su Benaron
Arizona State Museum
University of Arizona
P.O. Box 210026
Tucson, Arizona 85721-0026
520-621-2096
520-621-2976 fax
sbenaron@email.arizona.edu

Advisory Council on Historic Preservation

Alan L. Stanfill
Senior Program Analyst
Advisory Council on Historic Preservation
12136 West Bayaud Avenue, Suite 330
Lakewood, Colorado 80228
303-969-5110
303-969-5115 fax
astanfill@achp.gov

Southern California Edison Company

Tom Taylor?
Southern California Edison
P.O. Box 800
Rosemead, California 91770
street: 8631 Rush St.
Rosemead, California 91770-3714
626-302-#####
626-302-9730 fax
Tom.Taylor@sce.com

Peabody Western Coal Company

Gary Wendt
2836 W. Shamrell Blvd.
Peabody Western Coal Company
Flagstaff, Arizona 86001
928-677-5130
928-677-5083 fax
gwendt@peabodyenergy.com

Black Mesa Pipeline, Inc.

Melissa Lester
Black Mesa Pipeline, Inc.
13710 FNB Parkway
Omaha, Nebraska 68154
402-492-7559
402-492-7485 fax
melissa.lester@nborder.com

Salt River Project

Rick Anduze PAB 352

P.O. Box 52025

Salt River Project

Phoenix, Arizona 85072-2025

street: 1600 N. Priest Drive

Tempe, Arizona 85281-8100

602-236-2804

602-236-3407 fax

raanduze@srpnet.com

URS Corporation

Gene Rogge, Manager

Cultural Resources Group

7720 N. 16th Street, Suite 100

Phoenix, Arizona 85020

602-861-7414

602-371-1615 fax

gene_rogge@urscorp.com

**Black Mesa Project
Tribal Mailing List**
(updated 6 May 2005)

Chemehuevi Tribe

Shirley Smith, Chairwoman
Chemehuevi Tribe
P.O. Box 1976
Havasu Lake, California 92363
(street: 1990 Palo Verde Drive)
760-858-4219
760-858-5400 fax

Colorado River Indian Tribes

Daniel Eddy Jr., Chair
Colorado River Indian Tribes
Route 1, Box 23-B
Parker, Arizona 85344
928-669-9211 ext. 1281
928-669-1391 fax

copy to:

George Ray, Acting Director
Colorado River Indian Tribal Museum
Route 1, Box 23-B
Parker, Arizona 85344
928-669-1335
520-669-8262 fax

Fort Mojave Indian Tribe

Nora McDowell, Chairwoman
Fort Mojave Indian Tribe
500 Merriman Avenue
Needles, California 92363
760-629-4591
fax: 760-629-5767

copy to:

Linda Otero, Director
Aha Makav Cultural Society
Fort Mojave Indian Tribe
P.O. Box 5990
(street: 10225 Harbor Avenue)
Mojave Valley, Arizona 86440
928-768-4475
928-768-7996 fax

Havasupai Tribe

Rex Tilousi, Chairman
Havasupai Tribe
P.O. Box 10
Supai, Arizona 86435
(street: 10 Main Street)
520-448-2731
520-448-2551 fax
Havasupai@nbs.nau.edu

copy to:

Roland Manakaja, Director
Natural Resources
Havasupai Tribe
P.O. Box 10
(Street: 10 Main Street)
Supai, Arizona 86435
520-448-2271
520-448-2551 fax

Hualapai Tribe

Charles Vaughn, Chair
Hualapai Tribe
P.O. Box 179
(street: 215 Diamond Creek Road)
Peach Springs, Arizona 86434-0179
928-769-2216
520-769-2343 fax

copy to:

Loretta Jackson, Historic Preservation Officer
Office of Cultural Resources
Hualapai Tribe
P.O. Box 310
(Street: 878 W. Route 66)
Peach Springs, Arizona 86434-0179
928-769-2223/2234
520-769-2235 fax
"Loretta Jackson" <lorjac@citlink.net>

San Juan Southern Paiute

Johnny Lehi Sr., President
San Juan Southern Paiute Tribe
P.O. Box 1989
Tuba City, Arizona 86045
928-283-4587/4589
928-283-5761 fax

Yavapai-Apache Nation

Jamie Fullmer, Chairman
Yavapai-Apache Nation
2400 W. Datsi Street
Camp Verde, Arizona 86322
520-567-3649
520-567-3994 fax

copy to:

Christopher Coder, Archaeologist
Cultural Resources
Yavapai-Apache Nation
P.O. Box 1188
(street: 200 W. Datsi Street)
Camp Verde, Arizona 86322
928-567-7026
520-567-3994 fax

Yavapai-Prescott Indian Tribe

Ernie Jones Sr., President
Yavapai-Prescott Indian Tribe
530 E. Merritt Street
Prescott, Arizona 86301
520-445-8790
520-778-9445 fax

copy to:

Nancy Hayden, Director of Research
Cultural Research Committee
Yavapai-Prescott Indian Tribe
530 E. Merritt Street
Prescott, Arizona 86301
928-445-8790 x135
928-778-9445 fax
nhayden@pit.com

Zuni Tribe

Arlen P. Quetawki Sr., Governor
Zuni Pueblo
P.O. Box 339
(street: 1203 B, Hwy. 63)
Zuni, New Mexico 87327-0339
505-782-4481
505-782-2700 fax

Dr. Jonathan Damp
Tribal Historic Preservation Officer
Zuni Cultural Resources Enterprise Office
Zuni Pueblo
P.O. Box 1149
(street: 22 B Ave.)
Zuni, New Mexico 87327-0339
505-782-4814
505-782-2393 fax
damp@nm.net

Las Vegas Paiute Tribe

Alfreda Mitre, Chairwoman
Kenny Anderson, Cultural Resources Coordinator
Las Vegas Paiute Tribe
1 Paiute Drive
Las Vegas, Nevada 89106
702-386-3926

Pahrump Paiute Tribe

Richard Arnold, Tribal Chair
Pahrump Paiute Tribe
P.O. Box 3411
Pahrump, Nevada 89041
702-647-5842 (LVIC)
street: Las Vegas Indian Center, Inc.
2300 W. Bonanza Road
Las Vegas, Nevada 89106

[Similar letter sent to the following recipients.]

