SUMMARY

INTRODUCTION

Diné Power Authority (DPA), a Navajo Nation enterprise, proposes to construct, operate, and maintain a 500 kilovolt (kV) transmission line planned to deliver electric power from the Four Corners area in northwestern New Mexico across northern Arizona to a terminus in southeastern Nevada. The proposed project, the Navajo Transmission Project (NTP), is currently planned to be in service in the year 2001 and operate for about 50 years.

The preparation of an environmental impact statement (EIS) is required because of Federal government involvement, which includes (1) granting rights-of-way across Federal and tribal lands and (2) certain participation by Western Area Power Administration (Western), and agency of the U.S. Department of Energy (DOE). In accordance the National Environmental Policy Act of 1969 (NEPA), Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 CFR 1500-1508), DOE implementing regulations, and other applicable regulations, Western prepared this draft EIS (DEIS) to document the analysis of the potential effects that the proposed project could have on the natural, human, and cultural resources in the project area. Western is serving as the lead Federal agency under whose direction the EIS is being prepared.

The following sections provide summary descriptions of the purpose and need for the proposed project; alternatives considered including the proposed project; alternative routes including the environmentally preferred; affected environment; environmental consequences; and scoping, consultation, and coordination.

PURPOSE AND NEED

For more than a decade, regional electrical transmission systems have become increasingly stressed by the lack of adequate bulk transmission capacity west from the Four Corners area in northwestern New Mexico. Several thousand megawatts of power generation was added in the Rocky Mountains/Four Corners/Desert Southwest (RM/FC/DS) region in the 1970s and 1980s, but no new transmission lines have been constructed west from the Four Corners area since 1970. Although a number of projects have been planned, lack of approved rights-of-way across the Navajo Indian Reservation has precluded completion of any of the projects.

Considering this need for transmission of power west from the Four Corners area, DPA is pursuing the opportunity to develop an extra-high-voltage transmission line from the Shiprock Substation in northwestern New Mexico to the Mead Substation or the Marketplace Substation in southeastern Nevada. DPA was established as an enterprise by the Navajo Nation Council to promote the Navajo Nation's development of energy resources and new sources of transmission capacity. The proposed NTP is an opportunity of the Navajo Nation to own a transmission line that would be an integral part of a regional electrical transmission system in the western United States.

As the project is currently envisioned, revenue would be generated by leasing the capacity of the transmission line to regional utilities. Annual revenues over the life of the project would provide funds to allow the Navajo Nation to improve its economic condition and allow for investment in other long-range productive business opportunities. NTP is one project of a broader effort of the Navajo Nation to promote development to create a viable economy that provides for a decent standard of living, services, and jobs for the Navajo people.

The purposes and needs for the proposed project are described below.

Relieve the constraints on the transmission of electricity west from the Four Corners area to the Desert Southwest Currently, more energy can be imported from the north on existing transmission lines into the Four Corners area than is capable of being exported with existing transmission capacity to the west. The existing system is fully committed to transmitting energy from the Four Corners area and is generally heavily loaded, causing the amount of power scheduled across any one line to be periodically cut back to keep flows within established line limits. This transmission "bottleneck" essentially precludes economic sales of electricity to markets in south-central Arizona, Nevada, and southern California for which an estimate of future load growth is more than 10,000 megawatts (MW) during the next 10 years. A project with the characteristics of NTP would play an integral role in meeting a portion of this projected load growth.

Improve operational flexibility and reliability of the extra-high-voltage transmission system in the event of an outage of a parallel transmission system and, therefore, improve the overall system reliability in the RM/FC/DS region The extra-high-voltage transmission system west of Four Corners consists of one 500kV and two 345kV transmission lines. Under extreme operating conditions, there is a potential for the 500kV line to fail, an event that would automatically route the power to the 345kV lines and potentially cause an overload on the two 345 kV lines. The system could then exceed maximum limits for power flow, which would cause the power generators to slow down or shut off to avoid overloading and damaging the generators and the 345kV lines. NTP would provide additional capacity to support the system. Also, NTP would help enhance the existing transmission system grid in the western United States and contribute to increased reliability, efficiency, and capability, especially in the RM/FC/DS region.

Allow increased economical power transfers, sales, and purchases in the RM/FC/DS region Removing the existing transmission restriction, utilities in the area would be able to support their peak load periods by importing power from existing hydro and coal-fired generation in the Rocky Mountain area. Such economic purchases reduce the use of more expensive generation. NTP would improve the operational flexibility of area generation facilities and take advantage of economic and seasonal diversity in the electrical power market. When lower cost surplus power is available to the north and east of Four Corners, it could be "wheeled" across NTP to customers west and south of Four Corners, providing a sales benefit to the provider and a benefit to the purchasing utility ultimately resulting in lower rates to the customers.

Improve economic conditions of the Navajo Nation The Navajo Nation, the second largest American Indian tribe in the United States, is economically disadvantaged according to U. S. government statistics. Economic indicators suggest an absence of a strong and diverse economic base within the Navajo Nation.

Since the Economic Recovery Act of 1981 and later Gramm-Rudman initiatives, there has been a substantial reduction in Federal funding to tribes, and continued decreases are anticipated. The Navajo Nation realizes that it must develop programs and projects that generate revenue for producing sustainable growth, building economic self-sufficiency, and reinvesting in further productive activities. Over the life of the project, annual revenues would provide funds for the Navajo Nation to allow for investment in other business opportunities. In addition, development of NTP would provide short-term employment for American Indians during construction in a region that has an unemployment rate of about 30 percent (on the Navajo Reservation). After construction, it is anticipated that there may be limited opportunities for long-term employment in aspects of operation and maintenance of the transmission line. Availability of electricity on Navajo Nation lands also is critical to economic growth and infrastructure development of the Navajo Nation. NTP would allow Western an alternate path for firm-power deliveries, thus reducing dependence and freeing capacity on the 230kV path for increased deliveries to the Kayenta and Long House Valley substations. That would provide the Navajo Tribal Utility Authority (NTUA) with more flexibility to plan additional distribution of electricity.

Facilitate the Navajo Nation's development of energy resources and participation in the electric utility industry The role of the Navajo Nation in the energy industry traditionally has been that of a passive resource owner. Nonrenewable resources from Navajo Nation lands are exported to provide fuel for power for much of the western United States. The economy and self-sufficiency of the Navajo Nation depend heavily on the export of these resources. However, the businesses associated with the energy activities are typically non-Navajo. NTP is an opportunity for the Navajo Nation to own a transmission line that would be an integral part of a regional electrical transmission system, thereby establishing a role in the electric utility industry.

ALTERNATIVES INCLUDING THE PROPOSED ACTION

The following discussion addresses alternatives considered but eliminated from further study and project alternatives studied in detail.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER STUDY

Energy conservation and electric load management The intent of this alternative is to promote regional energy conservation among consumers through load management and development of energy standards and electric equipment standards. This requires that the demand for electricity be reduced through conservation. This alternative, however, would meet only a small part of the purpose and need for the proposed project. It would forestall the increase in regional energy demands only for a short period of time, while having no effect on the transmission system constraints west of the Four Corners area or on the economic condition of the Navajo Nation. Also, it is anticipated that the relief on energy demands brought about by this alternative would be minimal at best because most of the market area, such as southern California and southern Nevada, already has aggressive energy conservation and load management programs in place.

New generation facilities Building new generation facilities would help meet the increasing energy needs of the southwestern United States and, depending on the location of the generation project, could conceivably benefit the Navajo Nation. However, new generation facilities would not remove the transmission system constraints west of the Four Corners area and, in fact, would aggravate the situation. Not only is new transmission needed to remove existing constraints, but additional new transmission would be needed to accommodate new power generated.

Existing transmission systems Consideration was given to (1) scheduling power from the Four Corners area to major load areas via different existing transmission paths, (2) using a phase shifting transformer or transmission line compensation on existing paths, (3) using a phase shifting transformer or transmission line compensation on the existing transmission paths, and (4) upgrading Western's 230kV line. All of the electrical paths out of the Four Corners area are often scheduled to maximum capacity, meaning that there is more capacity available than can be safely scheduled out of the area. In addition, scheduling over alternate paths means a loss of revenue to other utilities who then have to find new paths, as well as absorb the increase in wheeling costs. The results of using a phase shifter or series compensation only partially mitigate the basic problem of lack of capacity available on the existing transmission system. Also, over the past several years Western has implemented upgrades to maximize the capability of its Shiprock-to-Glen Canyon 230kV line; however, the improvements were short term. This alternative has a very low benefit-to-cost ratio.

Alternative transmission technologies Alternative transmission technologies of (1) using voltage levels other than 500kV, (2) direct current (DC) versus alternative current (AC), (3) underground construction versus overland construction, and (4) use of new technologies were considered. Constructing a transmission line at other than 500kV would accomplish fewer of the benefits sought by project proponents. Adjusting the voltage level would result in either increased costs for construction (at higher voltage levels) or compromising capacity (at lower voltage levels). The key difference between DC and AC is the resulting flexibility of the system. The AC system can be interconnected to the existing electrical system more economically. Because of technical complications, economic cost, environmental impacts, and inaccessibility for maintenance, an underground system was not considered a viable alternative. Current research and development for other potential methods for bulk-power transmission of electric energy such as microwave, laser, and superconductors are not currently available for commercial use.

ALTERNATIVES STUDIED IN DETAIL

Alternatives studied in detail are no action and the proposed action, including alternative transmission line routes.

No-action alternative If no action is taken, the right-of-way for NTP would not be acquired and the transmission line would not be built. Advantages of the no-action alternative would include saving of construction costs of the new facilities and the preclusion of associated impacts on the environment. However, the needs of the project, described above, would not be met.

Proposed action As previously explained, NTP is a proposed 500kV AC transmission line from Western's Shiprock Substation west of Farmington in northwestern New Mexico to either Western's Mead Substation or the Marketplace Substation, both of which are south of Boulder City in southern Nevada. The approximate length of the line would be 400 to 500 miles depending on the alternative route selected for construction.

Figures 2-1 and 2-2 show the different types of tower structures typically used for a 500kV transmission line. The line would be supported primarily by guyed "V" steel-lattice structures, averaging 120 feet in height, spaced 1,200 to 1,500 feet apart. Other types of tower structures may be used in certain areas for engineering or economic reasons, or to mitigate environmental impacts. These other types include a guyed "delta", self-supporting steel-lattice, or steel pole. More robust structures would be used in areas of difficult terrain, areas where the span of the transmission line would be longer than normal, or where the line would angle or turn.

The right-of-way, or the strip of land over which the transmission line would cross, would be 250 feet wide. Figure 2-5 illustrates the right-of-way concept for NTP.

Ancillary facilities would include new equipment in the existing substations at the eastern and western ends of the transmission line, a new intermediate substation, and addition of equipment at an existing communication site. To supplement the existing microwave communication system, fiber optic cable may be imbedded in the overhead ground wire, and if the Red Lake site were to be chosen for the intermediate substation, a repeater (parabolic dish) would be added to an existing microwave tower on Bill Williams Mountain.

Upon selection of a route for the transmission line and prior to construction, a plan for the development and implementation of the project (a construction, operation, and maintenance plan, or COMP) would be prepared by the project proponents in coordination with by the affected regulatory and land-managing agencies. Construction of NTP would begin in late 1998 and would take about 2.5 years to complete. The life of the project is projected to be 50 years.

Typically, construction of a transmission line and associated facilities involves the following activities:

- surveying the transmission line centerline and substation sites
- identifying/upgrading or constructing temporary and long-term access roads
- clearing activities for right-of-way, tower sites, construction yards, batch plants, and substation sites
- excavating and installing foundations
- assembling and erecting towers with temporary and permanent pad sites
- installing substation equipment
- clearing of pulling, tensioning, and splicing sites
- stringing conductors and ground wires
- installing counterpoise (tower grounds) where needed
- cleaning up and reclaiming affected land areas

ALTERNATIVE ROUTES

A number of alternative routes for the proposed transmission line were identified, studied, and compared. The objective was to identify an environmentally preferred route. Substation sites and other ancillary facilities were studied as well. The substation site(s) selected for such facilities would depend on the final route selected for the transmission line.

PROCESS

The process used to compare the routes included the following steps.

The *Regional Corridor Environmental Feasibility* was conducted to identify potential corridors feasible for constructing a transmission line. Most of these paralleled existing linear features (e.g., transmission lines, pipelines), which is preferable since the construction of a second line in an existing utility corridor is a compatible use of land, would be less intrusive, and minimize new disturbance (e.g., existing access roads can be used).

The initial corridors were refined, then reviewed by the public and relevant agencies through *Scoping,* which initiated the NEPA process. During scoping, issues and concerns were identified that could help focus the further evaluation of alternatives.

A *Resource Inventory* was then conducted for each alternative route to establish the baseline of existing environmental resources. Through scoping and the inventory, a number of environmental issues were identified that influenced the direction of the analyses. Environmental issues included the following:

- accelerated soil erosion and degradation of water quality
- effects on special status plant and wildlife species
- effects on critical habitat, habitat fragmentation, and protection of biodiversity in certain habitats
- placing a priority on paralleling existing linear features
- effects on residences, agriculture, and timber management
- proximity of the transmission line to communities
- restricting uses within or adjacent to the proposed right-of-way
- proximity to and effects on parks, preservation, and recreation areas
- effects on scenic quality
- effects on cultural resources including archeological sites, special status sites, and traditional cultural places
- effects of electric and magnetic fields on the health of humans and animals

Once data were compiled, the environmental resource data were assessed to determine the potential impacts that could result from implementing the project. During *Impact Assessment and Mitigation Planning*, initial impacts of the project on each resource were identified, measures to effectively mitigate the impacts were recommended, and residual impacts (those that remain after mitigation) were determined. Through a systematic analysis, all of the alternative routes were *Screened and Compared*, based on potential impacts and key issues, in order to narrow the number of alternative routes and select the environmentally preferred alternative route (Figures A-2, A-3, 2-14, and 2-15).

RESULTS

For ease of comparison and presenting the results, the project area was divided into eastern and western areas. The Moenkopi Substation represents the midpoint: the endpoint of the eastern alternative routes and the beginning point of the western alternative routes. Four eastern area alternatives and six western area alternatives were carried forward for analysis in the DEIS. In the western area, three of the alternatives terminate at the Marketplace Substation and three at the Mead Substation. The alternative routes are listed below and shown on Figure 2-10.

Eastern Area Alternatives

Glen Canyon 1 (GC1)—260.6 miles
Kaibito 1 (KB1)—244.7 miles
Central 1 (C1)—186.7 miles
Central 2 (C2)—211.0 miles

Western Area Alternatives

Moenkopi to Marketplace
Northern 1 West (N1W)—217.0 miles
Northern 2 (N2)—225.1 miles
Southern 2 (S2)—247.7 miles

Moenkopi to Mead
Northern 3 (N3)—199.3 miles
Northern 4 (N4)—207.4 miles
Southern 4 (S4)—230.0 miles

These alternatives were compared and ranked based on potential impacts and key issues. In most locations, the issues and adverse impacts could be mitigated and the impacts remaining overall would be predominantly low (indiscernible-to-slight change to the environment) and some moderate (slight-to-substantial change). Only in some areas did high impacts (substantial-to-significant change) remain that could not be wholly resolved at this stage of the project. These potentially high impacts are associated with certain areas of traditional cultural places and visual resources (Figures 2-12 and 2-13).

Environmentally Preferred Alternative Routes

In the eastern portion of the project area, the environmentally preferred route is Kaibito 1 (K1), which would connect the Shiprock Substation with either the Red Mesa, Copper Mine, or Moenkopi Substation site. K1 is 244.7 miles long and parallels the Shiprock-to-Glen Canyon 230kV and the Glen Canyon-to-Pinnacle Peak 345kV transmission lines for a total of 178.8 miles (73 percent of the route). High adverse impacts on visual resources would be concentrated in the Kayenta area resulting from introduction of a new transmission line corridor in an area of high scenic quality and potential foreground views from residences. High adverse impacts on traditional Navajo and Hopi cultural places would be minimized using K1 by avoiding the issue areas of the Chuska Valley, Chuska Mountains, and southern portion of the Black Mesa, but would result in the area of northern Black Mesa and Marsh Pass.

In the western portion of the project area, two environmentally acceptable routes were identified—Northern 1 West (N1W) and Northern 3 (N3). The two alternatives share the same route for about 152 miles of the eastern majority of the alternative and then diverge to either the Mead Substation or the Marketplace Substation. Both alternative routes parallel existing transmission lines along their entire lengths and both cross the Colorado River. N1W parallels a 500kV transmission line and connects the Moenkopi Substation site with the Marketplace Substation. Lake Mead National Recreation Area is crossed by both N1W and N3, and prefers N1W (the southern crossing of the Colorado River) because the terrain is less rugged, there is less sensitive habitat, and there is only one existing transmission line crossing the river. N3 would connect Moenkopi Substation with the Mead Substation and uses the northern crossing of the Colorado River, which is traversed by two lines. The western portion of N3 parallels the Mead-to-Liberty 345kV line and the recently constructed Mead-to-Phoenix 500kV line, the access road of which was upgraded during its construction. No high impacts would result along either of these alternatives, and both are preferred to minimize impacts on traditional cultural places.

DECISIONS TO BE MADE

The final route for the transmission line has not been selected. Following the review of the DEIS, the comments on the DEIS and proposed action received from the public and agencies will be reviewed, analyzed, and incorporated as appropriate into the final EIS (FEIS). The FEIS will be distributed to the public with a Record of Decision by the Administrator of Western. The Record of Decision will (1) state what the decision is, (2) identify all alternatives considered in reaching the decision, and (3) state whether all practical means to avoid or minimize harm from the alternative selected have been adopted, and if not, why they were not. The Administrator will ensure that the decision is consistent with sound practices and that the decision is executed as stipulated.

AFFECTED ENVIRONMENT

The character of the existing environment in the project area is summarized below.

Climate—The climate is characterized by low relative humidity, a high percentage of sunshine, and relatively large temperature ranges. Average temperatures range from the mid 40s to the low 90s in the lowest elevations and from the upper 20s to the mid 60s in the highest elevations. Average annual precipitation ranges from approximately 4.2 inches in the lowest elevations to 22.8 inches in the highest elevations.

Air Quality—Air quality in the project area is generally characteristic of rural areas with some influence from industrial areas such as the coal-fired San Juan and Four Corners generating stations. The rest of the project area is sparsely populated with little or no commercial or industrial development. One Class

I air quality area occurs in the Glen Canyon National Recreation Area. (Class I areas are afforded the highest level of protection from air quality degradation, as opposed to Class II and Class III areas.) The Glen Canyon National Recreation Area, a Class I area, is not crossed by any of the alternative routes. The remainder of the project area is Class II.

Water Resources—The project area lies within an arid region including parts of two major hydrologic regions—the Great Basin system (Nevada portion) and the Colorado River system. There are two major perennial streams within the project area—the San Juan and Colorado rivers. The study focused on identifying locations of springs, perennial streams, and 100-year floodplains.

Earth Resources—The project area includes portions of three physiographic provinces—Colorado Plateau, Transition Zone, and Basin and Range. Mineral resources of economic importance (e.g., coal, oil, natural gas, uranium) are present in the project area, seismic activity has been identified for portions of the project area in all three states, and soil erosion potentials range from slight to high or severe.

Biological Resources—The project area supports diverse biological resources. The eight major vegetation types present within the project area are habitats for a diversity of wildlife species. Approximately 473 species of wildlife occur including 95 species of mammals, 268 species of birds, 71 species of reptiles and amphibians, and 39 species of fish. Wetlands are limited, occurring at springs or in association with other permanent water bodies.

Special status plant and wildlife species, species of concern to various agencies, are known or have the potential to occur along the alternative routes. Habitat suitable to support approximately 33 special status plant and 104 special status wildlife species have been identified by land-managing agencies including Federal, state, and tribal authorities, as well as the U.S. Fish and Wildlife Service (FWS). Habitats designated as critical to support special status species, as defined by the Endangered Species Act, are the San Juan River (Colorado squawfish and razorback chub), Chuska Mountains (Mexican spotted owl), Colorado River (bonytail chub and razorback sucker), and the Nevada portion of the project area (Mojave desert tortoise). California condors are to be released in the Vermillion Cliffs west of Page, and a management area has been established in the Aubrey Valley for reintroducing a population of black-footed ferrets. Both species are designated by FWS as "nonessential, experimental" populations, which reduces the level of protection afforded them under the Endangered Species Act. The reintroduction of black-footed ferret began in March of 1996.

Paleontological Resources—Sedimentary deposits underlying the alternative routes include 51 different geologic units, of which 25 have been assigned a high paleontologic potential, meaning there is a high potential for scientifically important fossils to be located there.

Land Use—The project area is located in portions of New Mexico, Arizona, and Nevada. The land uses inventoried included jurisdictions, as well as existing uses, future uses, and parks, preservation, and recreation areas. Alternative routes cross lands that are privately owned and those administered by Federal, tribal, state, and local agencies. Federal agencies that administer lands include Bureau of Land Management (BLM), Forest Service, National Park Service (NPS), Bureau of Indian Affairs (BIA), and the Bureau of Reclamation. Also crossed are lands of three American Indian groups—Navajo, Hopi, and Hualapai. The Navajo Nation owns (fee simple) land in the Big Boquillas Ranch area and the Hualapai own (fee simple) property near their reservation (Robinson Ranch area), both of which are crossed by alternative routes. The state of Arizona administers and owns land that could be crossed by NTP alternatives. No state lands were identified along the alternative routes in New Mexico or Nevada.

Existing land uses in the project area include residential, agriculture, timber, rangeland for grazing, and mining. Residences are dispersed throughout the project area with a greater number of residences located adjacent to alternative routes in the eastern portion of the project area. There is one area of irrigated agriculture crossed near the San Juan River in New Mexico. Timber management areas are in the Chuska Mountains, Defiance Plateau, and Kaibab National Forest. Livestock graze throughout the project area. Numerous individual, small mining claims are dispersed in areas along the alternative routes particularly in the western portion of the project area. Also, the project area is traversed by numerous highways, roads, and linear utilities. The majority of NTP alternative routes parallel existing utility corridors. Generally, the Federal agency management plans and community plans reviewed indicate that the agencies and communities will continue to manage their respective areas for the rural, open space character, allowing for compatible uses.

Socioeconomics—The socioeconomic study addressed baseline economic conditions for each of seven counties crossed by NTP alternative routes in three states. The seven counties included an aggregate population of about 1.3 million in 1990 and projections indicate an increase to 1.8 million by the year 2000. The American Indian population in the project area was about 166,000 in 1990, including 155,276 Navajo reservation residents, people living on the Hopi and Hualapai reservations, and the San Juan Southern Paiutes. Economic indicators (income, employment, dependency, and household size) show that San Juan County, New Mexico, and Apache and Navajo counties in Arizona have relatively high levels of economic dependency and distress compared to other counties in the region. Clark County, Nevada, and Yavapai and Mohave counties, Arizona have substantially higher levels of employment, income, housing value, and educational attainment. Coconino County indicators fall in between the two.

Visual Resources—The project area includes a diverse range of largely undeveloped vistas and open landscapes interspersed with small communities and rural towns. Landscapes are dominated by the distinctive features and landforms of the Colorado Plateau and Basin and Range physiographic provinces. The scenic quality of the large majority of the landscapes crossed by the alternative routes is minimal or average. Lands of outstanding or distinctive scenery accounted for about nine percent of the alternative routes.

Cultural Resources—Archaeological and historical sites are abundant throughout the project area, but little of the project area has been intensively inventoried. About 280 previously recorded archaeological and historical sites were identified, within a 0.5-mile-wide corridor, along all the alternative routes. About 15 percent of these are in New Mexico, 81 percent in Arizona, and 4 percent in Nevada.

A total of 10 special status cultural resources were identified within a six-mile-wide corridor. Two of these are in New Mexico, seven in Arizona, and one in Nevada.

The project area encompasses the traditional territories of many American Indian groups who continue to reside in the area, and traditional cultural places along the alternative routes were addressed. Places associated with traditional religions and ceremonies, and other nonritual traditional uses are found throughout much of the project area. Studies were conducted with the involvement of ethnographic specialists and members of the three tribes whose reservation lands would or could be crossed by the proposed transmission line—the Navajo Nation, Hopi Tribe, and Hualapai Tribe.

ENVIRONMENTAL CONSEQUENCES

NO ACTION

If no action is taken, the right-of-way for NTP would not be granted and the transmission line would not be constructed. Funds for the new facilities would not be expended and the environment would remain as it presently exists. However, the need for the project would not be met. Constraints on the transmission of electricity in the area would not be relieved; operational flexibility and reliability would not be improved; and economical power transfers, sales, and purchases in the area would not increase. The Navajo Nation would have to seek other means to attempt to improve its economic conditions and develop energy resources. Also, considering cultural and paleontological resources, this alternative would forego the opportunity to develop detailed inventories and recovery of data that might be undertaken to mitigate impacts of the proposed project.

PROPOSED ACTION

Potential environmental consequences, or impacts, that could result from the proposed project are summarized below.

Air Quality—Impacts on air quality would be short term, occurring only during construction in the form of temporary fugitive dust. Impacts on air quality are anticipated to be low.

Water Resources—Impacts on water resources would be low. Surface water resources (springs and perennial streams) would be spanned by the transmission line. No impacts on groundwater are anticipated since construction activities are not expected to reach groundwater depths.

Biological Resources—The primary concerns regarding biological resources are the effects on special status plants and wildlife species, vegetation (loss of habitat), and wildlife (particularly big game). Areas of concern include The Hogback (Mancos milkvetch and Mesa Verde cactus), Chuska Mountains (big game and biodiversity), northern Black Mesa (raptors), Aubrey Valley (black-footed ferret management area), Truxton Plain (pronghorn), Black Mountains (bighorn sheep), Eldorado Valley (desert tortoise).

Overall, residual impacts on biological resources would be low. Since the majority of the alternative routes parallel existing linear facilities (e.g., transmission lines), the need for new access roads is minimized thereby reducing the amount of vegetation loss and habitat modification. Mitigation is expected to effectively reduce impacts. Measures include carefully placing towers to avoid and/or span sensitive features, minimizing the amount of ground disturbance and loss of habitat, curtailing construction during critical seasons of the life cycles of certain species of wildlife, and restricting public access into sensitive areas (e.g., bighorn sheep and pronghorn habitat).

Residual impacts on habitats suitable for special status plant and wildlife species are anticipated to be low. The project proponents would be required to adhere to mitigation set forth in a Biological Opinion (U.S. Fish and Wildlife Service, Section 7 of the Endangered Species Act) for species listed as threatened or endangered. Also, the project proponents would coordinate with land-managing agencies to develop measures for species of concern that are not Federally listed.

Paleontological Resources—Potential impacts on paleontological resources are anticipated to be low. The inventory identified areas that have a high potential for yielding paleontological data. Areas considered by the land-managing agencies to be particularly sensitive and could not be avoided by construction activities, would be surveyed and data would be recovered prior to construction.

Land Use—The greatest potential for land use impacts appeared to be potential impacts on residences, but these were mitigable. Impacts on agriculture are expected to be low considering that towers would be judiciously placed. Impacts on timber management are predicted to be moderate in the Chuska Mountains and are low for the remaining portions of the alternative routes. Long-term impacts on grazing would be low because of the minimal amount of disturbance to rangelands and minimal displacement of animal unit months.

Impacts on future land uses would be low based on known future plans along the alternative routes and the use of existing utility corridors. Impacts on parks, preservation, and recreation areas along the alternative routes would be low primarily because the routes generally avoid these areas and follow existing utility corridors.

Socioeconomics—Employment and local purchases during construction of NTP would result in positive direct and indirect socioeconomic effects. Construction costs for NTP are estimated at $332 million (1995 dollars) based on the average length of the alternative routes. Up to 225 people would be employed during project construction; about half of the construction workforce would be hired locally, creating short-term job opportunities. The economy in the project area also would benefit from local purchases of construction materials, and goods and services such as food, lodging, concrete, and fuel. Regional economic modeling was conducted to estimate the direct and indirect economic impacts on individual counties, accounting for multiplier effects that include wages and salaries, and tax revenues. Results show that projected county output would range from $7 million in Yavapai County to $140 million in Coconino County.

Visual Resources—As mentioned, the majority of each alternative route parallels existing transmission lines. In these instances, residual impacts on visual resources would vary from low to moderate. Mitigation measures that would effectively reduce the short- and long-term visual impacts include minimizing new access roads, matching structure locations and types, and using nonspecular conductors. Where NTP would be establishing a new corridor, the construction and operation of the transmission line could result in impacts that range from moderate to high.

Cultural Resources—Impacts on archaeological and historical sites generally are rated as low to moderate throughout the project area. This is primarily a result of the ability to mitigate these impacts through detailed cultural surveys of the selected route and data recovery, where appropriate. Impacts on special status cultural resources are generally rated as low to moderate because most are relatively distant from the alternative routes and their settings already have been affected by previous transmission lines. Impacts on traditional cultural places generally are rated as high throughout much of the project area as none of the alternative routes can avoid these high impact areas.

Electric and Magnetic Fields—The operation of the proposed transmission line was evaluated for "corona" and "field" effects. These potential effects would be similar to or less than other 500kV transmission lines in Arizona. The electric and magnetic fields produced by the NTP line at the edge of the right-of-way would be lower than limit values established by other states (Arizona, New Mexico, and Nevada have no recommended field limits for transmission lines).

Despite the finding that the magnetic fields produced by the NTP transmission line would be below the values set by states with established criteria, and that NTP would result in magnetic field exposures well below those recommended by international and national scientific organizations, additional evaluation was made of research on the potential effects of long-term exposure to magnetic fields. Reports of weak and inconsistent associations between estimated exposure to magnetic fields and human health have not been determined to reflect a causal relationship. Laboratory studies have not provided either a mechanism or experimental basis to identify hazardous effects of exposures at the levels associated with the NTP transmission line. Similarly, a review of agriculture and wildlife studies did not indicate that plants and animals would be disturbed or affected by the fields from the line. One aspect of transmission line operation considered to be of concern is the possibility of induced shock from electricity flowing through or near conductive objects (e.g., irrigation pipes or vehicle antennas). Safety education and strict adherence to the National Electric Safety Code for safe distances from conductors are recommended.

The function of some models of cardiac pacemakers or defibrillators, which are implanted in persons to regulate heartbeat, may be affected by electric fields similar to those that would be generated by NTP. However, these fields are already present along existing transmission lines that parallel 60 to 100 percent of the alternative routes. In addition, less than three percent of the devices in use could be susceptible due to design improvements, and it appears that an extremely small percentage of people in the project area would have pacemakers (or would ever come near enough to the line to feel any effects).

No significant unavoidable adverse impacts were identified for biological, earth, paleontological, land use, socioeconomic, air, or noise resources for NTP. Significant unavoidable adverse impacts on visual and traditional cultural places are shown in Table 4-18.

The DEIS addresses the potential cumulative effects of NTP as well. Cumulative effects are the aggregate impacts of an action when added to other past, present, and reasonably foreseeable future actions in the same geographic area. For NTP, the cumulative effects analysis focuses largely on other transmission lines in the area. In fact, the Federal Land Management Policy Act mandates that utility projects should be located within existing utility corridors to minimize cumulative effects. Cumulative effects are discussed by resource in Chapter 4 of the DEIS, but in summary, the majority of NTP is located along existing corridors so the cumulative effects of the project are anticipated to be very small.

The DEIS also compares short-term impacts with long-term productivity of the project. Any environmental consequences are expected to occur in the short term, meaning that the environment would not be seriously or negatively altered by the project in the long term. The majority of environmental impacts would occur during construction-related ground disturbance. In the long term (50 years and beyond), the project is expected to expand and strengthen the regional electrical power network and to contribute to the economic growth and development of the Navajo Nation. Short-term and long-term effects are discussed more thoroughly in Chapter 4 of the DEIS.

SCOPING, CONSULTATION, AND COORDINATION

Scoping, a process open to the public and conducted early in the project, served to identify the range or scope of issues to be addressed during the environmental studies and in the EIS. Activities associated with scoping included (1) agency contacts and coordination with cooperating agencies; (2) public meetings; and (3) letter and newsletter mailings, media releases, and notices posted on and off the Navajo, Hopi, and Hualapai reservations to inform and solicit comments.

Early in the project, representatives of Western and DPA held several meetings with a number of agencies that could have some jurisdictional interest in the project. A total of 25 agency meetings were held. Further, Western requested that Federal agencies and American Indian tribes potentially affected by the project cooperate in preparing the EIS. These cooperating agencies include the Forest Service, BLM, BIA, NPS, Navajo Nation, Hopi Tribe, and Hualapai Tribe.

Twenty public meetings were conducted by Western at various locations within the project area from August through October in 1993. More than 325 people attended the meetings, and 131 written responses were received. In addition, newsletters were mailed, notices were posted, and print and broadcast media were notified. In general, comments from both the public and agencies related to project need, benefits, the transmission line alternative routes, right-of-way, and health and safety. These comments and the entire agency coordination and public involvement program are discussed in Chapter 5 of the DEIS.

The scoping activities described above are just part of the comprehensive program for agency coordination and public participation that was developed as an integral part of the environmental process (Chapter 5). Since scoping, additional newsletters have been distributed to provide updates on the project. Presentations were made at Hopi and Hualapai community meetings, Navajo Chapter meetings, grazing committee meetings, and various tribal government committee meetings. Displays at Navajo fairs have provided information to the public.

Public information meetings were later held in June 1995 to provide information about the preliminary results of the environmental studies and alternative route analysis. Comments similar to those received during scoping were expressed. Public review of the DEIS will be completed during a 60-day review period and through formal public hearings to be conducted by Western during the fall of 1996. There will be a public review of the FEIS as well.

Another related element of the environmental process is "environmental justice," which is mandated in the form of Executive Order 12898. The executive order requires that Federal actions avoid disproportionately high and adverse impacts on minority or low income communities. Based on the results of the NTP DEIS, no such impacts are anticipated. The project area encompasses a large geographic region within which are the reservations of three culturally different American Indian groups.

Considering the magnitude of the project and the economic importance of its outcome to the Navajo Nation, it is important that information about the project reach and be understood by people residing throughout the area for the project to be accepted. In order to encourage public partnerships and communication with low income and minority populations in the project area, the public involvement program (Chapter 5), integrated with the environmental planning process, was designed to be comprehensive and to respect and incorporate the different socio-cultural perspectives into the environmental analysis criteria. The process provided opportunities for public participation in and access to information on health and the environment as it relates to NTP. Serious attention to all public comments enhanced the outcome of the process.

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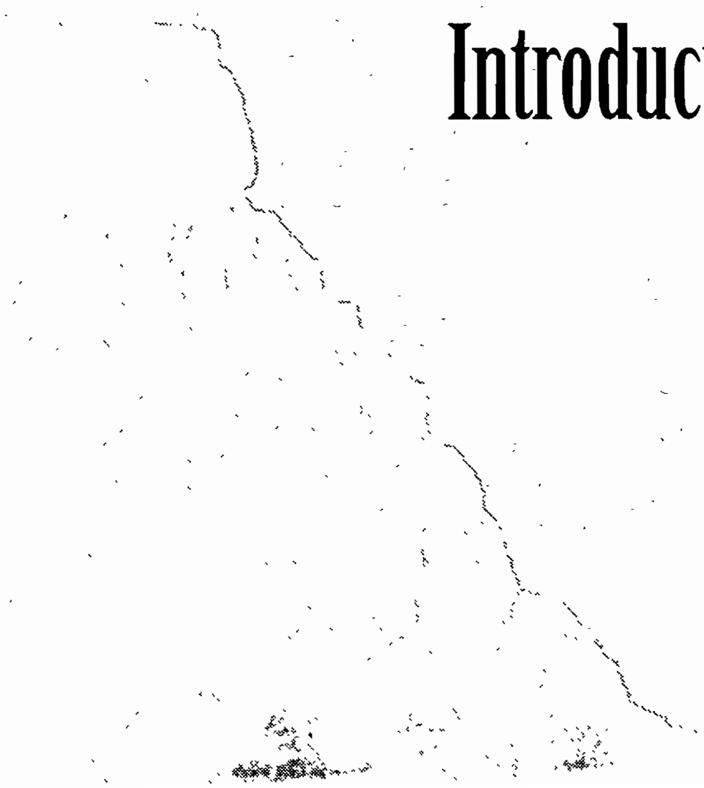
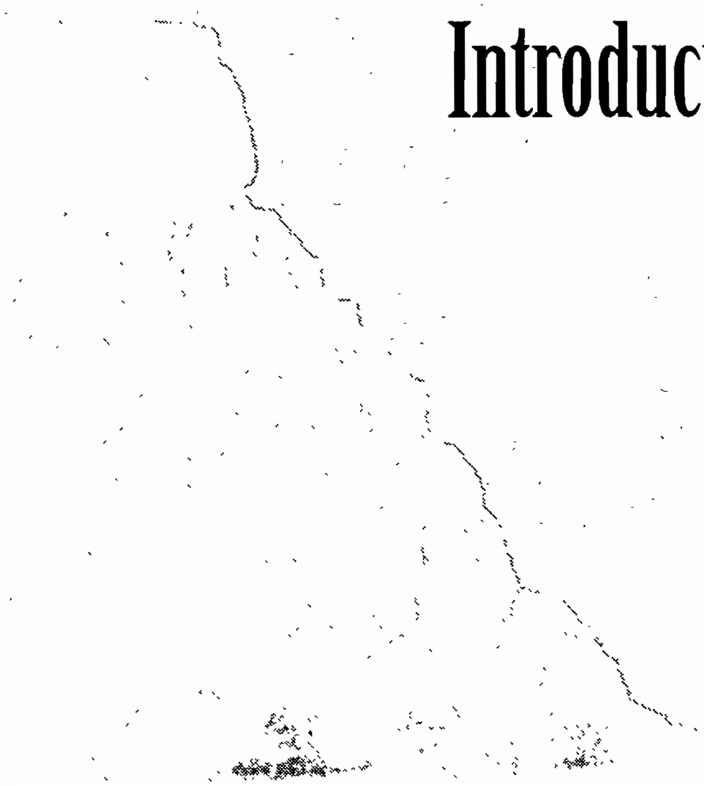


Introduction



INTRODUCTION

Diné Power Authority (DPA), an enterprise of the Navajo Nation, proposes to construct, operate, and maintain a 500 kilovolt (kV) transmission line from the Four Corners area to a terminus in southern Nevada. This draft environmental impact statement (DEIS) was prepared to document the analysis of the potential effects that the proposed action, the Navajo Transmission Project (NTP), could have on the natural, human, and cultural resources in the project area. The preparation of an EIS is required because of Federal government involvement, which includes (1) granting rights-of-way across Federal and tribal lands, and (2) certain participation by Western Area Power Administration (Western), an agency of the U.S. Department of Energy (DOE).