James Garrison
State Historic Preservation Officer
Arizona State Parks
1300 W. Washington Street
Phoenix, Arizona 86007

Ronald M. James
State Historic Preservation Officer
Department of Cultural Affairs
100 North Stewart Street
Carson City, Nevada 89701-4285]

Leigh Kuwanwisiwma, Director
Cultural Preservation Office
Hopi Tribe
P.O. Box 123
Kykotsmovi, Arizona 86039



IN REPLY REFER TO:

United States Department of the Interior

OFFICE OF SURFACE MINING
Reclamation and Enforcement
P.O. Box 46667
Denver, Colorado 80201-6667

May 20, 2005

Charles Vaughn, Chair
Hualapai Tribe
P.O. Box 179
Peach Springs, Arizona 86434-0179

Dear Chairman Vaughn:

The Office of Surface Mining Reclamation and Enforcement is preparing an environmental impact statement (EIS) to evaluate potential impacts of the proposed Black Mesa Project. The project consists of the following components:

- Revision to Peabody Western Coal Company's life-of-mine plans for the Kayenta and Black Mesa surface coal mines.

The Kayenta Mine and Black Mesa Mine are on the Hopi and Navajo reservations on Black Mesa about 125 miles northeast of Flagstaff. The 44,073-acre Kayenta Mine supplies coal to the Navajo Generating Station in Page, Arizona, and the 18,849-acre Black Mesa Mine supplies coal to the Mohave Generating Station in Laughlin, Nevada.

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Currently, the Kayenta and Black Mesa Mines pump water from the Navajo Aquifer for use at the mines and in preparing the coal and water slurry at the preparation plant. Use of Navajo-Aquifer water would be largely reduced through development of an alternate water supply in the Coconino Aquifer north of Interstate 40 in the vicinity of Leupp, Arizona. A water delivery pipeline (including pumping plants, storage tanks, power lines, and access roads) would be built from the well field to the coal-slurry preparation plant at the Black Mesa Mine. Two routes for

the pipeline are being considered: a 108-mile long corridor through the Navajo and Hopi reservations and a 140-mile long corridor through the Navajo reservation.

Enclosed is a map that shows the locations of the project components and land ownership in the project vicinity. For further details on the project and EIS, visit the Office of Surface Mining's Internet Web site at <http://www.wrcc.osmre.gov/bmk-eis/Default.htm>.

The Office of Surface Mining expects to issue a draft EIS for public review in late 2005 or early 2006 and to issue a final EIS and record of decision on the life-of-mine revision in mid-2006.

Cultural resource studies will be conducted to identify potential impacts so they can be described and addressed in the EIS and to provide data for evaluating alternatives. The studies also will support consultations pursuant to Section 106 of the National Historic Preservation Act. The Office of Surface Mining is contacting you at this time to initiate the Section 106 consultation process. We anticipate that a Section 106 Programmatic Agreement will be developed to address potential adverse effects on cultural resources.

Direct and indirect impacts on cultural resources will be assessed. The area of potential effects for construction impacts would be defined as those areas where ground-disturbing construction activities would occur. There appears to be relatively little potential for less-direct impacts on cultural resources that could result from factors such as modifications of visual settings, increased noise, and surface water impacts, but they also will be considered. We would appreciate your advice regarding the definition of the area of potential effects for other types of impacts that should be addressed.

The planned cultural resource studies will include:

- Records and literature reviews to compile information about prior cultural resource studies and previously recorded cultural resources,
- Intensive field surveys to identify and evaluate unrecorded archaeological and historical resources, and
- Studies of traditional cultural places and lifeways.

Many of the areas that would be affected by the Black Mesa Project are on the Hopi and Navajo reservations, and the Hopi Tribe and Navajo Nation are cooperating in the preparation of the EIS. The Hopi Cultural Preservation Office and Navajo Nation Archaeology Department will be conducting the cultural resource studies on their respective reservations. The one component of the project that extends well beyond the reservations is the coal slurry line, which crosses about 180 miles of private land, Arizona State Trust land, and Federal land managed by the Bureau of Land Management and the Kaibab National Forest. We would appreciate any advice you may have regarding the design of the cultural resource inventory strategy.

We are aware that several tribes have traditional cultural affiliations with the project area, but there is little information available about places that have traditional cultural significance for those communities. We invite you to provide relevant information or express concerns that we should consider as the EIS and cultural resources studies are prepared. We would appreciate any suggestions regarding the types of direct or indirect impacts that should be considered, particularly with respect to traditional cultural lifeways and traditional cultural resources that have significance for your community. The Office of Surface Mining intends to conduct tribal consultations in an appropriate government-to-government

framework, and we invite your community to participate in the Section 106 consultations. **By June 7, 2005, please let us know whether your community wants to participate in the consultations.**

We look forward to your comments and collaboration as the planning for this challenging project continues. If you have any questions, please contact Foster Kirby, Archeologist, by telephone at 303-844-1400, extension 1467, or by e-mail at fkirby@osmre.gov.