ORGANIZATION OF THIS DOCUMENT

The body of the DEIS contains five chapters and is followed by five sections of reference materials. Chapter 1 provides an explanation of the purpose and need for the project, as well as the planning requirements, environmental review, and licensing or permits anticipated to implement the project. Chapter 2 provides a description of the alternatives including the proposed action. This includes examining alternatives to implementing the proposed transmission line, as well as identifying and examining alternative routes for the proposed transmission line. Chapter 3 presents a description of the natural, human, and cultural environment of the project area, as it exists prior to the proposed action. This information served as the baseline data to assess potential impacts of the proposed transmission line. Chapter 4 contains a description of the potential consequences, or impacts, on the environment that could result from no action or implementing the proposed action, and measures to mitigate the impacts. Chapter 5 provides a description of the comprehensive program for agency coordination and public participation that was conducted in concert with the environmental process. The remaining sections provide bibliographic references, list of preparers and contributors, list of acronyms, glossary, and index.

Additional explanatory information that supports the DEIS is included in five appendices. Appendix A contains an overview of the route selection process, including study and analysis methods and tables comparing the alternative routes for each resource. Appendix B provides a comprehensive explanation regarding the addition and/or elimination of alternative routes or segments of alternative routes. Appendix C describes the alternative routes addressed in the DEIS; that is, the four alternative routes in the eastern portion of the project area and six alternative routes in the western portion. Appendix D contains data supporting the biological resources sections of Chapters 3 and 4. Appendix E contains information supporting the land use sections of Chapters 3 and 4.

The DEIS is accompanied by a map volume containing 19 maps that illustrate the alternatives and represent the various natural, human, and cultural resources studied for the DEIS. These maps should be reviewed in conjunction with the text of the DEIS. Each map is listed at the beginning of the map volume.

DOCUMENTATION SUPPORTING THE DEIS

Beginning with the initial studies, the process, methods, and study and analysis results have been compiled and/or documented for a comprehensive record. These documents and data supporting the DEIS, which are available upon request from Western, are listed below.

- *Regional Environmental Feasibility Study* (June 1992)—A report on the feasibility of alternative routes for the proposed transmission line.

- *Scoping Report* (January 1994)—A report on the scoping process that initiated the Federal environmental impact statement (EIS) studies and analyses, including summaries of issues and concerns identified from agency and public meetings.

- *Mitigation Plan* (September 1996)—A plan documenting the mitigation measures committed for project alternatives.

- *Resource Data Supporting the DEIS* (September 1996)—Information describing the inventory and impact assessment methods and results for each environmental resource studied.

ACRONYMS

AC	alternating current
ACEC	area of critical environmental concern
ACGIH	American Conference of Governmental Industrial Hygienists
ACHP	Advisory Council on Historic Preservation
ACSR	aluminum conductor steel reinforced
AFUDC	allowance for funds used for construction
AM	amplitude modulation
APS	Arizona Public Service
ARPA	Archaeological Resources Protection Act
ARS	Arizona Revised Statutes
AUM	animal unit month
BA	biological assessment
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CJA	Council January
COE	Corps of Engineers
COMP	Construction, Operation, and Maintenance Plan
CRPA	Cultural Resource Protection Act
CRSP	Colorado River Storage Project
dB	decibel
dBA	decibels, A-weighted
DC	direct current
DEIS	Draft Environmental Impact Statement
DOE	Department of Energy
DPA	Diné Power Authority
EIS	environmental impact statement
EMF	electric and magnetic field
EPA	Environmental Protection Agency
EPAMP	Energy Planning and Management Program
EPNG	El Paso Natural Gas
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEIS	final EIS
FERC	Federal Energy Regulatory Commission

FLPMA	Federal Land Policy and Management Act
FM	frequency modulation
FWS	U.S. Fish and Wildlife Service
GIS	geographic information system
GSCAP	Government Services Committee April
ICNIRP	International Commission on Non-ionizing Radiation Protection
IRP	Integrated Resource Plans
ISA	Instant Study Area
kV	kilovolt
kV/m	kilovolt/meter
LWCF	Land and Water Conservation Fund
MBTA	Migratory Bird Treaty Act
mG	milli-Gauss
MNA	Museum of Northern Arizona
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NAC	Nevada Administration Code
NDEP	Nevada Division of Environmental Protection
NEPA	National Environmental Policy Act
NESC	National Electric Safety Code
NESL	Navajo Endangered Species List
NFWD	Navajo Fish and Wildlife Department
NHPA	National Historic Preservation Act
NMSA	New Mexico Statutes Annotated
NNC	Navajo Nation Council
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRA	National Recreation Area
NRPB	National Radiological Protection Board
NRS	Nevada Revised Statutes
NSGS	Navajo South Generating Station
NTC	Navajo Tribal Code
NTP	Navajo Transmission Project
NTTL	Navajo Tribal Trust Lands
NTUA	Navajo Tribal Utility Authority
OSC	Oil Spill Contingency
OHV	off-highway vehicle

ppb	parts per billion
PL	public law
PM_{10}	particulate matter
PSD	prevention of significant deterioration
RCJN	Resource Committee January
RM/FC/DS	Rocky Mountains/Four Corners/Desert Southwest
SHPO	State Historic Preservation Officer
SPCC	Spill Prevention Control and Countermeasure
SRP	Salt River Project
TEP	Tucson Electric Power
USC	U.S. Code
USGS	U.S. Geological Survey
v	volts
V/m	volts/meter
VRM	visual resource management
VQO	visual quality objective
Western	Western Area Power Administration
WSA	wilderness study area
WSCC	Western Systems Coordinating Council

CHAPTER 1 - PURPOSE AND NEED

The purpose of this chapter is to briefly explain the purposes and needs for the proposed action. Also provided is a description of the potential planning requirements, environmental review, and permits or licensing that may have to be completed to implement the proposed action.

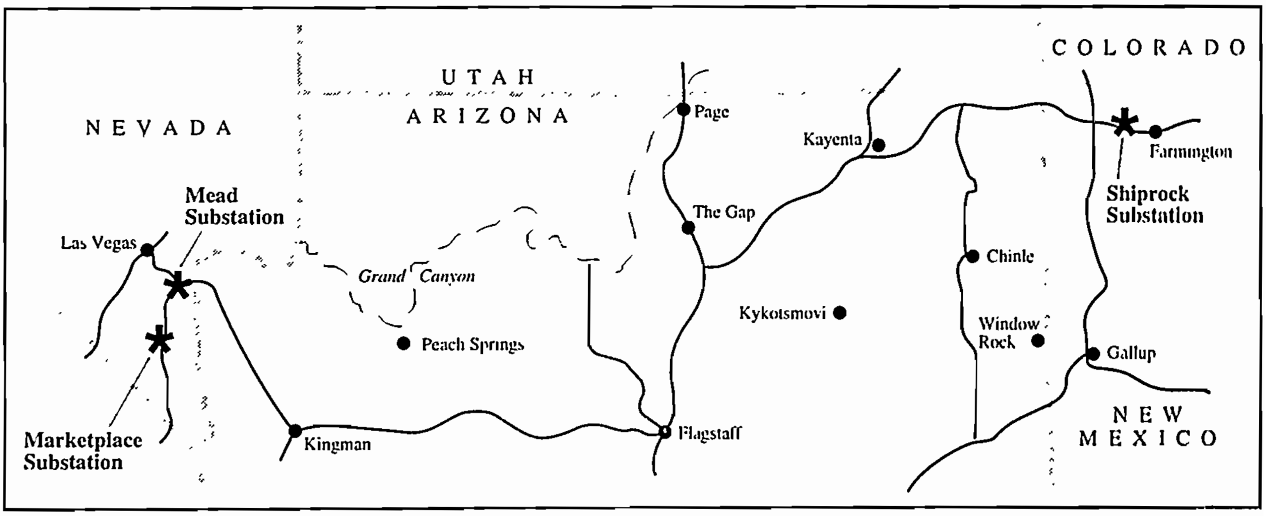
The following purposes and needs must be met when identifying and evaluating the range of reasonable alternatives that would accomplish the proposed action:

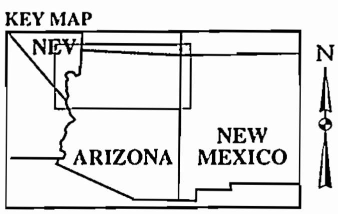
- relieve constraints on the transmission of electricity west from the Four Corners area to the Desert Southwest
- improve operational flexibility and reliability of the extra-high-voltage transmission system in the event of an outage of a parallel transmission system and, therefore, improve the overall system reliability in the Rocky Mountains/Four Corners/Desert Southwest (RM/FC/DS) region
- allow increased economical power transfers, sales, and purchases in the RM/FC/DS region
- improve economic conditions of the Navajo Nation
- facilitate the Navajo Nation's development of energy resources and participation in the electric utility industry

BACKGROUND

For more than a decade, regional electrical transmission systems have become increasingly stressed by the lack of adequate bulk transmission capacity west from the Four Corners area in northwestern New Mexico. Several thousand megawatts of power generation was added in the RM/FC/DS region in the 1970s and 1980s, but no new transmission lines have been constructed west from the Four Corners area since 1970. Although a number of projects have been planned, lack of approved rights-of-way across the Navajo Indian Reservation has precluded completion of any of the projects.

Considering this need for transmission of bulk power west of the Four Corners area, Diné Power Authority (DPA) is pursuing the opportunity to develop an extra-high-voltage transmission line from Shiprock Substation west of Farmington, New Mexico, across northern Arizona to the Mead or the Marketplace Substation in southern Nevada (Figure 1-1). DPA was established as an enterprise by the Navajo Nation Council to promote the Navajo Nation's development of energy resources and new sources of transmission capacity. The proposed Navajo Transmission Project (NTP) is an opportunity for the Navajo Nation to own a transmission line that would be an integral part of a regional electrical transmission system in the western United States.





PROJECT VICINITY
FIGURE 1-1

As the project is currently envisioned, revenue would be generated by leasing the capacity of the transmission line to regional utilities. Annual revenues over the life of the project would provide funds to allow the Navajo Nation to improve its economic condition and allow for investment in other long-range productive business opportunities. NTP is one project of a broader effort of the Navajo Nation to promote development to create a viable economy that provides for a decent standard of living, services, and jobs for the Navajo people.

DPA, the majority owner of NTP, began to develop the project in the early 1990s. Western Area Power Administration (Western) may participate and is assisting with preconstruction activities, including serving as the Federal lead agency for compliance with the National Environmental Policy Act of 1969 (NEPA).

As a Federal power-marketing agency, Western is responsible for marketing and transmitting power from Federal power facilities (e.g., Colorado River Storage Project [CRSP]) in 15 western states, which includes the RM/FC/DS region. Since the 1960s, Western has been assisting the Navajo Nation in meeting its energy needs through (1) existing firm-energy contract agreements with the Navajo Tribal Utility Authority (NTUA), a Navajo Nation enterprise providing utility services, and (2) various energy-related projects (such as construction and use of photo-voltaic units to serve remote residences on Navajo Nation lands).

Funding of the environmental and power-systems studies for NTP has been a combination of Navajo Nation funding to DPA and U.S. Congressional appropriations. Preconstruction activities are currently being supported through grants awarded under Section 2603(a) of Title XXVI of the Energy Policy Act of 1992, a program designed to support development of energy resources on American Indian reservations.

The following sections provide background information explaining the underlying purposes and needs listed above.

- ***Relieve constraints on the transmission of electricity west from the Four Corners area to the Desert Southwest***

Currently, more energy can be imported from the north on existing transmission lines into the Four Corners area than is capable of being exported with existing transmission capacity to the west. The existing system is fully committed to transmitting energy from the Four Corners area and is generally heavily loaded, causing the amount of power scheduled across any one line to be periodically cut back to keep flows within established line limits. This transmission "bottleneck" essentially precludes economic sales of electricity to markets in south-central Arizona, Nevada, and southern California. An estimate of future load growth in Arizona, Nevada, and southern California, based on conservative assumptions, is more than 10,000 megawatts (MW) during the next 10 years. A project with the characteristics of NTP would play an integral role in meeting a portion of this projected load growth.

Studies conducted by DPA and Western have shown that NTP would provide the needed transfer path for bulk electrical power and increase the electrical transfer level west of the Four Corners area. The additional capacity would support the existing system and prevent or reduce damages from outages, thereby enhancing the existing transmission grid and contributing to increased reliability, efficiency, and capability in the southwestern United States.

- ***Improve operational flexibility and reliability of the extra-high-voltage transmission system in the event of an outage of a parallel transmission system and, therefore, improve the overall system reliability in the RM/FC/SD region***

The extra-high-voltage transmission system west of Four Corners consists of one 500kV line and two 345kV lines owned by Arizona Public Service (APS). There are restrictions on how much capacity each of the lines west of Four Corners may carry for reasons of safety and reliability. A margin of safety has been provided in anticipation of the consequences should the largest line in the system (the 500kV line) suddenly fail. Under extreme operating conditions, there is the potential for the 500kV line to fail and cause an overload on the two parallel 345kV lines. That would happen when the power that was being carried on the 500kV line is automatically routed to the 345kV lines. The system could then exceed the maximum limits for power flow, causing the power generators to either slow down or shut off to avoid overloading and damaging the generators and the 345kV lines. Studies have shown that NTP would provide additional capacity to support the system and prevent or reduce damages from such an outage.

Several western states, two Canadian provinces, and the northern portion of Baja California and Norte Mexico form one interconnected electric power system that is largely independent from the rest of the United States, Canada, and Mexico. NTP would help enhance the existing transmission grid and contribute to increased reliability, efficiency, and capability, especially in the RM/FC/DS region. Figure 1-2 shows 345kV and 500kV transmission lines in the western United States and Western's Shiprock-to-Glen Canyon 230kV line in the project area.

- *Allow increased economical power transfers, sales, and purchases in the RM/FC/DS region*

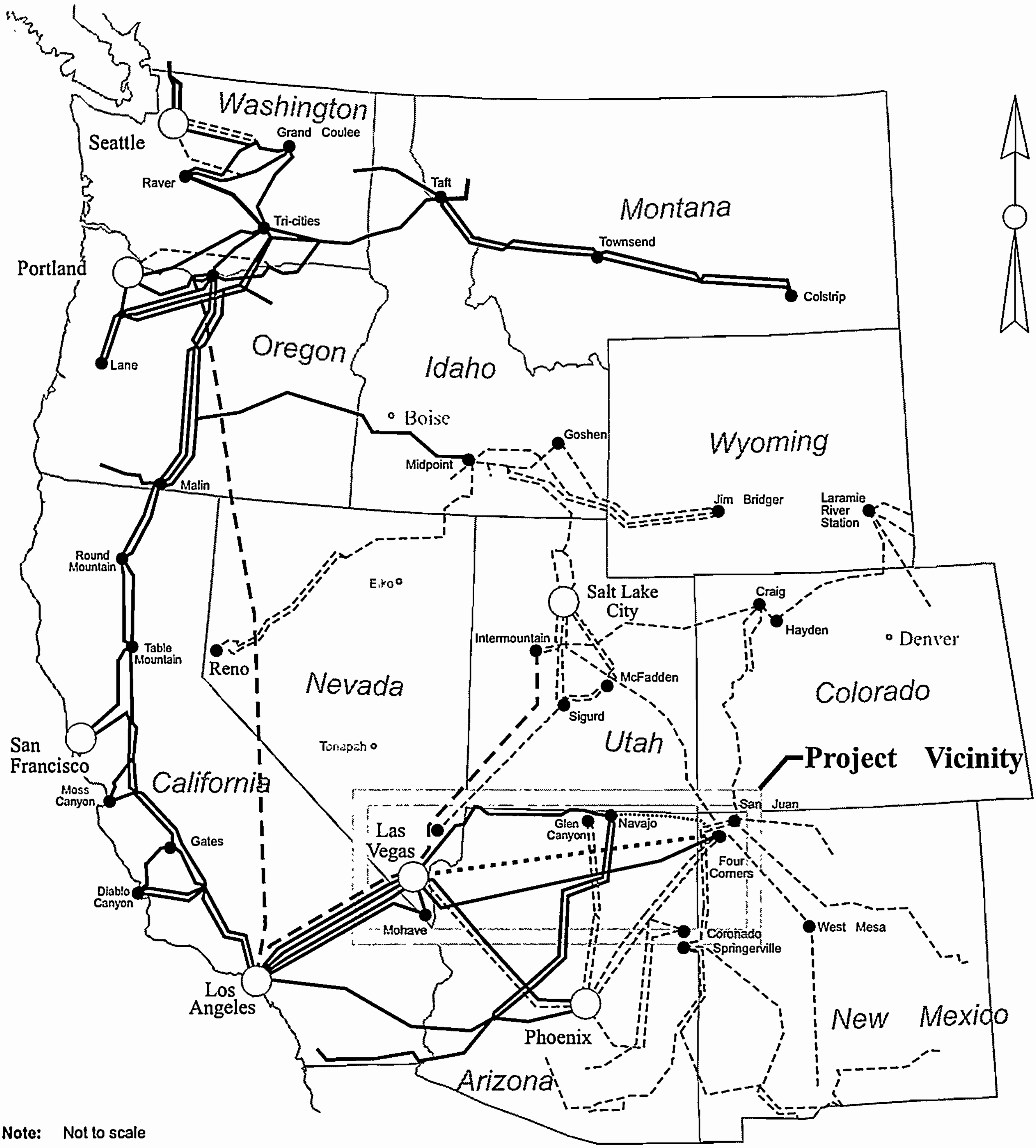
By removing the existing transmission restrictions and/or interconnecting with other regional systems in the Four Corners area, Arizona, California, and Nevada, utilities would be able to increase economical transfer of seasonal surpluses of electrical generation from resources in the Rocky Mountain and Four Corners areas. Also, they would be able to support their peak load periods by importing power from existing hydro and coal-fired generation sources in the Rocky Mountain area. Such economic purchases reduce the use of more expensive generation.

Western's participation in NTP would benefit CRSP customers by increasing the reliability of the critical Shiprock-to-Glen Canyon transmission line path. The capacity of Western's Shiprock-Kayenta-Glen Canyon 230kV line is now fully committed and Western is unable to provide any new long-term firm transmission service over the line. NTP could carry some of the capacity now delivered across the 230kV line and provide replacement capacity should there be an extended outage of one or more of the existing transmission lines west of Four Corners. NTP would improve the operational flexibility of area generation facilities and take advantage of economic and seasonal diversity in the electrical power market. When lower cost surplus power is available to the north and east of Four Corners, it could be "wheeled" across NTP to customers west and south of Four Corners, providing a sales benefit to the provider and a benefit to the purchasing utility ultimately resulting in lower rates to the customers.

- *Improve economic conditions of the Navajo Nation*

The Navajo Nation is economically disadvantaged according to U.S. government statistics. Per capita annual income is $5,943, median family income is $24,961. The Navajo Nation is the second largest American Indian tribe in the United States with a population of 162,378 according to 1994 statistics of the Navajo Economic Development Commission. According to the 1990 U.S. Census Bureau statistics, approximately 57 percent of families live below the poverty level. Furthermore, more than 60 percent of Navajo Nation residences do not have electricity.

Economic indicators suggest an absence of a strong and diverse economic base within the Navajo Nation. Since the Economic Recovery Act of 1981 and later Gramm-Rudman initiatives, there has been a substantial reduction in Federal funding to American Indian tribes, and continued decreases are anticipated. The decreases affect all services and employment opportunities on the Navajo Reservation. The Nation realizes that it must diligently develop programs and projects that generate revenue for producing sustainable growth, building economic self-sufficiency, and reinvesting in further productive



Note: Not to scale

Source: Western Systems Coordinating Council Map of Principal Transmission Lines, Jan. 1, 1992

Legend

500kV AC	
500kV DC	
345kV	
230kV (Western)	
NTP (AC)	
Local System	

Regional Transmission Network

Navajo Transmission Project

Figure 1-2

activities. It is believed that this can be achieved through wise use of the land, natural resources, human resources, and capital.

NTP would assist in improving the economic condition of the Navajo Nation. As NTP is currently envisioned, revenue would be generated by leasing the capacity of the transmission line to regional utilities. Annual revenues over the life of the project would provide funds to allow the Navajo Nation to invest in other long-range productive business opportunities. The amount of revenue would depend on final percent of ownership, right-of-way costs, lease agreements, operation and maintenance costs, and availability of capacity. In addition, the development of NTP would provide short-term employment opportunities for American Indian groups during construction in a region having an unemployment rate of about 30 percent (on the Navajo Reservation). Skills and experience gained from construction jobs would be useful for future employment. After construction, it is anticipated that there may be limited opportunities for long-term employment in aspects of operation and maintenance of the transmission line. NTP is expected to contribute to an increase in the income and standard of living for the Navajo Nation.

Availability of electricity on the Navajo Reservation is critical to economic growth and infrastructure development of the Navajo Nation. A substantial portion of the Navajo Nation's power and energy is delivered from Western and Tucson Electric Power (TEP) to the Navajo Reservation in bulk form across Western's Shiprock-to-Glen Canyon 230kV line to the Long House Valley and Kayenta substations. From there, NTUA delivers electricity to Navajo Reservation businesses and residences across lower-voltage transmission and distribution lines. Additional power is received from TEP through wheeling arrangements across transmission systems owned by Public Service Company of New Mexico and APS.

Because of the capacity constraints, NTUA cannot plan to accommodate expansion of business and residential development on Navajo Nation lands. NTP would allow Western an alternate path for firm-power deliveries, thus reducing dependence and freeing capacity on the 230kV path for increased deliveries of electricity to the Kayenta and Long House Valley substations. That would provide NTUA with more flexibility to plan additional distribution. A source of high-voltage transmission is still needed to meet present and future needs of the NTUA and Navajo Nation. Because of vast distances between consumers and low-density populations of consumers on Navajo Nation lands, it is not economically feasible for NTUA alone to construct a high-voltage transmission line solely to accommodate the small number of business and residential consumers in the area.

- ***Facilitate the Navajo Nation's development of energy resources and participation in the electric utility industry***

The role of the Navajo Nation in the energy industry traditionally has been that of a passive resource owner. Nonrenewable resources from the Navajo Nation lands are exported to provide fuel for power for much of the western United States. The economy and self-sufficiency of the Navajo Nation depend heavily on the export of these resources. However, the businesses associated with the energy activities are typically non-Navajo.

The Navajo Nation is in the process of developing a comprehensive strategy for energy development. The goal is to provide for benefits and ensure that future generations will share equitably from the energy resources while protecting the land, environment, and culture. The resources that have provided economic benefits in the past also must constitute the foundation for the future prosperity of the Nation. Preliminary strategies include planned exploration, developing new energy resources, promoting recovery of other resources that are now only marginally economic, and promoting energy conservation and energy-efficient behavior.

With the understanding of what markets exist for basic energy resources and products, such as electricity, the Navajo are making decisions about energy development activities. The Navajo Nation continues to identify and analyze market conditions and trends with respect to energy resources and products in the regional, national, and global economies in order to guide its energy development strategies and investments. Through greater involvement in refining, generating, distributing, and marketing functions, the Navajo Nation will gain more control over the use of its energy resources and ensure the appropriate use of resources to fully benefit the Navajo Nation.

NTP is an opportunity for the Navajo Nation to own a transmission line that would be an integral part of a regional electrical transmission system, thereby establishing a role in the electric industry. A feasibility study for NTP examined the potential for marketing the project. The study focused on marketing excess power from frequently less costly coal-fired generation sources in the Four Corners area and using it to replace existing, frequently more costly, generation sources in southern Nevada and southern California. The study considered generation units located in Utah, Colorado, New Mexico, and northeastern Arizona. The feasibility study concluded that the differences in the production costs between the Four Corners area and the southern Nevada and southern California area could be sufficient to offset the cost of NTP and yield a significant cost savings to participants in NTP. (This conclusion was based on findings examining strictly fuel-production cost differences and assumptions regarding the NTP load factor and transfer capability).

Also, NTP would allow access to the Western Systems Coordinating Council's (WSCC) southern 500kV transmission grid, which covers the states of New Mexico, Arizona, and southern California. This would provide the opportunity for NTUA to buy less expensive power that may be available through regional and seasonal diversity, or due to the new Federal Energy Regulatory Commission's (FERC) transmission open access guidelines.

PLANNING REQUIREMENTS, ENVIRONMENTAL REVIEW, AND LICENSING

This draft environmental impact statement (DEIS) was prepared by Western in compliance with Federal regulations and guidelines, principally NEPA, Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500-1508), Department of Energy (DOE) NEPA Implementation Procedures (10 CFR 1021), and other applicable regulations.

Also, Western is responsible for ensuring compliance with applicable regulations of other affected agencies, including the agencies cooperating in the preparation of this DEIS. The cooperating agencies for NTP include the Bureau of Land Management (BLM); Bureau of Indian Affairs (BIA); Forest Service; National Park Service (NPS); and Navajo, Hopi, and Hualapai tribes. The cooperating agencies have participated in the NEPA process, including scoping, since early in the project (see Chapter 5).

These and other relevant agencies have been involved throughout the environmental process and have provided resource data and other information. Agency plans were consulted and relevant information was incorporated into the DEIS. Applicable agency plans are listed in Table 1-1. If a decision is made to construct the transmission line, a construction, operation, and maintenance plan (COMP) would be developed in coordination with the land-managing and regulatory agencies to incorporate agency specifications based on the final design. The COMP is described in Chapter 2.

TABLE 1-1
APPLICABLE AGENCY MANAGEMENT PLANS

Agency/Planning Authority	Plan	Date
Boulder City	■ Boulder City Master Plan	1991
Coconino County	■ Red Lake Area Plan ■ Comprehensive Plan ■ Doney Park Area Plan	1992 1990 1988
City of Page	■ Community Master Plan	1989
Hopi Tribe	■ Comprehensive Development Plan	1988
Navajo Nation	■ Monument Valley Navajo Tribal Park Management Plan	1983
Coconino National Forest	■ Coconino Forest Plan	1987
Kaibab National Forest	■ Kaibab Forest Plan	1987
BLM, New Mexico	■ Farmington Resource Management Plan	1988
BLM, Arizona	■ Kingman Resource Area Proposed Resource Management Plan ■ Phoenix Resource Area Management Plan	1993 1988
BLM, Nevada	■ Draft Stateline Resource Area Management Plan	1992
NPS	■ General Management Plan and Alternatives, Lake Mead National Recreation Area (NRA) ■ Proposed General Management Plan, Lake Mead NRA	1986 1979

Table 1-2 provides a summary of the major Federal, state, and tribal permits that could be required for construction and operation of NTP. Approval to cross Navajo, Hopi, and Hualapai tribal lands would be at the discretion of the respective tribal councils.

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
FEDERAL				
NEPA compliance	Federal action: to grant right-of-way across land under Federal jurisdiction	Lead agency - Western; cooperating agencies	EIS and Record of Decision	NEPA (42 USC 4321), CEQ (40 CFR 1500-1508), DOE NEPA implementing Regulations (10 CFR 1021)
Right-of-way across land under Federal management	Preconstruction surveys; construction, operation, maintenance, and abandonment	BLM	Right-of-way grant and temporary use permit	Federal Land Policy and Management Act (FLPMA) of 1976 (PL 94-579) 43 USC 1761-1771 43 CFR 2800
		BIA, tribe	Right-of-way grant across American Indian lands	25 CFR 169
		Forest Service	Special use authorization permit or easement	36 CFR 251
		NPS	Authorization to cross NPS lands	18 USC, 36 CFR 14
		Fish and Wildlife Service (FWS)	Special use permit for crossing a national wildlife refuge	50 CFR 25

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Right-of-way across land under Federal management (continued)	"Conversion of use" for a use other than recreation on lands reserved with Land and Water Conservation Fund Act (LWCF) monies	NPS	Review of transmission line corridor to identify conflicts with recreational area	Land and Water Conservation Fund Act PL 88-578, Section 6(f)(3)
	Construction, operation, maintenance, and abandonment of transmission line across or within highway rights-of-way	Federal Highway Administration	Permits to cross Federal Aid Highway; 4 (f) compliance	Department of Transportation Act 23 CFR 1.23 and 1.27 23 USC 116, 123, and 315 23 CFR 645 23 CFR 771
Ground disturbance and water quality degradation	Construction sites with greater than five acres of land disturbed	Environmental Protection Agency (EPA)	Section 402 National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges from Construction Activities	Clean Water Act (33 USC 1342)
	Construction across water resources	Army Corps of Engineers (COE)	General easement	10 USC 2668 to 2669
	Crossing 100-year floodplain, streams and rivers	COE	Floodplain use permits	40 USC 961
	Construction in or modification of floodplains	Federal lead agency	Compliance	Executive Order 11988 Floodplains

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Ground disturbance and water quality degradation (continued)	Construction in or modification of wetlands	Federal lead agency	Compliance	Executive Order 11990 Wetlands
	Potential discharge into waters of the state (including wetlands and washes)	COE (and states); EPA on tribal lands	Section 401 permit	Clean Water Act (33 USC 1344)
	Discharge of dredge or fill material to a watercourse	COE; EPA on tribal lands	404 Permit (individual or nationwide)	Clean Water Act (33 USC 1344)
	Placement of structures and construction work in navigable waters of the U.S.	COE	Section 10 permit	Rivers and Harbors Act of 1899 (33 USC 403)
	Protection of all rivers included in the National Wild and Scenic Rivers Systems	Affected land-managing agencies	Review by permitting agencies	Wild and Scenic Rivers Act (PL 90-542) (43 CFR 83.50)
	Potential pollutant discharge during construction, operation, and maintenance	EPA	Spill Prevention Control and Countermeasure (SPCC) Plan for substations	Oil Pollution Act of 1990 (40 CFR 112)
Biological resources	Grant right-of-way by Federal land-managing agency	FWS	Endangered Species Act compliance by Federal land-managing agency and lead agency	Endangered Species Act of 1973 as amended (16 USC 1531 et seq)

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Biological resources (continued)	Protection of migratory birds	FWS	Compliance	Migratory Bird Treaty Act of 1918 16 USC 703-712 50 CFR Ch1
	Protection of bald and golden eagles	FWS	Compliance	Bald and Golden Eagle Protection Act of 1972 (16 USC 668)
Cultural resources	Disturbance of historic properties	Federal lead agency, State Historic Preservation Officers (SHPO), Advisory Council on Historic Preservation (ACHP)	Section 106 consultation	National Historic Preservation Act of 1966, (16 USC 470) (36 CFR Part 800)
	Excavation of archaeological resources	Federal land-managing agency	Permits to excavate	Archaeological Resources Protection Act of 1979 (16 USC 470aa to 470ee)
	Potential conflicts with freedom to practice traditional American Indian religions	Federal lead agency, Federal land-managing agency	Consultation with affected American Indians	American Indian Religious Freedom Act (42 USC 1996)
	Disturbance of graves, associated funerary objects, sacred objects, and items of cultural patrimony	Federal land-managing agency	Consultation with affected Native American group regarding treatment of remains and objects	Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001)

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Cultural resources (continued)	Investigation of cultural and paleontological resources	Affected land-managing agencies	Permit for study of historical, archaeological, and paleontological resources	Antiquities Act of 1906 (16 USC 432-433)
	Investigation of cultural resources	Affected land-managing agencies	Permits to excavate and remove archaeological resources on Federal lands; American Indian tribes with interests in resources must be consulted prior to issuance of permits	Archaeological Resources Protection Act of 1979 (16 USC 470aa) to 470ee (43 CFR 7)
	Protection of segments, sites, and features related to national trails	Affected land-managing agencies	National Trails System Act compliance	National Trails System Act (PL 90-543) (16 USC 1241 to 1249)
Paleontological resources	Ground disturbance on Federal land or Federal aid project	BLM	Compliance with BLM mitigation and planning standards for paleontological resources of public lands	FLPMA of 1976 (43 USC 1701-1771) Antiquities Act of 1906 (16 USC 431-433)
Air Traffic	Location of towers in regards to airport facilities and airspace	Federal Aviation Administration (FAA)	A "No-hazard Declaration" required if structure is more than 200 feet in height	FAA Act of 1958 (49 USC 1501) (14 CFR 77)
			Section 1101 Air Space Permit for air space construction clearance	FAA Act of 1958 (49 USC 1501) (14 CFR 77)

TABLE 1-2 SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION				
Issue	**Action Requiring Permit, Approval, or Review**	**Agency**	**Permit, License, Compliance, or Review**	**Relevant Laws and Regulations**
Rate regulation	Sales for resale and transmission services	FERC	Federal Power Act compliance by power seller	Federal Power Act (16 USC 792)
STATE				
NEW MEXICO				
Right-of-way encroachment	Crossing state highways	New Mexico Department of Transportation	Encroachment permit	New Mexico Department of Highways rules and regulations
	Crossing state lands	New Mexico State Land Office	Right-of-way permit	State Lands Office Rule #10
	Construction and operation	State Public Utility Commission	Certificate of convenience and necessity - new construction for utility franchise	New Mexico Statutes Annotated (NMSA) 1978 Compilation) Article 9-1 Sec 62-9-1 to 62-9-3
Ground disturbance and water quality degradation	100-year floodplain, streams and rivers, waters of the state	New Mexico Environment Department	Floodplain use permits Clean Water Act 401, 402, and 404 permits	New Mexico Statutes - State Water Quality Certification rules

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Cultural resources	Construction and operation	Office of Historic Preservation	Section 106 consultation	National Historic Preservation Act of 1966 (16 USC 470) Advisory Council on Historic Preservation Regulations (36 CFR 800)
	Investigation of cultural resources on state lands	New Mexico Cultural Properties Review Committee	Permits to conduct archaeological survey or excavation	New Mexico Cultural Properties Act (NMSA 18-6-1 to 18-6-17) (1978 Compilation)
	Disturbance of human burials on non-Federal or non-Indian lands in New Mexico	New Mexico Cultural Properties Review Committee	Human burial excavation permit	New Mexico Cultural Properties Act (NMSA 18-6-11) (1978 Compilation)
Biological resources	Ground disturbance in areas with sensitive plant species	New Mexico Department of Energy, Minerals, and Natural Resources	Permit	New Mexico Endangered Plant Species Act (NMSA 9-10-10)
	Habitat modification in areas of sensitive animal species	New Mexico Department of Game and Fish	Permit	New Mexico Wildlife Conservation Act (NMSA 17-2-37 to 17-2-46)

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
ARIZONA				
Right-of-way encroachment	Encroachment into state lands	State Land Department	Right-of-way permit	Title XII, Article 8, R12-5-164
	Encroachment into state roadway	Arizona Department of Transportation	Encroachment permit	Arizona Revised Statutes (ARS) 28-1870
Utility siting	Construction and operation	Corporation Commission-Utilities Division-Power Plant and Transmission Line Siting Committee	Certification of Environmental Compatibility	ARS 40-360-6.2
Ground disturbance and water quality degradation	Crossing 100-year floodplain, streams and rivers, waters of the state	Department of Environmental Quality	Floodplain use permits; Clean Water Act 401, 402, and 404 permits	ARS - State Water Quality Certification rules
Cultural and paleontological resources	Investigation of archaeological and vertebrate paleontological resources on state lands	Arizona State Museum, Arizona State Land Department	Permit to investigate	Arizona Antiquities Act (ARS 41-841 et seq.)
	Disturbance of graves, associated funerary objects, and items of cultural patrimony on state and private lands	Arizona State Museum	Notification of discoveries, consultation with affiliated groups	Arizona Antiquities Acts (ARS 41-841 to 41-846) (ARS 41-65)
Biological resources	Loss of special status plant species	Arizona Department of Agriculture	Permit to remove plants	Native Plant Law (ARS Ch. 7)

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Biological resources (continued)	Disturbance or loss of special status animal species habitat	Arizona Game & Fish Department	Consultation and review	Threatened Native Wildlife in Arizona (ARS Ch. 17)
NEVADA				
Right-of-way encroachment	Encroachment into state roadway right-of-way	Nevada Department of Transportation	Right-of-way encroachment permit	Nevada Revised Statutes (NRS) 408.423 NRS 408.210
Ground surface disturbance	Project construction	Division of Environmental Protection (NDEP)	Registration certificate	Nevada Administration Code (NAC) 445.704
	Construction of electric transmission line	Public Service Commission	Authority to construct and certificate of need	NRS 704.330 NRS 704.820 NRS 704.701
Ground disturbance and water quality degradation	100-year floodplain, streams and rivers, waters of the state	NDEP	Floodplain use permits, Clean Water Act 401, 402, and 404 permits	Nevada State Statutes - State Water Quality Certification rules
Stormwater and water quality degradation	Pollution discharge	NDEP	Storm water pollution prevention plans (SWP3) SPCC plan	Nevada State Statutes - State Water Quality Certification rules