Sincerely,

Peter A. Rutledge, Chief
Program Support Division

Enclosure

[Identical letters to addressees, with copies to cultural specialists when identified.]

**Black Mesa Project
Tribal Mailing List**
(updated 6 May 2005)

Chemehuevi Tribe

Shirley Smith, Chairwoman
Chemehuevi Tribe
P.O. Box 1976
Havasu Lake, California 92363
(street: 1990 Palo Verde Drive)
760-858-4219
760-858-5400 fax

Colorado River Indian Tribes

Daniel Eddy Jr., Chair
Colorado River Indian Tribes
Route 1, Box 23-B
Parker, Arizona 85344
928-669-9211 ext. 1281
928-669-1391 fax

copy to:

George Ray, Acting Director
Colorado River Indian Tribal Museum
Route 1, Box 23-B
Parker, Arizona 85344
928-669-1335
520-669-8262 fax

Fort Mojave Indian Tribe

Nora McDowell, Chairwoman
Fort Mojave Indian Tribe
500 Merriman Avenue
Needles, California 92363
760-629-4591
fax: 760-629-5767

copy to:

Linda Otero, Director
Aha Makav Cultural Society
Fort Mojave Indian Tribe
P.O. Box 5990
(street: 10225 Harbor Avenue)
Mojave Valley, Arizona 86440
928-768-4475
928-768-7996 fax

Havasupai Tribe

Rex Tilousi, Chairman
Havasupai Tribe
P.O. Box 10
Supai, Arizona 86435
(street: 10 Main Street)
520-448-2731
520-448-2551 fax
Havasupai@nbs.nau.edu

copy to:

Roland Manakaja, Director
Natural Resources
Havasupai Tribe
P.O. Box 10
(Street: 10 Main Street)
Supai, Arizona 86435
520-448-2271
520-448-2551 fax

Hualapai Tribe

Charles Vaughn, Chair
Hualapai Tribe
P.O. Box 179
(street: 215 Diamond Creek Road)
Peach Springs, Arizona 86434-0179
928-769-2216
520-769-2343 fax

copy to:

Loretta Jackson, Historic Preservation Officer
Office of Cultural Resources
Hualapai Tribe
P.O. Box 310
(Street: 878 W. Route 66)
Peach Springs, Arizona 86434-0179
928-769-2223/2234
520-769-2235 fax
"Loretta Jackson" <lorjac@citlink.net>

San Juan Southern Paiute

Johnny Lehi Sr., President
San Juan Southern Paiute Tribe
P.O. Box 1989
Tuba City, Arizona 86045
928-283-4587/4589
928-283-5761 fax

Yavapai-Apache Nation

Jamie Fullmer, Chairman
Yavapai-Apache Nation
2400 W. Datsi Street
Camp Verde, Arizona 86322
520-567-3649
520-567-3994 fax

copy to:

Christopher Coder, Archaeologist
Cultural Resources
Yavapai-Apache Nation
P.O. Box 1188
(street: 200 W. Datsi Street)
Camp Verde, Arizona 86322
928-567-7026
520-567-3994 fax

Yavapai-Prescott Indian Tribe

Ernie Jones Sr., President
Yavapai-Prescott Indian Tribe
530 E. Merritt Street
Prescott, Arizona 86301
520-445-8790
520-778-9445 fax

copy to:

Nancy Hayden, Director of Research
Cultural Research Committee
Yavapai-Prescott Indian Tribe
530 E. Merritt Street
Prescott, Arizona 86301
928-445-8790 x135
928-778-9445 fax
nhayden@pit.com

Zuni Tribe

Arlen P. Quetawki Sr., Governor
Zuni Pueblo
P.O. Box 339
(street: 1203 B, Hwy. 63)
Zuni, New Mexico 87327-0339
505-782-4481
505-782-2700 fax

copy to:

Dr. Jonathan Damp
Tribal Historic Preservation Officer
Zuni Cultural Resources Enterprise Office
Zuni Pueblo
P.O. Box 1149
(street: 22 B Ave.)
Zuni, New Mexico 87327-0339
505-782-4814
505-782-2393 fax
damp@nm.net

Las Vegas Paiute Tribe

Alfreda Mitre, Chairwoman
Kenny Anderson, Cultural Resources Coordinator
Las Vegas Paiute Tribe
1 Paiute Drive
Las Vegas, Nevada 89106
702-386-3926

Pahrump Paiute Tribe

Richard Arnold, Tribal Chair
Pahrump Paiute Tribe
P.O. Box 3411
Pahrump, Nevada 89041
702-647-5842 (LVIC)
street: Las Vegas Indian Center, Inc.
2300 W. Bonanza Road
Las Vegas, Nevada 89106

[LIST OF RECIPIENTS]

Shirley Smith, Chairwoman
Chemehuevi Tribe
P.O. Box 1976
Havasu Lake, California 92363

Daniel Eddy Jr., Chair
Colorado River Indian Tribes
Route 1, Box 23-B
Parker, Arizona 85344

George Ray, Acting Director
Colorado River Indian Tribal Museum
Route 1, Box 23-B
Parker, Arizona 85344

Nora McDowell, Chairwoman
Fort Mojave Indian Tribe
500 Merriman Avenue
Needles, California 92363

Linda Otero, Director
Aha Makav Cultural Society
Fort Mojave Indian Tribe
P.O. Box 5990
Mojave Valley, Arizona 86440

Rex Tilousi, Chairman
Havasupai Tribe
P.O. Box 10
Supai, Arizona 86435

Roland Manakaja, Director
Natural Resources
Havasupai Tribe
P.O. Box 10
Supai, Arizona 86435

Charles Vaughn, Chair
Hualapai Tribe
P.O. Box 179
Peach Springs, Arizona 86434-0179

Loretta Jackson, Historic Preservation Officer
Office of Cultural Resources
Hualapai Tribe
P.O. Box 310
Peach Springs, Arizona 86434-0179

Johnny Lehi Sr., President
San Juan Southern Paiute Tribe
P.O. Box 1989
Tuba City, Arizona 86045

Jamie Fullmer, Chairman
Yavapai-Apache Nation
2400 W. Datsi Street
Camp Verde, Arizona 86322

Christopher Coder, Archaeologist
Cultural Resources
Yavapai-Apache Nation
P.O. Box 1188
Camp Verde, Arizona 86322

Ernie Jones Sr., President
Yavapai-Prescott Indian Tribe
530 E. Merritt Street
Prescott, Arizona 86301

Nancy Hayden, Director of Research
Cultural Research Committee
Yavapai-Prescott Indian Tribe
530 E. Merritt Street
Prescott, Arizona 86301

Arlen P. Quetawki Sr., Governor
Zuni Pueblo
P.O. Box 339
Zuni, New Mexico 87327-0339

Dr. Jonathan Damp
Tribal Historic Preservation Officer
Zuni Pueblo
P.O. Box 1149
Zuni, New Mexico 87327-0339

Alfreda Mitre, Chairwoman
Kenny Anderson, Cultural Resources Coordinator
Las Vegas Paiute Tribe
1 Paiute Drive
Las Vegas, Nevada 89106

Richard Arnold, Tribal Chair
Pahrump Paiute Tribe
P.O. Box 3411
Pahrump, Nevada 89041

APPENDIX L



Appendix L

Federal Register Notices

- 1) Volume 69, Number 230, Wednesday, December 1, 2004: Notice of Intent to prepare an environmental impact statement and to hold public scoping meetings.
- 2) Volume 7, Number 23, Friday, February 4, 2005: Extension of the scoping comment period for an environmental impact statement.

- 1) Volume 69, Number 230, Wednesday, December 1, 2004: Notice of Intent to prepare an environmental impact statement and to hold public scoping meetings**

DEPARTMENT OF THE INTERIOR

Office of Surface Mining Reclamation and Enforcement

Black Mesa and Kayenta Mines, Life-of-Mine Plans and Water Supply Project, Coconino, Navajo, and Mohave Counties, AZ, and Clark County, NV

AGENCY: Office of Surface Mining Reclamation and Enforcement, Interior.

ACTION: Notice of intent to prepare an environmental impact statement and to hold public scoping meetings.

SUMMARY: Pursuant to the National Environmental Policy Act of 1969 (NEPA), the Office of Surface Mining Reclamation and Enforcement (OSM), as the lead Federal agency, plans to prepare an environmental impact statement (EIS) to analyze the effects of Peabody Western Coal Company's proposed operation and reclamation plans for the Black Mesa and Kayenta coal mines; the Coal Slurry Preparation Plant at the Black Mesa Mine; the reconstruction of the 273-mile long Coal Slurry Pipeline across northern Arizona from the Coal Slurry Preparation Plant to the Mohave Generating Station (electrical) in Laughlin, Nevada; the construction and operation of water wells in the Coconino aquifer (C-aquifer) northwest of Winslow, Arizona; and construction and operation of a water supply pipeline running about 120 miles across the Navajo and Hopi Reservations from the wells to the Coal Slurry Preparation Plant.

The Hopi Tribe, Navajo Nation, Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Bureau of Reclamation (BOR), U.S. Environmental Protection Agency (USEPA); U.S. Department of Agriculture Forest Service (USFS), County of Mohave, Arizona; and City of Kingman, Arizona, will cooperate with OSM in the preparation of the EIS.

OSM solicits public comments on the scope of the EIS and significant issues that should be addressed in the EIS.

At <http://www.wrcc.osmre.gov/bmk-eis>, interested persons may view information about the proposed projects; the comment period during which persons may submit comments; the locations, dates, and times of public scoping meetings; and the procedures that OSM will follow at the scoping meetings.

DATES: Written comments must be received by OSM by 4 p.m. on January 21, 2005, to ensure consideration in the preparation of the draft EIS.

Public scoping meetings will be held in:

- Saint Michaels, Arizona, on Monday, January 3, 2005, from 6 p.m. to 10 p.m. at the Saint Michaels Chapter House on Indian Route 12 about 2 miles south and west of Window Rock, Arizona.

- Forest Lake, Arizona, on Tuesday, January 4, 2005, from 12 p.m. to 4 p.m. at the Forest Lake Chapter House on Navajo Route 41 about 20 miles north of Pinon, Arizona.

- Kayenta, Arizona, on Tuesday, January 4, 2005, from 6 p.m. to 10 p.m. at the Kayenta Chapter House on Highway 163 at the intersection with Navajo Route 6485, Kayenta, Arizona.

- Kykotsmovi, Arizona, on Wednesday, January 5, 2005, from 6 p.m. to 10 p.m. at the Community Center, Kykotsmovi, Arizona.