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Cultural and paleontological resources	Crossing state lands	Division of State Lands	Easement onto state lands	NRS 321.001
	Investigation of paleontological, archaeological, and historic sites	Nevada State Museum	Permit to investigate antiquities	Nevada Antiquities Law (NRS 381.195 to 381.227)
	Disturbance of American Indian burial sites on state and private lands	Nevada State Historic Preservation Office	Notification of discoveries, consultation with affiliated groups	Nevada Protection of Indian Burial Sites (NRS 383.150) (NRS 383.190)
Air quality	Construction and operation	NDEP	Authority to construct, permit to operate	NRS 445
Biological resources	Modification of sensitive plant species habitat	Division of Forestry	Compliance to survey for identification of plant species	NRS 527.270 NRS 527.050
	Disturbance of special status plant species	Division of Forestry	Permit for lawful take of protected plant	NRS 527.250
	Construction and operation in areas of rare and endangered animal species	Division of Wildlife	Compliance	NRS 501 NAC 503
	Modification of habitat of threatened and endangered species	Division of Wildlife	Special permit	NAC 5-4.510 through 4.550

TABLE 1-2 SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION				
Issue	**Action Requiring Permit, Approval, or Review**	**Agency**	**Permit, License, Compliance, or Review**	**Relevant Laws and Regulations**
LOCAL				
NEW MEXICO				
Right-of-way encroachment	Crossing county roads and land	San Juan County	Right-of-way easement	County rules and regulations
ARIZONA				
Land use	Construction and operation of transmission lines	Coconino County, Department of Community Development	Conditional-use permit	County rules and regulations
Right-of-way encroachment	Encroachment onto county rights-of-way	Mohave County Public Works Department	Standard right-of-way agreement	Mohave County ordinance
	Encroachment onto City of Page land	City of Page	Right-of-way easement	Disposition of Public Land City Code Article 3-5
NEVADA				
Air quality	Construction activities	Clark County Health District-Air Pollution Control Division	Dust permit	Clark County Health District Rules, Section 17
Ground surface disturbance	Construction and operation	Clark County Planning and Zoning	Conditional-use permit	Clark County Ordinance Title 29.66

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Biological resources	Construction and operation in areas with special status species - desert tortoise (Mohave population)	Clark County, FWS, and Nevada Department of Wildlife	Incidental Take Permit	Habitat Conservation Plan (Section1 [1a, 1b]) Endangered Species Act (16 USC 1531 to 1543)
TRIBAL				
NAVAJO				
Biological resources	On-ground investigations for tribal or Federally protected species	Navajo Department of Fish & Wildlife	Biological Investigation Permit	Government Services Committee Resolution SFCF-3-94
	Pre-construction activities, construction, operation, and maintenance	Resources Committee of the Navajo Nation Council	Formal written approval	2 Navajo Tribal Codes (NTC) 164
	Wetlands	US EPA Region IX Navajo Nation EPA	NPDES Permit	Navajo Nation Council (NNC) CJA-16-96

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Right-of-way over Navajo Tribal Trust Lands (NTTL) under Federal Trust Management (BIA)	Permission to survey on NTTL 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 NTC 695 25 CFR 169
sensitive animal and plant species	construction disturbance in areas of sensitive animal and plant species	Navajo Fish & Wildlife *Natural Heritage Program	Review and approval by Navajo Nation	25 CFR 169.4 to 169.5
cultural resources	construction disturbance in areas of cultural resources	*Historic Preservation Department	Review and approval by Navajo Nation	25 CFR 169.5
right-of-way encroachment	encroachment of all existing rights-of-way	Navajo Nation reviewing departments	Navajo Nation consent letter	25 CFR 169.3
Right-of-way over NTTL under Federal Trust Management (BIA)	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 NTC 695 (B)(6)
	Restoration of right-of-way	Navajo Nation EPA	Review and approval	25 CFR 169.5

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Cultural resources	Cultural resource investigations on Navajo Nation lands	Navajo Nation Historic Preservation Department; BIA, Navajo Area Office	Class B inventory permits, Class C excavation permits, Archaeological Resources Protection Act (ARPA) permits for disturbance to archaeological resources	Navajo Nation Cultural Resource Protection Act (CRPA-19-88) ARPA (43 CFR 47)
Forest and woodland resources	Clearing, transporting, selling, trading, or bartering any Navajo Forest product	Navajo Nation Forestry Department	Commercial permit	Resource Resolution RCJN-69-88; 23 NTC 902 (c); 17 NTC 525; 18 USC 1853; 18 USC 1855; 18 USC 1850
Water resources	Potential effects on the water of Navajo Nation lands	Department of Water Resources Management	Water use permit	Chapter 7, NTC 254 22 NTC 1101 et seq.
Earth resources	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

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
		HOPI		
Cultural resources	Preconstruction activities: 1) historical or scientific research 2) conducting archaeological surveys and excavations	Hopi Tribal Council	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
Ground surface disturbance	Construction in or removal of range improvements	Hopi Tribal Department of Range Management	Written authorization from 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
		HUALAPAI		
Cultural resources	Cultural resource monitoring during construction	Hualapai Tribal Council Office of Cultural Resources	Hualapai Tribal Council Cultural Resources Department	Constitution of the Hualapai Tribe (Amended March 13, 1991)

TABLE 1-2
SUMMARY OF POTENTIAL, MAJOR FEDERAL, STATE, LOCAL, AND TRIBAL PERMITS OR LICENSES REQUIRED AND OTHER ENVIRONMENTAL REVIEW REQUIREMENTS FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, License, Compliance, or Review	Relevant Laws and Regulations
Right-of-way on Hualapai land	Construction, operation, and maintenance	BIA Truxton Cañon Realty Office Hualapai Tribal Council	Lease agreement approval Tribal Council resolution	Constitution of the Hualapai Tribe (Amended March 13, 1991)
Biological resources	Entering Hualapai land for preconstruction and construction activities	Hualapai Tribe Natural Resources Department	Permit	Wildlife Conservation Ordinance No. 24-70 (1990 Revision)
Land use	Construction activities in rangeland (grazing) areas	Hualapai Tribe Natural Resources Department (Agricultural Program)	Trespass fee	Proper Utilization of Range Resources Ordinance No. 28 (1990 Revision)

CHAPTER 2 - ALTERNATIVES INCLUDING THE PROPOSED ACTION

The purpose of this chapter is to present the alternatives that were considered. The discussion is divided into two sections—alternatives considered but eliminated from further study and project alternatives studied in detail.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER STUDY

Several alternatives to the proposed action were analyzed in detail but eliminated from further study because they do not meet the purposes and needs of the project. These alternatives included (1) energy conservation and electric load management; (2) new generation facilities; (3) existing transmission systems; and (4) alternative transmission technologies (voltage levels, direct or alternating current, underground, and new transmission technologies).

ENERGY CONSERVATION AND ELECTRIC LOAD MANAGEMENT

One alternative to building a new transmission line would be to promote energy conservation among consumers in the project area. The National Energy Policy Act of 1992 made provisions for a wide range of energy conservation measures, including a number of incentives for energy conservation, load management, and the development of energy standards and electric equipment standards. The National Energy Policy Act also provides incentives for renewable energy developments and the commercialization of energy technologies (such as biomass programs), as well as providing for many different programs to promote efficiency, generation and use, coal and petroleum use, clean fuels, and others.

As an example, Western's Energy Planning and Management Program (EPAMP) was initiated at about the same time as the National Energy Policy Act. The goal of EPAMP is to encourage power and energy customers to consider cost-effective demand-side and supply-side options, renewable energy alternatives, and efficiency.

Despite the National Energy Policy Act and programs such as Western's EPAMP, this alternative meets only a small part of the purposes and needs for NTP. Specifically, this alternative would manage to forestall the increase in regional energy demands for only a short period of time, while having no effect on the transmission system constraints west of the Four Corners area or on the economic condition of the people of the Navajo Nation. Furthermore, it is anticipated that the relief of energy demands brought about by this alternative would be minimal at best because most of the market area, such as southern California and southern Nevada, already has aggressive energy conservation and load management programs in effect.

Because this alternative failed to meet the purposes and needs for NTP and because the projected benefits are anticipated to be minimal, this alternative was deemed to be unacceptable as an alternative to constructing NTP.

NEW GENERATION FACILITIES

Building new generation facilities would help meet the increasing energy needs of the southwestern United States and, depending on the location of the project, could conceivably benefit the Navajo Nation. However, any new generation facilities built would not remove the transmission system constraints west of the Four Corners area and, in fact, would aggravate the situation. Not only is new transmission needed to remove existing constraints, but additional new transmission would be needed to accommodate new power generated. Also, construction of any new generation facility would not be able to lend itself to seasonal or regional energy exchanges because there would still be a lack of adequate transmission capability. For these reasons, this alternative was not considered further.

EXISTING TRANSMISSION SYSTEMS

The alternative of using the existing transmission systems included evaluation of the following: (1) scheduling power from the Four Corners area to major load areas via different electrical transmission paths, (2) using a phase shifting transformer or transmission line compensation on the existing transmission paths, and (3) upgrading Western's 230kV line.

As previously explained, all of the electrical paths out of the Four Corners area are often used to the maximum capacity. This results in "trapped" generation in the Four Corners area, meaning that there is more generation capacity than can be safely transmitted out of the area. Scheduling power across alternate transmission paths and through multiple systems owned by different utilities results in increased losses. These losses coupled with the costs of wheeling over multiple systems become cost prohibitive.

Another consideration evaluated was using a power-control device such as a phase shifter or series compensation. This does not mitigate the basic problem of lack of capacity available on the existing transmission system.

Over the past several years Western has implemented upgrades to maximize the capability of its Shiprock-to-Glen Canyon 230kV transmission line to the extent practicable, thereby postponing participation in a major project such as NTP. During this same time, however, Western has considered several options for providing the additional power transfer capability needed across the 230kV line while maintaining acceptable voltage levels at the Kayenta and Long House Valley substations. Options evaluated included uprating the line to a higher voltage level, reconductoring the line (which would take the line out of service for six to nine months), wheeling power through agreements with other utilities, and adding a series of shunt capacitors. Cost was considered prohibitive as a long-term solution for all but the option for series capacitors. Series capacitors were installed at the Kayenta Substation in 1992, improving the flowability of the Shiprock-to-Glen Canyon line from 240 MW to about 350 MW, while keeping voltage levels at Kayenta and Long House Valley substations within acceptable limits. However, this was a short-term improvement overall.

In summary, this alternative has a very low benefit-to-cost ratio. The minimal benefits obtained would come at a high cost. As such, no further consideration was given to this alternative.

ALTERNATIVE TRANSMISSION TECHNOLOGIES

Alternative Voltage Levels

It is possible that the stated purposes and needs for NTP could be met by designing for voltage levels other than 500kV. However, adjusting the voltage level would result in either increased costs for construction (at higher voltage levels) or compromising capacity (at lower voltage levels).

If NTP were to be constructed at a higher voltage, such as 765kV, the estimated cost of construction would be up to 1.75 times the cost of constructing NTP at 500kV. A 765kV line would require taller structures, larger conductors, increased insulation of equipment, wider right-of-way, and larger-sized equipment. In addition, electrical system studies have shown that voltage levels higher than 500kV do not result in higher capacities without significant facility additions to the existing systems. Constructing NTP at less than 500kV would result in less transmission capacity than the amount projected to be needed and would accomplish fewer of the benefits sought by the project proponents (less potential revenue). The magnitude of these disadvantages led to the decision to choose construction of NTP at the 500kV level.

Direct or Alternating Current Transmission

The benefit of a direct current (DC) system is greater control of power flows over long distances. However, a DC system does not provide much flexibility for interconnections with alternative current (AC) systems. To interconnect with an AC system, the DC must be converted to AC. Converter substations are very expensive and require more land than a typical AC substation. An AC system can be interconnected with existing systems more economically. For these reasons, the AC design for NTP was chosen over a DC design.

Underground Transmission

Some high-voltage underground lines (115kV or above) have been constructed, but only for short distances, and usually where circumstances dictated that overhead lines were not feasible (e.g., in the vicinity of airports and urban centers).

High-voltage underground transmission lines have markedly different technological requirements than lower-voltage underground distribution lines. For example, underground high-voltage transmission lines require extensive cooling systems to dissipate the heat generated by the transmission of bulk electricity. Cooling systems are complex and very expensive. The extremely high cost of large cooling systems and other special design requirements are prohibitive for long distance electric transmission. Currently, the only underground transmission systems in the United States that are 230kV or larger are 25 miles or less in length. In addition, the basic cost of constructing a high-voltage transmission line underground would be several times more than the cost of overhead transmission line construction. Underground systems would require a pipeline and aboveground ancillary facilities such as oil-pressurizing and pumping stations, and cooling stations to transport cooling oil along the transmission line. Oil pumping and cooling facilities would be required at the originating and terminating substations, and approximately every 7 to 10 miles along the transmission route (more frequently in hilly or mountainous terrain).

While underground transmission lines are relatively immune to weather conditions, they are vulnerable to washouts, seismic events, cooling system failures, and incidental excavation. Outages for underground lines could last days or weeks while the problem is being located and repaired. Typically, failures in overhead lines can be located and repaired in a matter of hours. Long-term outages would be unacceptable for a circuit carrying bulk power.

Negative environmental impacts from construction of an underground transmission line would be similar to those for major pipeline construction. Typical construction would require a continuous trench between endpoints resulting in ground disturbance along a partial right-of-way. By comparison, overhead transmission line construction typically results in partial disturbances of the right-of-way only at individual tower or substation sites and in areas providing access to the right-of-way. Further, a major cooling system failure could result in coolant spills.

In summary, because of the technical complications, economic cost, environmental impacts, and accessibility for maintenance, an underground system was not considered a viable alternative and was eliminated from further consideration.

New Transmission Technologies

Other technologies considered as alternatives for economical bulk-power transmission of electric energy to load centers were microwave, laser, and superconductors. Current research and development indicates some of these technologies eventually may become viable alternatives to overhead transmission systems; however, none of them are currently available for commercial use. Therefore, new transmission technologies were eliminated from further consideration for this project.

ALTERNATIVES STUDIED IN DETAIL

Project alternatives studied in detail included no action and the proposed action, including alternative transmission line routes.

NO-ACTION ALTERNATIVE

If no action is taken, the right-of-way for NTP would not be granted and the transmission line would not be constructed. Advantages of the no-action alternative would include the saving of construction costs of new facilities and the preclusion of associated impacts on the environment. However, the needs for the project, as explained in Chapter 1, would not be met. Constraints on the transmission of electricity in the area would not be relieved; operational flexibility and reliability would not be improved; and economical power transfers, sales, and purchases in the area would not increase. In addition, the Navajo

Nation would have to seek other means to attempt to improve its economic conditions and develop energy resources.

PROPOSED ACTION

DPA is proposing to construct, operate, and maintain a 500kV AC transmission line from Western's Shiprock Substation west of Farmington in northwestern New Mexico across northern Arizona to either the Marketplace Substation or Western's Mead Substation, both of which are located in southern Nevada. The needs stated in Chapter 1 would be met by this proposed action.

The following sections describe the proposed action including the transmission line, substation, and communication facilities; right-of-way acquisition; construction activities (e.g., survey, access roads, clearing, tower installation, conductor stringing, cleanup, and reclamation); and operation, maintenance, and abandonment. The alternative routes studied for the DEIS including the environmentally preferred are discussed later in this chapter. However, a final preferred route has not been selected by the lead and cooperating agencies in cooperation with DPA as of the date of this DEIS. A decision on the final preferred route will be documented in the Record of Decision following the final EIS (FEIS).

Transmission Line

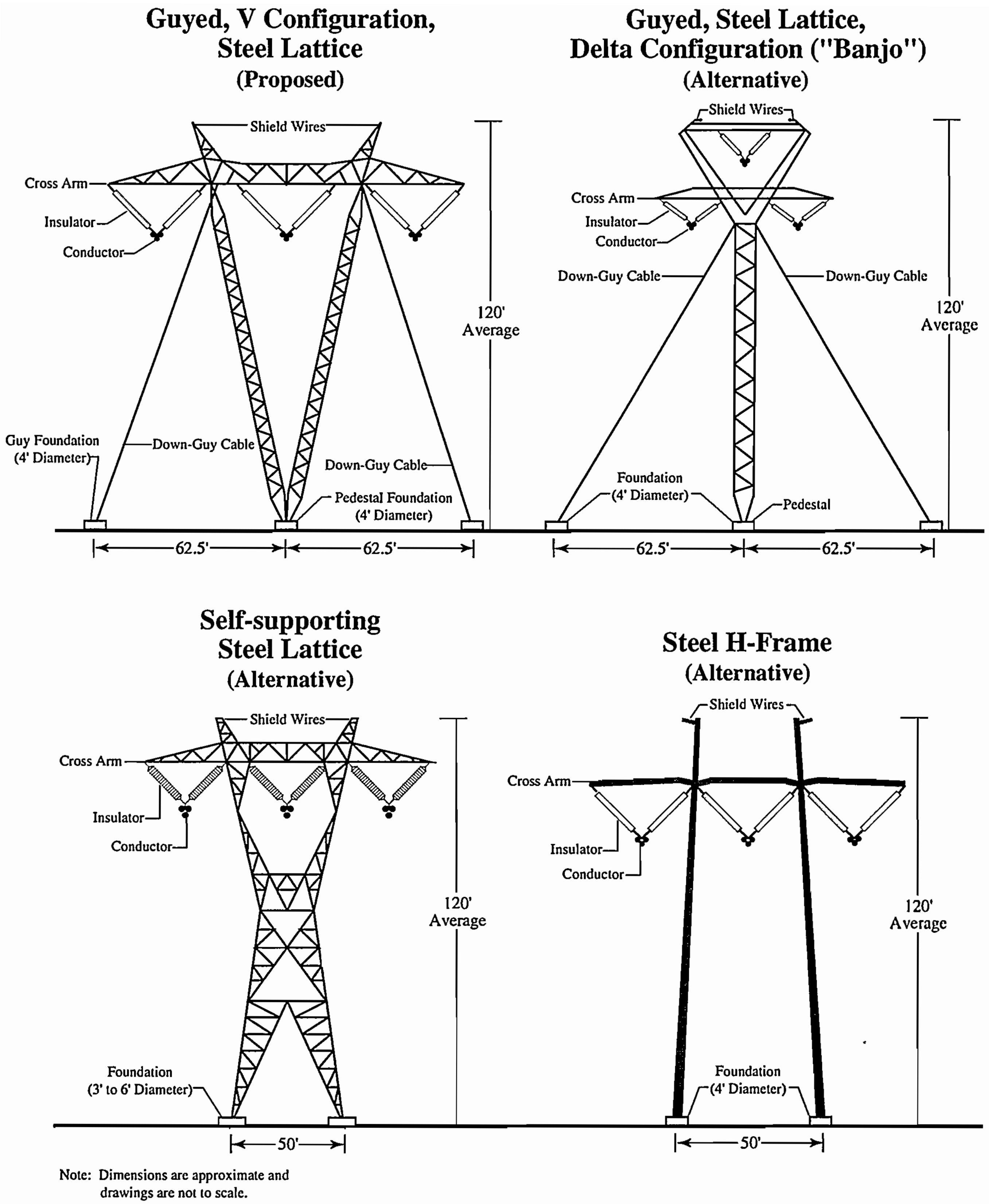
The components of the transmission line are described below.