- Leupp, Arizona, on Thursday, January 6, 2005, from 12 p.m. to 4 p.m. at the Leupp Chapter House on Navajo Route 15, Leupp, Arizona.

- Kingman, Arizona, Wednesday, January 12, 2005, from 12 p.m. to 4 p.m. at the Mohave County Board Room, Negus Building, 809 E. Beale Street, Kingman, Arizona.

- Laughlin, Nevada, on Wednesday, January 12, 2005, from 6 p.m. to 10 p.m. at the Laughlin Town Hall, 101 Civic Way, Laughlin, Nevada.

- Flagstaff, Arizona, on Thursday, January 13, 2005, from 6 p.m. to 10 p.m. at the Coconino County Board Room, 219 E. Cherry, Flagstaff, Arizona.

ADDRESSES: Comments may be submitted in writing or by e-mail. At the top of your letter or in the subject line of your e-mail message, please indicate that the comments are "BMK EIS Comments."

- E-mail comments should be sent to: BMK-EIS@osmre.gov.

- Written comments sent by first-class or priority U.S. Postal Service should be mailed to: Richard Holbrook, Chief, Southwest Branch, OSM WRCC, P.O. Box 46667, Denver, Colorado 80201-6667.

- Comments delivered by U.S. Postal Service Express Mail or by courier service should be sent to: Richard Holbrook, Chief, Southwest Branch, OSM WRCC, 1999 Broadway, Suite 3320, Denver, Colorado 80202-5733.

FOR FURTHER INFORMATION CONTACT: Richard Holbrook, Chief, Southwest Branch, Program Support Division, OSM Western Regional Coordinating Center, by telephone at (303) 844-1400, extension 1491, or by e-mail at BMK-EIS@osmre.gov.

SUPPLEMENTARY INFORMATION:

I. Background on the Black Mesa and

- Kayenta Mines
- II. Proposals for the Mines, Coal Slurry Pipeline, and C-Aquifer Water Supply System
- III. Decisions to Be Made by OSM and the Cooperating Agencies
- IV. Public Comment Procedures

I. Background on the Black Mesa and Kayenta Mines

The contiguous Black Mesa and Kayenta surface coal mines have operated since 1970 and 1973, respectively. Peabody Western Coal Company operates the mines on three leaseholds comprising about 65,000 acres within the boundaries of the Navajo and Hopi Reservations. The mines are located on the Black Mesa about 125 miles northeast of Flagstaff, Arizona, and 10 miles southwest of Kayenta, Arizona. The Kayenta Mine produces about 8.5 million tons of coal per year, all of which are delivered to the Navajo Generating Station near Page, Arizona, by electric railroad. Currently, the Kayenta Mine is to provide coal to the Navajo Generating Station through 2011. The Black Mesa Mine produces about 4.8 million tons of coal annually, all of which are delivered to the Mohave Generating Station at Laughlin, Nevada, through the 273-mile long Coal Slurry Pipeline originating at the Black Mesa Coal Slurry Preparation Plant. Currently, the Black Mesa Mine is to provide coal to the Mohave Generating Station through 2005.

Black Mesa Pipeline, Inc., operates the Coal Slurry Preparation Plant and the Coal Slurry Pipeline that transports coal from the Black Mesa Mine to the Mohave Generating Station. Currently, about 3,100 acre-feet of water from Peabody Western Coal Company's wells in the Navajo aquifer (N-aquifer) are used annually to slurry the coal.

II. Proposals for the Mines, Coal Slurry Pipeline, and C-Aquifer Water Supply System

In the past, public concern about the mines and related projects has centered on use of the N-aquifer water. Under the proposals, most of the water used by the Black Mesa and Kayenta Mines and Coal Slurry Pipeline would come from the C-aquifer rather than the N-aquifer. Peabody Western Coal Company would continue to pump some water from wells in the N-aquifer (about 500 acre-feet per year) for domestic uses at the mines, providing potable water for use by the local residents in the vicinity of the mines, and to ensure that the wells are functional in the event that they are needed for mining-related purposes or for the Coal Slurry Pipeline if there is a temporary or emergency disruption in

water delivery from the C-aquifer Water Supply System.

Peabody Western Coal Company's life-of-mine revision proposes that the Black Mesa and Kayenta Mines would continue mining through at least 2026. Mining methods would not change at either mine. The annual coal production rate at the Black Mesa Mine would increase from 4.8 million tons to 6.2 million tons and would remain unchanged at the Kayenta Mine. A coal wash plant would be constructed at the Black Mesa Mine to remove waste from the coal. The plant would extract about 0.8 million tons of waste from the coal each year. About 500 acre-feet of water would be used each year for washing the coal. Waste would be dewatered and disposed in the mining pits. The wastewater would be recycled through the wash plant. About 5.4 million tons of washed coal produced each year would be crushed and slurried with C-aquifer water at the Coal Slurry Preparation Plant and would be shipped to the Mohave Generating Station through the Coal Slurry Pipeline. Because of the increased coal production, the amount of water needed to slurry coal from the mine would increase from about 3,100 to 3,700 acre-feet per year. The Black Mesa Mine would use an additional 1,300 acre-feet of water for mine-related and domestic purposes (including coal washing). The Kayenta Mine would use an additional 800 acre-feet of water for mine-related and domestic purposes.