Tower Structures

The proposed tower structure for NTP is a guyed, V-shaped, single-pedestal, steel-lattice structure fabricated from unpainted, galvanized steel (Figure 2-1 and Table 2-1). This type was selected because less steel is required for the structure and therefore it is less expensive. Alternative structure types would be used where warranted for engineering or economic reasons or to mitigate environmental impacts. Other potential structure types that could be used include (1) guyed delta structure; (2) four-legged, self-supporting structure; or (3) H-frame, tubular-steel structure. Regardless of the structure type used, the span between towers would range from 1,200 to 1,500 feet (4 or 5 towers per mile), with occasional exceptions as required. The height of the structures could range from 90 to 160 feet, but would average 120 to 130 feet. In addition, more robust dead-end structures would be used regardless of the tangent structure type used.

The area of the base of the structures would vary depending on structure type and terrain. However, all of the area surrounding the foundations and/or guy anchors would be usable for compatible and permitted uses, which are described in the operation, maintenance, and abandonment section of this chapter.

The following paragraphs describe the structure types in more detail.



Typical 500kV Tangent Structure Types

Navajo Transmission Project

Figure 2-1

TABLE 2-1 DESIGN CHARACTERISTICS OF THE 500kV TRANSMISSION LINE	
Line Length	■ 386 to 508 miles (depending on route selected)
Type of Structure	■ guyed, "V-shaped" steel lattice (proposed) ■ guyed steel-lattice, delta configuration (alternative) ■ self-supporting steel lattice (alternative) ■ tubular-steel H-frame (alternative)
Structure Height	■ average 120 feet (range 90 to 160 feet)
Span Length	■ 1,200 to 1,500 feet average span
Number of Structures Per Mile	■ 4 to 5
Right-of-way Width	■ 250 feet
Land Temporarily Disturbed (per mile): (1) Tower base: ■ guyed steel lattice ■ tubular steel H-frame ■ self-supporting steel lattice (2) Wire-pulling sites (3) Wire-splicing sites (4) Material staging sites (5) Batch plants	 ■ 200 x 200 feet (0.9 acre) (3.5 to 4.5 acres per mile) ■ 200 x 200 feet (0.9 acre) (3.5 to 4.5 acres per mile) ■ 200 x 200 feet (0.9 acre) (3.5 to 4.5 acres per mile) ■ 200 x 200 feet (0.9 acre) per 3 miles ■ 20 x 50 feet (0.02 acre) per 3 miles ■ 400 x 540 feet (5 acres) per 40 miles ■ 2 acres per 30 miles
Land Required Permanently (per mile): (1) Tower base: ■ guyed steel lattice ■ self-supporting steel lattice ■ tubular-steel H-frame (2) Access roads (average acres per mile of transmission line) by ground disturbance level: ■ use existing roads (Access Level 1) ■ upgrade existing roads (Access Level 2) ■ construct new roads (Access Level 3) (Access Level 4) (Access Level 5) (Access Level 5)	 ■ five 4-foot-diameter foundations (.006 acre or 283 square feet) ■ four 6-foot-diameter foundations (.01 acre or 509 square feet) ■ two 4-foot-diameter foundations (.0026 acre or 113 square feet) ■ 0.3 acre ■ 0.3 acre ■ 1.5 acres ■ 1.7 acres ■ 2.3 acres ■ 3.1 acres
Voltage	■ 500,000 volts (v) AC
Capacity	■ 1,200 to 1,800 MW
Circuit Configuration	■ single circuit, two- to three-conductor bundle per phase with three phases, horizontal configuration
Conductor Size	■ 1272 to 1590 kcmil (1.345 to 1.504 inch diameter) ACSR (final selection under study)
Max. Anticipated Electric Field at Edge of ROW	■ 1.0kV/meter
Magnetic Field at Edge of Right-of-Way	■ less than 50 milli-Gauss (mG)
NESC Standard for Ground Clearance of Conductor	■ 29 feet minimum at 176 degrees Fahrenheit
Tower Foundations	■ drilled piers, cast-in-place concrete, pre-cast pads, or inserts

Guyed, "V"-Shaped Structure—The guyed, V-shaped steel-lattice structure with a horizontal cross arm at the top would have a single footing and four down-guy cables. Each cable would be about one inch in diameter. The foundation for the single footing would be 3 to 4 feet in diameter and 12 to 24 feet deep. Each guy anchor would be four feet in diameter and about six feet deep. The concrete foundations and guy anchors would be cast in place.

Guyed, "Delta" Structure—This guyed, steel-lattice structure would have a single footing and four down-guy cables, and the body of the tower would be a single pedestal with a delta- or triangle-shaped top. The foundation and guy anchors would be the same as that for the guyed, V-shaped structure.

Four-Legged, Self-Supporting Structure—In certain instances, the four-legged, self-supporting, unpainted galvanized steel lattice structure may be preferable. These structures could be used in areas of steep terrain where slopes are greater than the angle of the guy, or in situations where guy cables would extend beyond the edge of the right-of-way. In areas considered visually sensitive where the proposed line would parallel existing self-supporting structures, less visual contrast would be created if structures similar to the existing ones were used. Self-supporting structures also could be used to reduce potential construction and maintenance problems (e.g., where a narrower right-of-way would be needed due to terrain constraints). The concrete foundation of each leg would be 3 to 6 feet in diameter and 12 to 24 feet deep.

H-Frame, Tubular-Steel Structure—H-frame, self-supporting, tubular-corten steel (dark, rust-like finish) towers may be less intrusive in some areas and could be used instead of other tower types (particularly guyed structures) where they may interfere with other land use activities such as agricultural practices (e.g., machinery operations and gravity water flow irrigation systems). Also, in areas where an existing H-frame transmission line may be paralleled, an H-frame structure may be recommended as mitigation to reduce the visual contrast in the landscape. The concrete foundation of each leg would be about four feet in diameter and 12 to 24 feet deep.

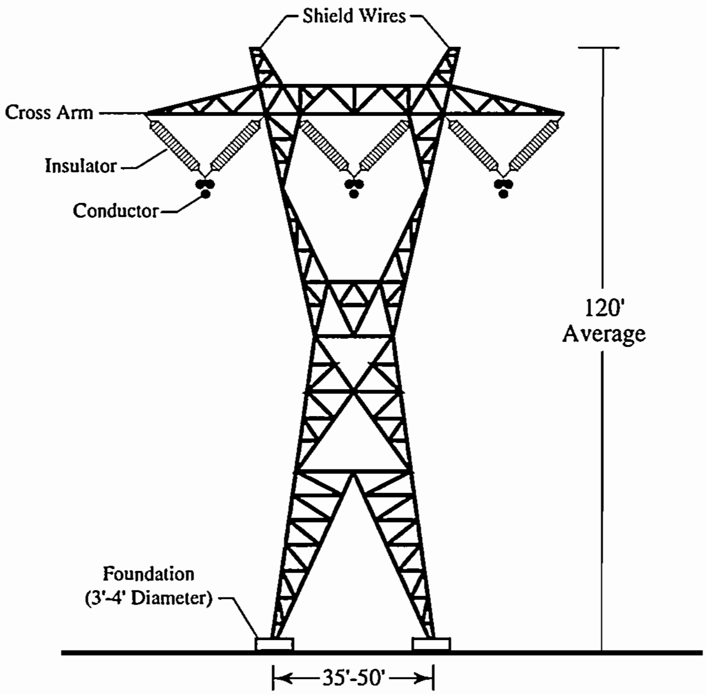
Dead-End Structure—At certain locations along the transmission line, more robust tower structures would be needed (1) to add longitudinal strength to the line, (2) at turning points (angles), (3) for added safety at crossings of utilities such as transmission lines, and (4) to interrupt long distances (15 to 25 miles) of suspension structures that would otherwise provide more exposure to a catastrophic line failure. In most cases, the more robust structures would be self-supporting steel lattice. Alternatives to this would be self-supporting, three-pole, tubular-steel structures; tangent structures for straight portions of the line; or angle structures for turns in the line. Alternative dead-end structures are shown on Figure 2-2.

Conductor

The conductor, the wire cable strung between transmission line towers through which the electric current flows, would be aluminum conductors steel reinforced (ACSR). The aluminum carries most of the electrical current and the steel provides tensile strength to support the aluminum strands. The NTP transmission line would have three phases, each consisting of a bundle of two or three conductors. Spacing between each subconductor in a bundle would be about 18 inches, but the configuration of the

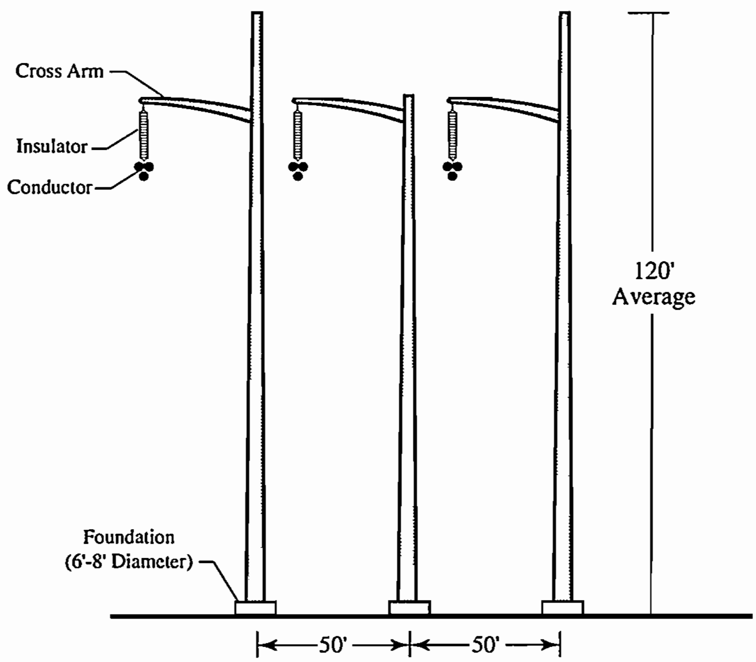
Self-supporting Steel-lattice

(used with steel-lattice tangent towers)



Self-supporting Tubular Steel

(used with H-Frame tangent towers)



Note: Dimensions are approximate and drawings are not to scale

Typical 500kV Dead-end Structure Types

Navajo Transmission Project

Figure 2-2

bundles would be determined at the engineering-design stage of the project. The conductor would be treated to make it less shiny and noticeable. This "nonspecular" type of conductor would be used for the entire length of the transmission line, thereby reducing the visual impact of the transmission line in the landscape.

The height of the conductors above the ground would be a minimum of 29 feet, based on the National Electric Safety Code (NESC) and Western's standards. The minimum conductor vertical clearance dictates the exact height of each tower structure, based on topography and requirements for safety. The minimum conductor vertical clearances in some instances may be greater in response to logistical requirements or more specific NESC requirements (e.g., minimum clearance above trees in forested areas).

Insulators and Associated Hardware

Insulators, which are made of an extremely low conducting material such as porcelain, glass, or polymer, are used to suspend the conductors from each tower. Insulators inhibit the flow of electrical current from the conductor to the ground or another conductor. A permanent assembly of insulators, ranging from 14 to 20 feet long, would be used to position and support each of the three conductor bundles to the tower. These assemblies are either V or I shaped. The assemblies of insulators are designed to maintain electrical clearances between the conductors, tower, and ground.

Overhead Ground Wires (Shield Wires)

To protect conductors from lightning strikes, two nonspecular overhead ground wires three-eighths to one-half-inch in diameter would be installed on top of the tower structures. Energy from lightning strikes would be transferred through the ground wires and structures into the ground. The ground wire could contain fiber optic cable to serve, in part, as a communication system for the project in addition to Western's existing microwave communication system. The appearance of the proposed ground wire/fiber optic cable would not be substantially different from a conventional ground wire without fiber optic cable.

Substations

Three substations would be constructed for the proposed NTP transmission line—one at each end of the transmission line and one at an intermediate location. The amount of land required for the substations would vary depending on the layout of associated electrical equipment (345kV or 500kV interconnection), and potential setbacks from relocation of existing utilities (e.g., electric transmission lines).

The proposed substation at the eastern end of the transmission line would be constructed at Western's existing Shiprock Substation near Shiprock, New Mexico. The additional equipment required most likely would be installed adjacent to the northwestern portion of the existing substation. Approximately 50 additional acres would be needed.

Two alternative locations are being considered for the substation at the western end of the transmission line in southeastern Nevada—either at Western's existing Mead Substation or at the jointly owned Marketplace Substation, both located near Boulder City, Nevada. Approximately six additional acres of space would be needed at the Mead Substation if the line were to terminate at that location and a small amount, if any, of additional acreage would be needed if the line were to terminate at the Marketplace Substation.

Five alternative sites in north-central Arizona are being considered for the intermediate substation:

- Honey Draw Substation site approximately 3 miles south of Page and 1.5 miles west of the community of Lechee

- Red Mesa Substation site near Red Mesa along Western's existing 345kV transmission line

- Copper Mine Substation site approximately 9 miles southwest of the community of Copper Mine along Western's existing 345kV transmission line

- a site near or adjacent to the existing Moenkopi Substation

- Red Lake Substation site approximately 15 miles north of Williams, Arizona

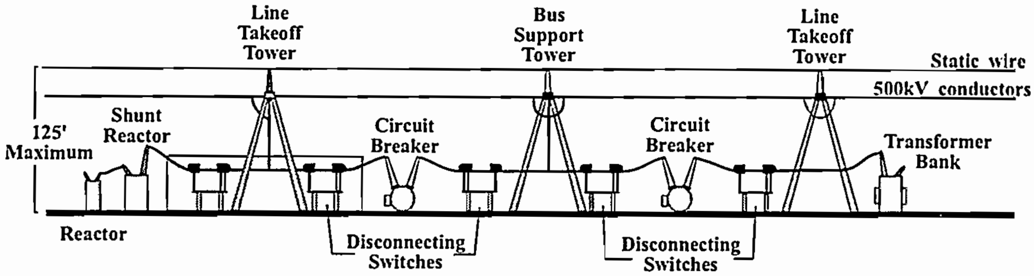
About 60 acres would be needed for the intermediate substation.

Preparation of sites for substation facilities would require the following:

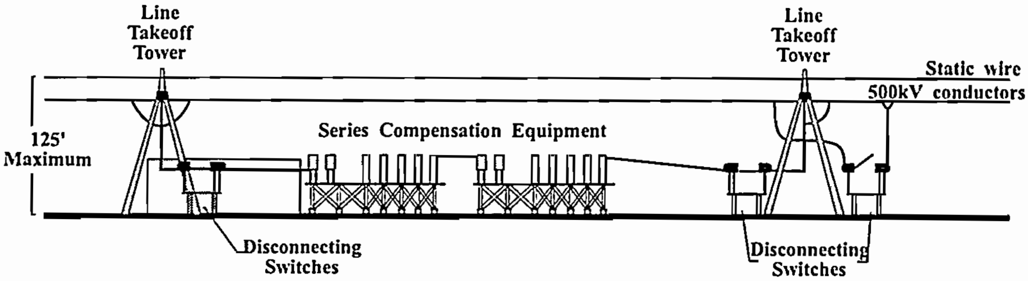
- cut-and-fill grading
- placement and compaction of structural fill to serve as a foundation for equipment
- grading to maintain drainage patterns
- oil spill containment facilities
- gravel-surfaced yard
- gravel-covered parking areas approximately 100 by 100 feet
- gravel-base roads approximately 20 feet wide
- fencing and gate
- revegetation with native plants, where practicable
- subsurface grounding grids

The appearance of a substation for NTP would be similar to the illustration in Figure 2-3. The maximum height of structures in the substation would be approximately 125 feet. The substation yards would be open air and would include transformers, circuit breakers, disconnect switches, lightning/surge arresters, reactors, capacitors, bus (conductor) structures, and a microwave antenna (Table 2-2). Also, series compensation equipment would be included within the NTP substations (see Figure 2-3).

Typical Section of a 500kV Substation

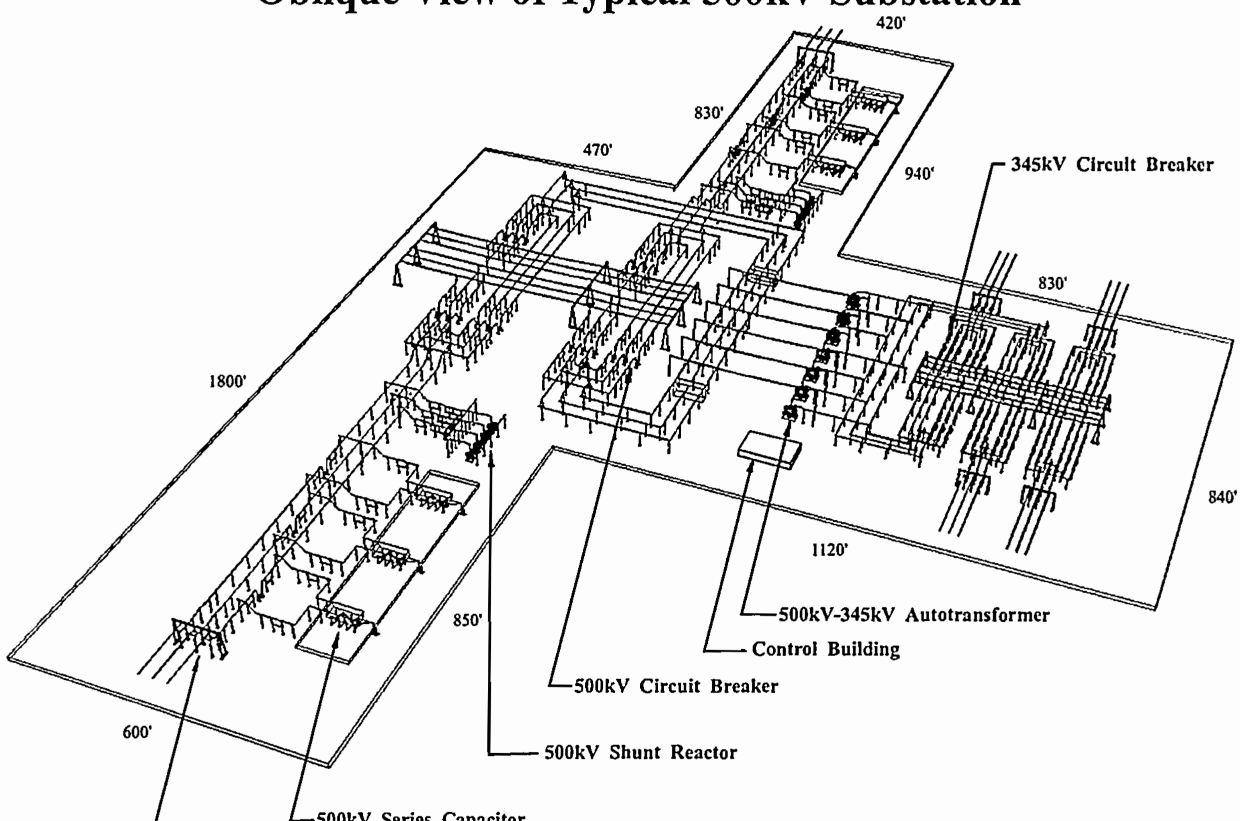


Typical Section of a Series Compensation Station



Note: 1) Illustration for graphics representation only, not approved for construction.
2) Series compensation equipment would be within the substation yard.

Oblique View of Typical 500kV Substation



Substation and Series Compensation Facilities

Navajo Transmission Project

Figure 2-3

Note: Dimensions are approximate and drawings are not to scale.

TABLE 2-2
DESIGN CHARACTERISTICS OF A SUBSTATION AND SERIES COMPENSATION STATION

	Substations	Series Compensation
Site Size (approximate)	■ 50 to 60 acres	■ included in substation
Equipment	■ transmission line takeoff structures ■ power circuit breakers ■ power transformers ■ switches equipment ■ buswork or bus conductor ■ control house ■ microwave antenna ■ current limiting reactor	■ electrical towers ■ series capacitor banks ■ switching equipment ■ bus conductors
Access Road ■ width ■ road surface ■ grading	 ■ 20 feet ■ gravel ■ heavy road base to support larger equipment	 ■ same as substation
Power Required for Operation	■ 50 kilowatts	■ 50 kilowatts
Fire Protection Facilities	■ fire wall barriers for protection from transformers	
Building	■ 5,000 square feet	■ not required
Slopes/Drainages	■ 0.5 to 1.0 percent	■ 0.5 to 1.0 percent
Substation/Series Compensation Grounding	■ use copper wire for personnel safety and grounding	■ use copper wire for personnel safety and grounding
Land Temporarily Disturbed	■ site specific	■ site specific
Land Permanently Disturbed	■ site specific grading and drainage	■ site specific grading and drainage
Voltage	■ multiple voltages, can change voltage from 500kV to 230kV	■ 500kV single voltage

500kV Transmission Station Electrical Requirements and Ratings
- ■ Transfer Capacity—1,500 to 2,200 megavolt amperes
- ■ Operating Voltage Range—475 to 550kV, root mean squared
- ■ Bus Capacity @ 525kV, 1,650 Amps
- ■ Basic Insulation Levels - 1,500kV for bus support insulation
  1,800kV for bushings and switch gaps
- ■ Phase-to-phase clearances (metal-to-metal) 20 to 28 feet
- ■ Phase-to-ground clearances (metal-to-metal) 10 to 12 feet
- ■ Phase-to-ground clearances (personal safety) 23 feet minimum
- ■ Phase-to-ground clearances (station roadways) 40 feet minimum

The control building would be a structure approximately 50 feet wide, 100 feet long, and approximately 10 feet high, and it would be constructed of conventional building material.

The substations would be designed and constructed to prevent and control accidental spills from oil-filled equipment from affecting adjacent land uses and from reaching water bodies in the vicinity of the substation. The ground level of the substation yard would be graded to direct the flow of water runoff.

The yard would be covered with a layer of gravel (four or more inches thick) that would help inhibit flow of water or other liquids, and would serve as an absorbent in the event of an oil spill. Berms, or other barriers, would be used around the perimeter of the yard (along the fence line) to control runoff. Where needed, control areas such as retention ponds would be designed and constructed to contain runoff. Also, containment structures would be constructed at the base of oil-filled equipment. These structures, usually made of cement, would be designed to contain spills. If a large volume of oil were to leak from a piece of electrical equipment, an alarm or a failure would occur notifying the operations center of the problem, and a trained maintenance crew would be dispatched to the substation immediately to begin repairs and cleanup. Oil Spill Contingency (OSC) plans and/or SPCC plans would be developed for the new substation and updated for the expansion of existing substations. These plans explain cleanup and emergency notification procedures specific to each substation. Also, the substation facilities would be enclosed by chain-link fence with a locking gate and adequate night lighting for security.

Communication Facilities

For safe and efficient operation, the proposed transmission line would require reliable, secure communication circuits for protective and control relaying. Communication systems for NTP would employ microwave and/or fiber optics.

As mentioned previously, fiber optic cable may be imbedded in the overhead ground wire and would function, in part, as a communication system for the project in addition to Western's existing microwave communication system. The new fiber optic system could be used for voice communication, protective relaying telemetering, supervisory control and data acquisition, and potentially for other commercial communications purposes. The fiber optic communication system would require regeneration stations at 40- to 60-mile intervals to reamplify the signals across the system. The regeneration stations are typically housed in buildings, the bases of which are approximately 10 by 10 feet and the height is about 8 feet. The buildings contain optical regenerator equipment, 48-volt batteries, and battery chargers.

With one exception, Western's existing microwave communication system could be used for NTP regardless of the final route selected for the transmission line. If the Red Lake Substation alternative were to be selected and constructed, a new intermediate repeater would be needed between Western's existing microwave site at Elden Mountain and the Red Lake Substation. The facility would be placed at a developed communication site on the peak of Bill Williams Mountain, administered by the Coconino National Forest, south of the town of Williams. According to the Forest Service, there is not sufficient space to construct any additional communication facilities on the peak; however, Western could negotiate an agreement with an existing user to share their facility. The existing microwave facilities could require some modifications (e.g., new equipment); however, these modifications would not be expected to require much ground-disturbing activity. Often, only a new parabolic (bowl-shaped) dish (6 to 8 feet in diameter) would have to be added to the tower. Antenna heights are approximately 60 feet or less. Communications equipment at Red Lake Substation would be constructed within the substation yard. A typical microwave facility is shown on Figure 2-4.

No new communication buildings would be needed since there are existing buildings at Bill Williams Mountain and Elden Mountain, and since the substation control building would house the communication equipment at Red Lake Substation. The buildings at these facilities are locked and secured, with entry restricted to appropriate utility personnel. The microwave facilities are unmanned and operate automatically in response to incoming signals.

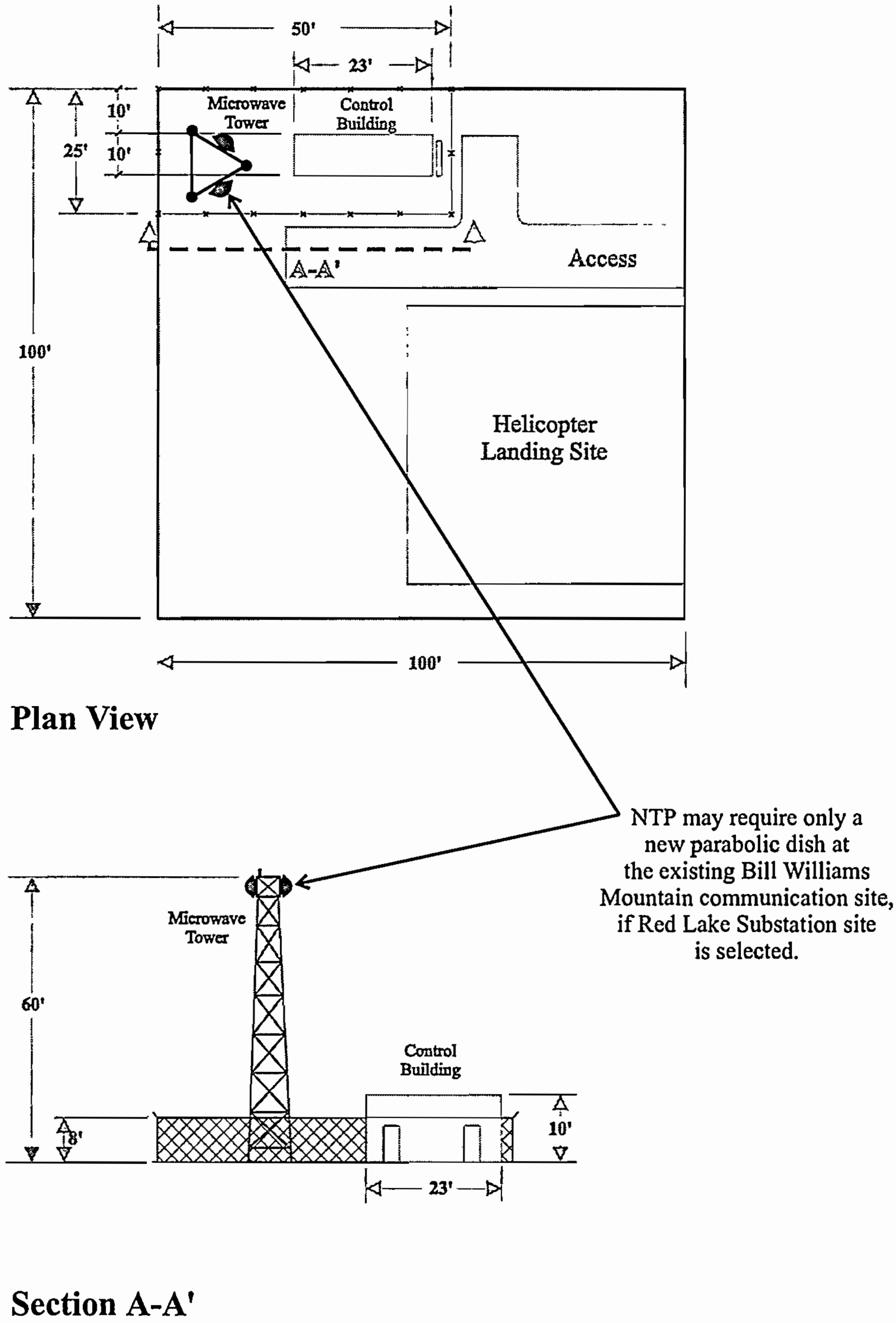
Right-of-Way Acquisition

New or additional land rights would be needed to accommodate NTP including the transmission lines, access roads, and substations. The transmission line right-of-way, the strip of land across which the transmission line passes, would require a width of 250 feet (Figure 2-5). Where the proposed transmission line would parallel an existing transmission line, the NTP right-of-way would be adjacent to or overlap the existing right-of-way. The right-of-way width must be sufficient to accommodate "conductor blowout" due to wind (which is the swinging of the conductor midway between tower structures), guy wires and anchors, and maintenance clearances at the tower sites. Additional right-of-way may be required in areas where the proposed transmission line would turn at a sharp angle and for installation of ground rods. Also, areas used temporarily (e.g., roads, staging areas, batch plants) may require temporary use permits.

In September 1992, the Resources Committee of the Navajo Nation Council granted a conditional right-of-way to accommodate the 250-foot-wide right-of-way required by NTP and additional right-of-way for a potential future transmission line (a total of 400 feet). The location of the conditional right-of-way is contingent on satisfactorily completing all permitting requirements. Currently, no firm plans or proposals for another transmission line have been identified. Until a clear need for another line arises, the size, type, and system requirements (path) cannot be known; therefore, only the impacts of the current proposed action (i.e., NTP) within a 250-foot right-of-way are addressed in this DEIS. (Refer to discussion of potential impacts associated with a second line in Chapter 4 cumulative effects section.)

Acquisition of Right-of-way Across American Indian Lands

Acquisition of rights-of-way across American Indian reservation lands is administered by numerous authorities, acts of Congress, and treaties. All American Indian reservation lands are held in trust by the Federal government. Any activities, dispositions, or uses, must be approved by the Secretary of the Department of the Interior through the BIA with contemporaneous consent of the tribal government. It is assumed that right-of-way on the Navajo Reservation and other American Indian reservation lands would be acquired by DPA and the Navajo Nation.

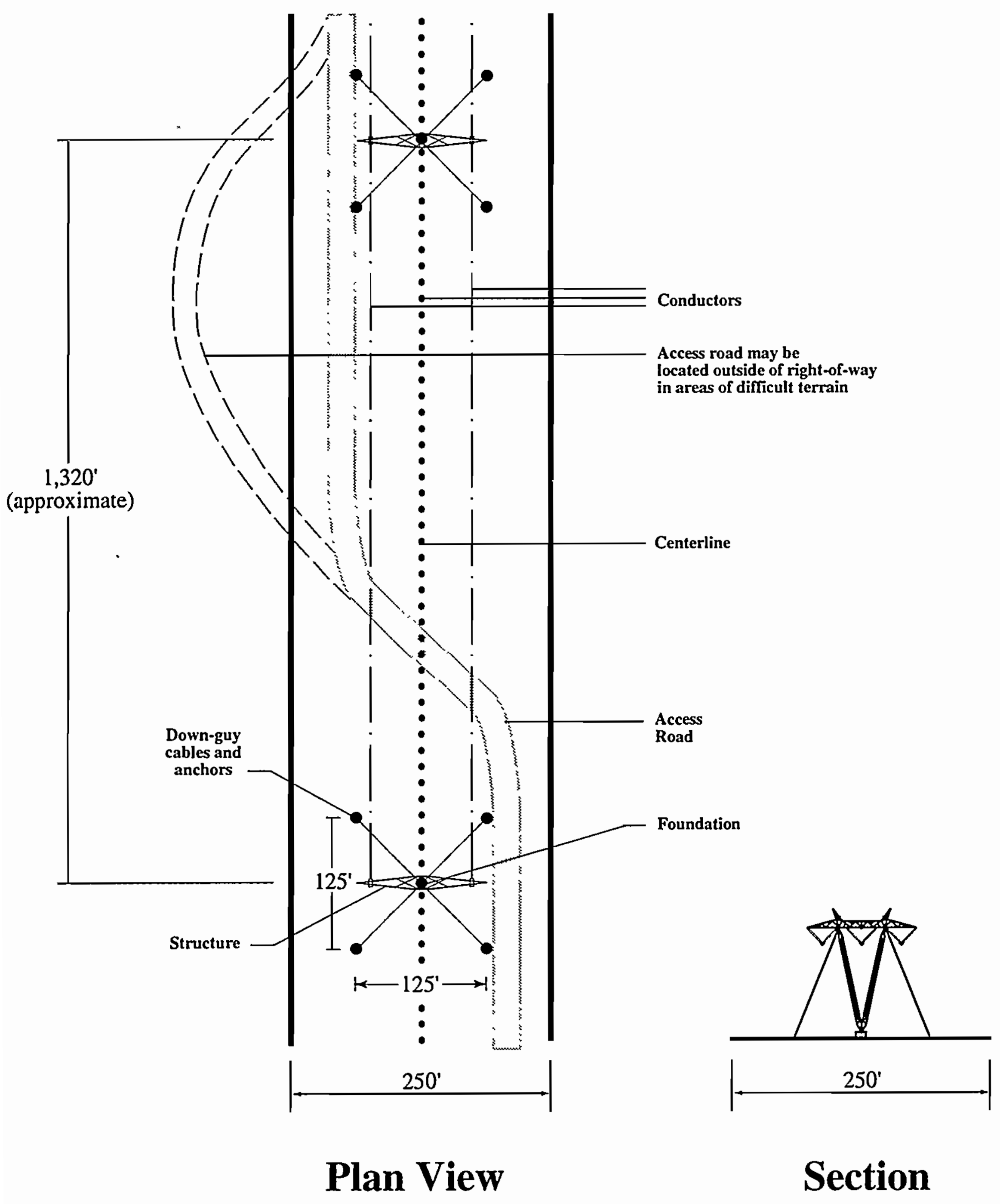


Note: Dimensions are approximate and drawings are not to scale.

Typical Microwave Facility

Navajo Transmission Project

Figure 2-4



Note: Dimensions are approximate and drawings are not to scale.

Right-of-way

Navajo Transmission Project

Figure 2-5

A right-of-way application would be made to the appropriate Real Property Management Branch, BIA agency office. The BIA Phoenix Area Office has jurisdiction over the Hopi (Hopi Agency) and Hualapai (Truxton Cañon Agency) tribes. The Navajo Area Office has jurisdiction over the Navajo Nation. The BIA then informs the tribe of the application. Concurrently, a right-of-way application would be made to the tribe, which processes the application. The application would be reviewed for accuracy, description, completion of the EIS, drawings, and local land users' consent.

Once the application is approved, it is reviewed for consideration by the tribal council, which acts on the application. Tribal approval of the right-of-way would be evidenced by a resolution approved by the respective tribe; whereas written consent of each landowner would be required on allotted lands. The application would be signed by the President or Chairman of the Nation or Tribe and then forwarded to the BIA for final approval. Upon satisfactory compliance with all requirements, the BIA Agency would prepare a grant of easement for right-of-way.

The applicant must first obtain permission to survey the centerline. The appropriate BIA Agency would furnish the applicant with names, addresses, and ownership interest in each trust allotment. The allottees then grant permission to survey. Separate consents are required for the allottees to grant right-of-way. The application includes a written agreement of compliance; maps of definite locations; appraisal report; and deposit of right-of-way consideration, allottees' written consent, archaeological clearance, and a copy of the EIS.

Acquisition of Right-of-way Across Federal Lands

The project proponents would need to obtain approval from each land-managing agency and reserve a grant for right-of-way (1) 250 feet wide for a specific number of miles across public lands; (2) for a specific period of time; (3) for the number of acres needed to construct a substation, if applicable; (4) for the amount of additional right-of-way acreage needed for access roads located outside of the 250-foot-wide right-of-way; and (5) for the estimated amount of acreage for an estimated number of any additional ancillary facilities that may cross or be constructed on public lands. In addition, temporary use permits would be required for temporary use areas such as material staging areas and concrete batch plants. Temporary use areas would have to be approved by the land-managing agency and the temporary use permits issued prior to construction.

For BLM, Western filed a preliminary right-of-way application early in the project (spring of 1994) to alert the BLM field offices regarding the proposed right-of-way, the type of use, and the Western point of contact. Once the Record of Decision has been issued, the application would be completed with project design details. A single right-of-way grant would be issued by the BLM Arizona State Office for all BLM lands crossed by the project.

The project proponents would seek the issuance of an agreement from NPS, a 50-year land use permit from the Forest Service, and a perpetual right-of-way reservation from BLM along with notices to proceed from each.

Acquisition of Right-of-way Across State Lands

Usually, land rights across state lands, such as in New Mexico and Nevada, would be acquired like private lands. However, the state of Arizona requires a public auction to dispose of real property interests.