Black Mesa Pipeline, Inc., would replace about 95 percent of the 273-mile long Coal Slurry Pipeline because the existing pipeline is reaching its design life. The pipeline passes through the Navajo and Hopi Reservations; through Federal lands administered by the Bureau of Land Management and the U.S. Forest Service (Kaibab National Forest); through lands owned by the State of Arizona, the County of Mohave, Arizona, and the City of Kingman, Arizona; and through privately-owned lands. Pipeline reconstruction would involve decommissioning the existing buried pipeline (mostly leaving it in place) and burying a new coal slurry pipeline adjacent to the existing pipeline. Additional right-of-way width (about 15 feet) would be needed for construction activities along much of the 50-foot wide right-of-way. The new pipeline would pass under the Colorado River at Laughlin, Nevada and under the Little Colorado River east of Cameron, Arizona. The C-aquifer Water Supply System would provide an alternative water source to N-aquifer water currently used to slurry coal at the Black Mesa Preparation Plant and for mine-

related uses at the Black Mesa Mine and Kayenta Mine. The system would be capable of providing 6,000 acre-feet per year for coal slurry and mine-related uses. Development of this water supply system would provide an opportunity to make water available to the Navajo Nation and Hopi Tribe for municipal and industrial uses by expanding the system. In anticipation of the potential future use of the system for tribal purposes, OSM anticipates that it would evaluate an alternative that provides an expanded delivery system and well configuration design for up to an additional 5,600 acre-feet per year (*i.e.*, up to a total capacity of 11,600 acre-feet per year). The additional capacity would allow future spur pipelines to be constructed to Navajo and Hopi communities.

Major components of the C-aquifer Water Supply System would include:

- A well field in the southwest part of the Navajo Reservation (southwest of Leupp, Arizona) and, possibly, a well field on Hopi-owned lands immediately south of the Navajo Reservation well field, consisting of approximately 20 production wells (for the 11,600 acre-foot maximum capacity) and associated collector pipelines.
- An approximately 120-mile long main pipeline from the well field(s) north-northeast to the Black Mesa Mine following, to the extent possible, existing roads.
- Associated facilities (*e.g.*, an estimated five pump stations, access roads and electrical transmission lines).

III. Decisions To Be Made by OSM and the Cooperating Agencies

Under applicable laws, OSM and the cooperators would need to make several decisions on whether to approve various aspects of the Black Mesa and Kayenta Mines life-of-mine revision, the Coal Slurry Preparation Plant, the Coal Slurry Pipeline, and the C-aquifer Water Supply System. OSM has approval authority for the permit revision application for the Kayenta and Black Mesa Mines and the permit application for the Coal Slurry Preparation Plant. BLM has approval authority for the mining plan for the Kayenta and Black Mesa Mines. BIA, Navajo Nation, and Hopi Tribe would have various realty actions to undertake such as granting of rights-of-way, as well as approval authorities and responsibilities for several other components of the project, such as C-aquifer water usage. BLM, USFS, Mohave County, and City of Kingman also would have realty actions to undertake such as granting of rights-of-way. USEPA has a number of responsibilities under the Clean Water

Act including section 401 certification authority, which is a prerequisite to section 404 permit authorization. Under section 402, USEPA issues and enforces National Pollutant Discharge Elimination System (NPDES) permits. USEPA also is responsible for implementing the Clean Air Act requirements on the Hopi reservation and for implementing most Clean Air Act requirements on the Navajo reservation. USEPA recently delegated to the Navajo Environmental Protection Agency the Clean Air Act Part 71 Operating Permit Program for sources located on Navajo land. Some aspects of the proposed projects will require a Department of the Army permit from the U.S. Army Corps of Engineers under section 404 of the Clean Water Act and section 10 of the River and Harbor Act of 1899.

The EIS would evaluate the environmental effects of the proposed project and a variety of alternatives. Alternatives that may be evaluated include alternative alignments for the Coal Slurry Pipeline and the C-aquifer water supply pipeline, amounts of water to be withdrawn from the C-aquifer for tribal municipal and industrial uses as well as mine related and coal slurry uses, and a variety of approval and disapproval options related to the various components of the project. Other alternatives may be evaluated based on the comments received during the scoping comment period.

IV. Public Comment Procedures

In accordance with the Council on Environmental Quality's regulations for implementing NEPA, 40 CFR parts 1500 through 1508, OSM solicits public comments on the scope of the EIS and significant issues that it should address in the EIS.

Written comments, including email comments, should be sent to OSM at the addresses given in the ADDRESSES section of this notice. Comments should be specific and pertain only to the issues relating to the proposals. OSM will include all comments in the administrative record.

If you would like to be placed on the mailing list to receive future information, please contact the person listed in the section, **FOR FURTHER INFORMATION CONTACT**, above.

Availability of Comments

OSM will make comments, including names and addresses of respondents, available for public review during normal business hours. OSM will not consider anonymous comments. If individual respondents request confidentiality, OSM will honor their

requests to the extent allowable by law. Individual respondents who wish to withhold their name or address (except for the city or town) from public review must state this prominently at the beginning of their comments and must submit their comments by regular mail. All submissions from organizations or businesses and from individuals identifying themselves as representatives or officials of organizations or businesses will be available for public review in their entirety.

Scoping Meetings

If you wish to speak at a scoping meeting, you should sign up to speak when you arrive at the meeting. OSM will call upon persons to speak in the order of the sign-in. If you are in the audience and have not signed up to speak, you will be allowed to speak after those who have signed up. For persons who wish not to speak, OSM also will accept written comments at the meeting.

A transcriber will be present at the meetings to record comments. To assist the transcriber and ensure an accurate record, OSM requests that each speaker provide a written copy of his or her comments, if possible. OSM will end the meeting after everyone who wishes to speak has been heard. If a large number of people wish to speak at a meeting, OSM may limit the length of time each person has to speak in order to give everyone an opportunity to speak.

Hopi and Navajo interpreters will be present at meetings on the Hopi and Navajo Reservations.

If you are disabled or need special accommodations to attend one of the meetings, contact the person under **FOR FURTHER INFORMATION CONTACT** at least one week before the meeting.

Dated: November 17, 2004.

Allen D. Klein,

Regional Director, Western Regional Coordinating Center.

[FR Doc. 04-26439 Filed 11-30-04; 8:45 am]

BILLING CODE 4310-05-P

INTERNATIONAL TRADE COMMISSION

[Inv. No. 337-TA-508]

Certain Absorbent Garments; Notice of a Commission Determination Not To Review an Initial Determination Terminating the Investigation With Respect to all Respondents on the Basis of a Consent Order; Issuance of Consent Order; Termination of Investigation

AGENCY: U.S. International Trade Commission.

ACTION: Notice.

SUMMARY: Notice is hereby given that the U.S. International Trade Commission has determined not to review an initial determination ("ID") of the presiding administrative law judge ("ALJ") granting the joint motion of the complainants and four respondents, Grupo ABS Internacional, S.A. de C.V., Absormex S.A. de C.V., and ABS Bienes de Capital S.A. de C.V. all of Mexico, and Absormex USA, Inc., of Laredo, Texas, to terminate the above-captioned investigation with respect to those respondents on the basis of a consent order. The investigation is terminated in its entirety.

FOR FURTHER INFORMATION CONTACT: Michael K. Haldenstein, Esq., telephone 202-205-3041, Office of the General Counsel, U.S. International Trade Commission, 500 E Street, SW., Washington, DC 20436. Copies of all nonconfidential documents filed in connection with this investigation are or will be available for inspection during official business hours (8:45 a.m. to 5:15 p.m.) in the Office of the Secretary, U.S. International Trade Commission, 500 E Street SW., Washington, DC 20436, telephone 202-205-2000. General information concerning the Commission may also be obtained by accessing its Internet server (<http://www.usitc.gov>). The public record for this investigation may be viewed on the Commission's electronic docket (EDIS-ON-LINE) at <http://edis.usitc.gov>. Hearing-impaired persons are advised that information on the matter can be obtained by contacting the Commission's TDD terminal on 202-205-1810.

SUPPLEMENTARY INFORMATION: The Commission instituted this investigation on May 2, 2004, based on a complaint filed by Tyco Healthcare Retail Group, Inc. and Paragon Trade Brands, Inc. A supplement to the complaint was filed on April 26, 2004. The complaint, as supplemented, alleges violations of section 337 in the importation into the United States, the sale for importation,

and the sale within the United States after importation of certain absorbent garments by reason of infringement of claims 1, 9, 12-13 of U.S. Patent No. 5,275,590, claims 1-2 of U.S. Patent No. 5,403,301, and claims 8-9 of U.S. Patent No. 4,892,528. The complaint further alleges that there exists an industry in the United States as required by subsection (a)(2) of section 337. The complaint named three respondents: Grupo ABS Internacional, S.A. de C.V. and Absormex S.A. de C.V. of Mexico, and Absormex USA, Inc. of Laredo Texas. ABS Bienes de Capital S.A. de C.V. was added as a respondent on July 15, 2004.

On October 12, 2004, the two complainants and the four respondents filed a joint motion to terminate the investigation as to all four respondents. The joint motion was based on a proposed consent order, filed pursuant to a consent order stipulation and Memorandum of Understanding (MOU) between the parties. The Commission Investigative Attorney ("IA") filed a response in support of the motion on October 22, 2004. The ALJ denied the joint motion on October 27, 2004 because it appeared to him that the parties may have intended to have the Commission enforce the MOU. The parties then moved for reconsideration of the denial of the joint motion on October 29, 2004.

The ALJ issued the subject ID on November 2, 2004, granting the motion for reconsideration and terminating the investigation as to all four respondents on the basis of a consent order. The ALJ indicates in the ID that he is satisfied that the parties made clear in their motion for reconsideration that they do not intend for the Commission to enforce the MOU. The ID also indicates that the consent order stipulation satisfies the provisions of Commission rule 210.21(c)(3)(i). No petitions for review of the subject ID were filed.

This action is taken under the authority of section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. 1337, and Commission rule 210.42, 19 CFR 210.42.

Issued: November 24, 2004.

By order of the Commission.

Marilyn R. Abbott,

Secretary to the Commission.

[FR Doc. 04-26485 Filed 11-30-04; 8:45 am]

BILLING CODE 7020-02-P

- 2) **Volume 7, Number 23, Friday, February 4, 2005: Extension of the scoping comment period for an environmental impact statement**

6107, Salt Lake City, Utah, 84138; telephone (801) 524-3715; faxogram (801) 524-3858; e-mail at dkubly@uc.usbr.gov at least five (5) days prior to the meeting. Any written comments received will be provided to the AMWG and TWG members.

FOR FURTHER INFORMATION CONTACT: Dennis Kubly, telephone (801) 524-3715; faxogram (801) 524-3858; or via e-mail at dkubly@uc.usbr.gov.

Dated: January 24, 2005.

Randall V. Peterson,

Manager, Environmental Resources Division, Upper Colorado Regional Office, Salt Lake City, Utah.

[FR Doc. 05-2142 Filed 2-3-05; 8:45 am]

BILLING CODE 4310-MN-P

DEPARTMENT OF THE INTERIOR

Office of Surface Mining Reclamation and Enforcement

Black Mesa and Kayenta Mines, Life-of-Mine Plans and Water Supply Project, Coconino, Navajo, and Mohave Counties, AZ, and Clark County, NV

AGENCY: Office of Surface Mining Reclamation and Enforcement, Interior.

ACTION: Extension of the scoping comment period for an environmental impact statement.

SUMMARY: Pursuant to the National Environmental Policy Act of 1969 (NEPA), the Office of Surface Mining Reclamation and Enforcement (OSM) is extending the scoping comment period for the Black Mesa Project environmental impact statement (EIS). The Black Mesa Project includes Peabody Western Coal Company's proposed operation and reclamation plans for the Black Mesa and Kayenta coal mines; the Coal Slurry Preparation Plant at the Black Mesa Mine; the reconstruction of the 273-mile long Coal Slurry Pipeline across northern Arizona from the Coal Slurry Preparation Plant to the Mohave Generating Station (electrical) in Laughlin, Nevada; the construction and operation of water wells in the Coconino aquifer (C-aquifer) northwest of Winslow, Arizona; and construction and operation of a water supply pipeline running about 120 miles across the Navajo and Hopi Reservations from the wells to the Coal Slurry Preparation Plant.

DATES: Written comments must be received by OSM by 4 p.m. on March 4, 2005, to ensure consideration in the preparation of the draft EIS.

ADDRESSES: Comments may be submitted in writing or by e-mail. At the

top of your letter or in the subject line of your e-mail message, please indicate that the comments are "BMK EIS Comments."

- E-mail comments should be sent to: BMK-EIS@osmre.gov.

- Written comments sent by first-class or priority U.S. Postal Service should be mailed to: Richard Holbrook, Chief, Southwest Branch, OSM WRCC, P.O. Box 46667, Denver, Colorado 80201-6667

- Comments delivered by U.S. Postal Service Express Mail or by courier service should be sent to: Richard Holbrook, Chief, Southwest Branch OSM WRCC, 1999 Broadway, Suite 3320, Denver, Colorado 80202-5733

FOR FURTHER INFORMATION CONTACT: Richard Holbrook, Chief, Southwest Branch, Program Support Division, OSM Western Regional Coordinating Center, by telephone at (303) 844-1400, extension 1491, or by e-mail at BMK-EIS@osmre.gov.

SUPPLEMENTARY INFORMATION: On December 1, 2004, OSM published in the **Federal Register** a notice of intent to prepare an EIS for the Black Mesa Project and to hold public scoping meetings (69 FR 69951).

OSM held eight scoping meetings to solicit public comments on the scope of the EIS and significant issues that should be addressed in the EIS. Due to the complex nature of the project and numerous concerns expressed during the scoping meetings, OSM is extending the scoping comment period.

The Black Mesa Project includes Peabody Western Coal Company's proposed operation and reclamation plans for the Black Mesa and Kayenta coal mines; the Coal Slurry Preparation Plant at the Black Mesa Mine; the reconstruction of the 273-mile long Coal Slurry Pipeline across northern Arizona from the Coal Slurry Preparation Plant to the Mohave Generating Station (electrical) in Laughlin, Nevada; the construction and operation of water wells in the Coconino aquifer (C-aquifer) northwest of Winslow, Arizona; and construction and operation of a water supply pipeline running about 120 miles across the Navajo and Hopi Reservations from the wells to the Coal Slurry Preparation Plant. At www.wrcc.osmre.gov/bmk-eis, interested persons may view information about the proposed projects.

In accordance with the Council on Environmental Quality's regulations for implementing NEPA, 40 CFR Parts 1500 through 1508, OSM solicits public comments on the scope of the EIS and

significant issues that it should address in the EIS.

Written comments, including email comments, should be sent to OSM at the addresses given in the **ADDRESSES** section of this notice. Comments should be specific and pertain only to the issues relating to the proposals. OSM will include all comments in the administrative record.

If you would like to be placed on the mailing list to receive future information, please contact the person listed in the section, **FOR FURTHER INFORMATION CONTACT**, above.

OSM will make comments, including names and addresses of respondents, available for public review during normal business hours. OSM will not consider anonymous comments. If individual respondents request confidentiality, OSM will honor their requests to the extent allowable by law. Individual respondents who wish to withhold their name or address (except for the city or town) from public review must state this prominently at the beginning of their comments and must submit their comments by regular mail. All submissions from organizations or businesses and from individuals identifying themselves as representatives or officials of organizations or businesses will be available for public review in their entirety.

Dated: January 27, 2005.

Allen D. Klein,

Regional Director, Western Regional Coordinating Center.

[FR Doc. 05-2180 Filed 2-3-05; 8:45 am]

BILLING CODE 4310-05-P

INTERNATIONAL TRADE COMMISSION

[Investigation No. 731-TA-101 (Second Review)]

Greige Polyester/Cotton Printcloth From China

AGENCY: United States International Trade Commission.

ACTION: Revised schedule for the subject review.

EFFECTIVE DATE: January 28, 2005.

FOR FURTHER INFORMATION CONTACT: Gail Burns (202-205-2501), Office of Investigations, U.S. International Trade Commission, 500 E Street SW, Washington, DC 20436. Hearing-impaired persons can obtain information on this matter by contacting the Commission's TDD terminal on 202-205-1810. Persons with mobility impairments who will need special