Acquisition of Right-of-way Across Private Lands

All land rights would be acquired in accordance with Federal laws and regulations. Once a route for a transmission line has been selected, a list of all landowners with title to property lying within the transmission line right-of-way would be obtained from the county records. Permission to enter the property would be requested from the landowners for project personnel to conduct surveys, real property appraisals, environmental studies, and geological studies. From survey data of the transmission line and access road rights-of-way, detailed legal descriptions would be prepared and tract plats of the land rights to be acquired would be drawn. Every right-of-way would be individually appraised by a qualified real estate appraiser. The appraised value is tied directly to the value of the land and the impact of the facility on the land.

After the title evidence is obtained and the appraisal and legal descriptions are completed, realty specialists would present formal offers to acquire the necessary land rights. Land rights would be acquired in the form of an easement contract for transmission line rights-of-way and the land for substations would be acquired in fee simple. The realty specialist would explain the project and contract to the landowners. If agreeable to both the landowner and realty specialist, the contract would be signed. The executed contract would be recorded in the official records of the county and the right-of-way would be insured with title insurance. The landowner would be paid the amount of the contract's consideration. Also, all costs incidental to the contract's execution, such as recording fees, closing costs, and title insurance fees would be paid. After completion of construction, realty specialists would work with the landowners to settle any construction damages to the landowner's property.

If in negotiations between the project proponents and the landowner an agreement cannot be reached, or if clear title cannot be acquired, only then may Western be asked to use its authority to acquire land rights by "eminent domain" proceedings. Condemnation actions are handled by the local United States District Attorney, and condemnation cases are tried by the Federal District Court. Immediately upon filing a Declaration of Taking in the court, title to the land rights on the right-of-way would be vested in the name of the United States. Western would deposit in the court registry the just compensation amount determined by the appraisal. The court would determine the issue of just compensation at a subsequent date. During the trial, the landowner and the United States have the opportunity to present to the court evidence regarding just compensation.

Construction, Operation, and Maintenance Plan

Upon selection of a transmission line route, a plan for the development and implementation of the project would be prepared. Most of the Federal land-managing agencies require such a plan (e.g., a plan of development for BLM and a COMP for the Forest Service). At a meeting with the agencies early in the project, it was agreed that one document, a COMP, would be developed for the entire project to satisfy the requirements of the regulatory and land-managing agencies involved.

A COMP is a comprehensive document that completes a right-of-way application. A COMP addresses and incorporates requirements, policies, and principles of the applicable regulatory and land-managing agencies regarding the construction, operation, maintenance, and abandonment of the transmission line. The document provides detailed descriptions of work required at each tower site, ancillary facility location, and for each access road following selection of the final route and the final design. Agency stipulations and resource protection plans provide detailed guidelines for resource protection and site rehabilitation during and after construction (e.g., mitigation). Also, a COMP provides information about responsible project and agency authorities, emergency response plans, health and safety requirements, etc.

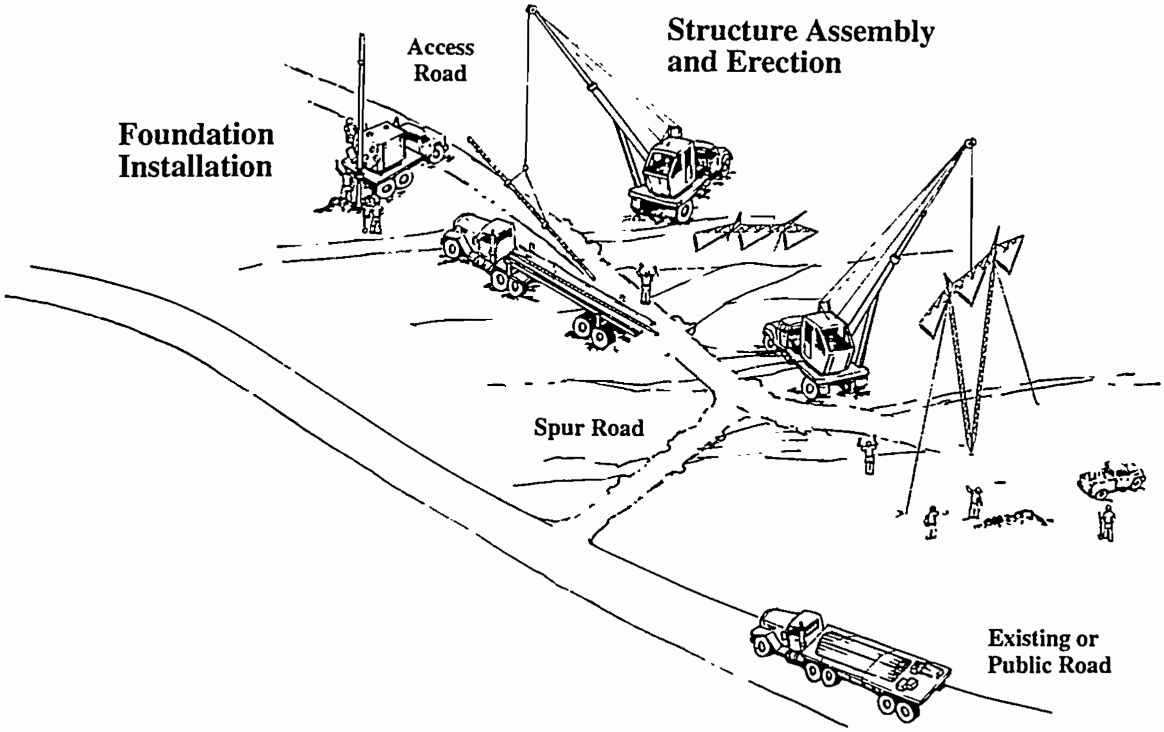
Construction

Preconstruction conferences with each of the affected agencies would be conducted to introduce the contractors and their field representatives, discuss mitigation measures and schedules, and introduce each agency's point of contact prior to commencement of construction. As construction proceeds, the construction engineer or inspector would continue to monitor activities and right-of-way authorizations to ensure compliance or to initiate modifications, where necessary. In environmentally sensitive areas, an environmental specialist with appropriate qualifications (e.g., biologist, archaeologist) would monitor construction activities to ensure compliance with specific resource mitigation. Following completion of the construction, the line would be mapped as built and separate packages would be submitted to each of the various agencies to close the acquisition process. Post-construction meetings with each of the agencies may be necessary to review the acquisition process and to determine if modifications are needed.

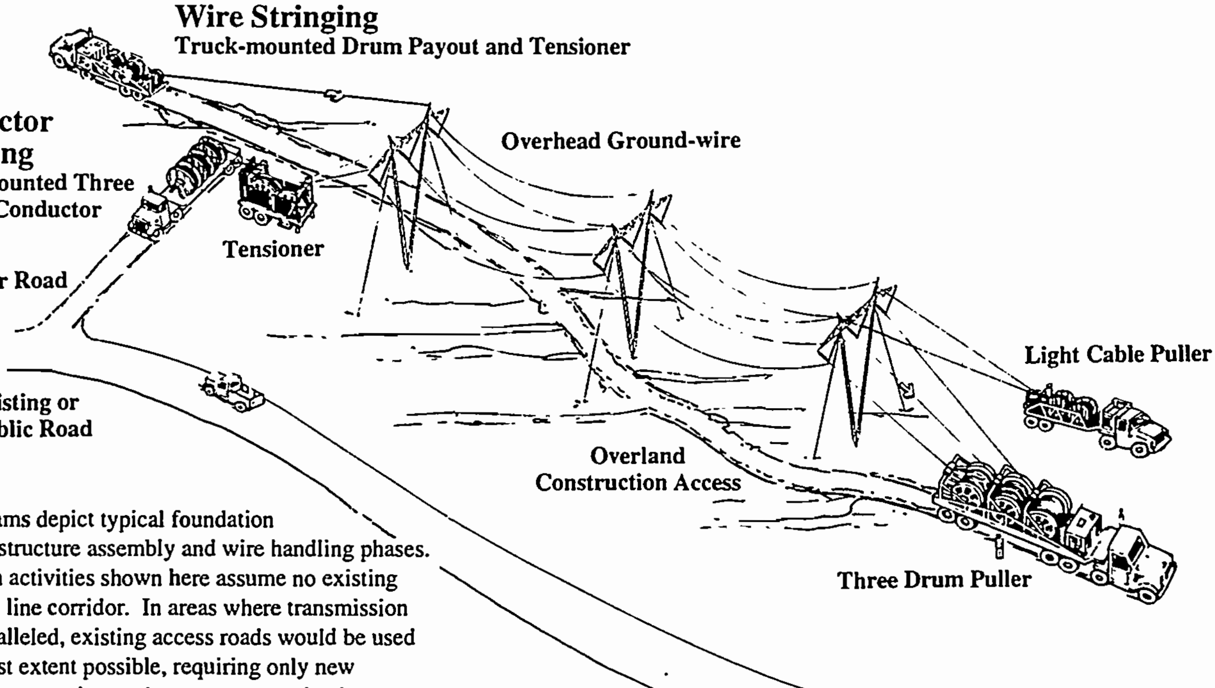
Construction of a transmission line is discussed in the following section according to the sequence of activities as listed below (Figure 2-6):

- surveying the transmission line centerline
- identifying/upgrading or constructing temporary and long-term access roads
- clearing activities for right-of-way, tower sites, construction yards, batch plants
- excavating and installing foundations
- assembling and erecting towers with temporary and permanent pad sites
- clearing of pulling, tensioning, and splicing sites
- stringing conductors and ground wires
- installing counterpoise (tower grounds) where needed
- cleaning up and reclaiming affected land areas

Foundation and Structure Construction Activities



Conductor and Ground-wire Stringing Activities



These diagrams depict typical foundation installation, structure assembly and wire handling phases. Construction activities shown here assume no existing transmission line corridor. In areas where transmission lines are paralleled, existing access roads would be used to the greatest extent possible, requiring only new spur roads to tower sites and temporary overland access.

Typical Construction Activities

Navajo Transmission Project

Figure 2-6

The proponents, DPA and Western, commit to undertake certain measures to protect the environment as standard practice for the entire project. These measures are referred to in this document as "generic mitigation," and are summarized in Table 2-3.

Surveying the Centerline—The survey would involve verifying the centerline of the route, tower center hubs, down-guy anchor hubs, right-of-way boundaries, access roads (where needed), and spur roads to tower sites. Some of these activities could begin as much as two years before the start of construction. Project proponents may decide to begin cultural and biological resources intensive surveys once certain points along the centerline are established.

Access Roads—Roads enable access to the right-of-way and tower sites for both construction and long-term maintenance of the transmission line. Access roads must be sufficient to bear the weight and endure heavy construction vehicle use. All roads would be upgraded or constructed in accordance with standard construction practices, or according to the land-managing agency's requirements. However, existing paved and unpaved highways and roads would be used, where possible, for the transportation of materials and equipment from the storage yards to the areas where they would be needed along the transmission line right-of-way.

Private landowners or land users would be consulted before road construction begins. Specific plans for construction, rehabilitation, and/or maintenance of roads would be documented in the COMP during the engineering-design phase of the project. These plans would incorporate the relevant criteria of the affected agencies and landowners or land users.

Where the proposed transmission line would parallel existing transmission lines or other linear utilities, the access roads along the existing utilities would be used where possible to minimize the amount of new road construction. However, these roads could require upgrading before they could be used for construction. All roads existing prior to construction of NTP would be left in a condition equal to or better than their condition prior to construction. Where existing roads could be used, only spur roads to the tower sites may be needed. Also, many areas may not require road access, but rather could be accessed by simply driving overland.

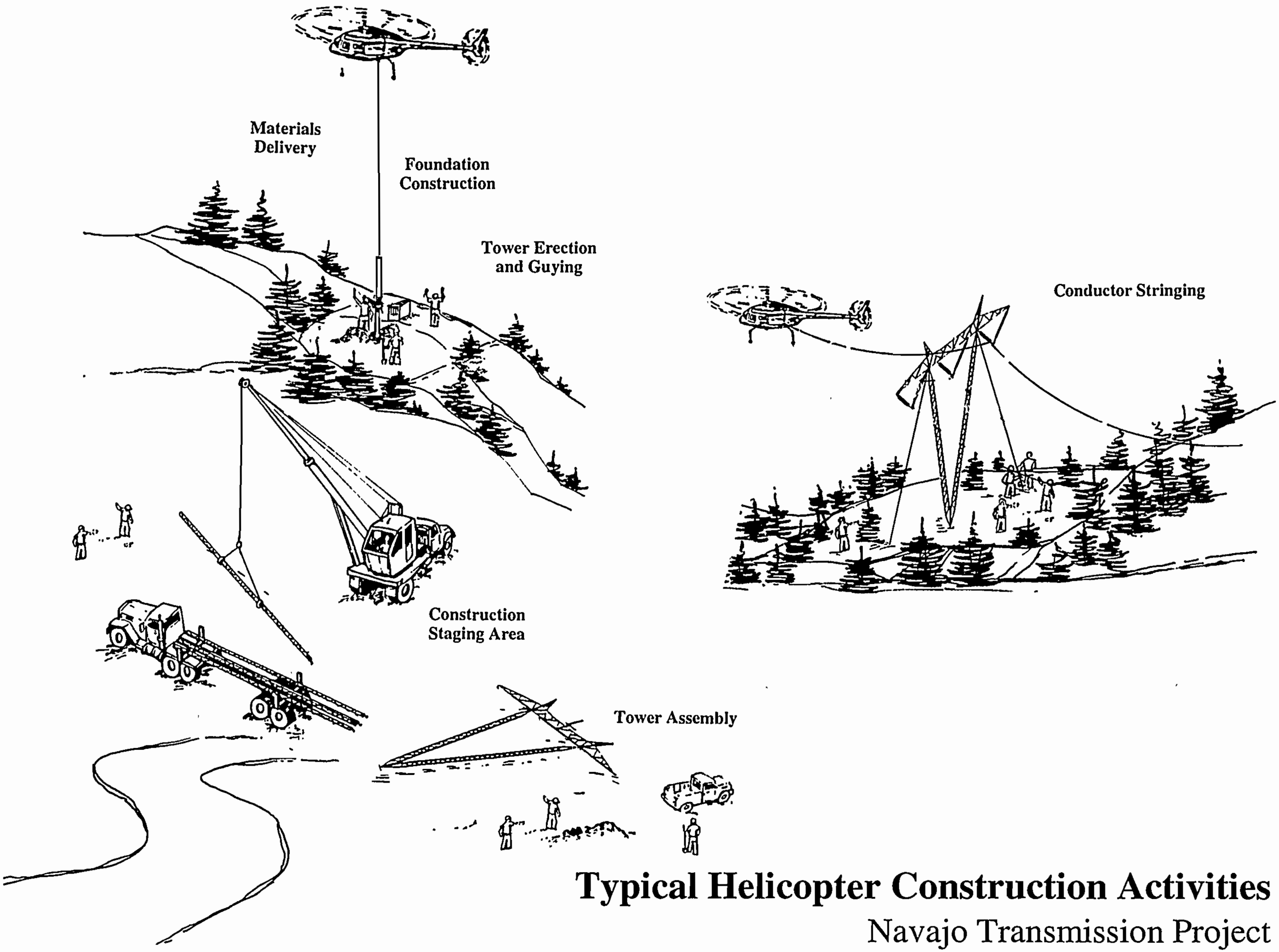
In some areas, only temporary roads would be needed. Typically, these temporary roads would be graded to a travel-surface width of about 12 feet. Turnout areas and curves would require a wider surface. Normally a ditch drainage system would not be constructed for temporary roads.

Helicopters may be used for construction (tower placement) in areas where there are environmental constraints, access is difficult due to terrain, or it is economically practical (Figure 2-7).

Permanent access roads would be constructed where needed for construction and long-term maintenance, or where the landowners or land-managing agencies require. Permanent roads also would be graded to a travel-surface width of about 12 feet except where turnout areas and curves or specifications of the land-managing agency require a wider surface. The roads would usually follow the natural grade; the maximum slope would be 15 percent. Typically, ditches on either side of the road would serve as drainage.

TABLE 2-3 GENERIC MITIGATION	
1.	All construction vehicle movement outside the right-of-way normally will be restricted to predesignated access, contractor-acquired access, or public roads.
2.	The areal limits of construction activities normally will be predetermined, with activity restricted to and confined within those limits. No paint or permanent discoloring agents will be applied to rocks or vegetation to indicate limits of survey or construction activity.
3.	In construction areas where recontouring is not required, vegetation will be left in place wherever possible and original contour will be maintained to avoid excessive root damage and allow for resprouting.
4.	In construction areas (e.g., marshalling yards, tower sites, spur roads from existing access roads) where ground disturbance is substantial or where recontouring is required, surface restoration will occur as required by the landowner or land-management agency. The method of restoration normally will consist of returning disturbed areas back to their natural contour, reseeding (if required), installing cross drains for erosion control, placing water bars in the road, and filling ditches. To avoid fragmentation of pronghorn habitat, fencing will not be used as a means of closing roads or otherwise limiting access. These instances will be reviewed on a case-by-case basis.
5.	Watering facilities and other range improvements will be repaired or replaced if they are damaged or destroyed by construction activities to their condition prior to disturbance as agreed to by the parties involved.
6.	Towers and/or ground wire will be marked with highly visible devices where required by governmental agencies (e.g., Federal Aviation Administration).
7.	On agricultural land, right-of-way will be aligned, to the extent practicable, to reduce the impact on farm operations and agricultural production.
8.	Prior to construction, all supervisory construction personnel will be instructed on the protection of cultural, paleontological, and ecological resources. To assist in this effort, the construction contract will address: (a) Federal, state, and tribal laws regarding antiquities, fossils, plants and wildlife, including collection and removal; and (b) the importance of these resources and the purpose and necessity of protecting them.
9.	Cultural resources will continue to be considered during post-EIS phases of project implementation in accordance with the programmatic agreement that is being developed in conjunction with preparation of the EIS. This will involve intensive surveys to inventory and evaluate cultural resources within the selected corridor and any appurtenant impact zones beyond the corridor, such as access roads and construction equipment yards. In consultation with appropriate land-managing agencies and State Historic Preservation Officers, specific mitigation measures will be developed and implemented to mitigate any identified adverse impacts. These may include project modifications to avoid adverse impacts, monitoring of construction activities, and data recovery studies. American Indian groups will be involved in these consultations to determine whether there are effective or practical ways of addressing impacts on traditional cultural places.
10.	The project sponsors will respond to individual complaints of radio or television interference generated by the transmission line by investigating the complaints and implementing appropriate mitigation measures (e.g., adjusting or using filtering devices on antennae). The transmission line will be patrolled on a regular basis so that damaged insulators or other transmission line materials, which could cause interference, are repaired or replaced.
11.	The project sponsors will apply mitigation needed to eliminate problems of induced currents and voltages onto conductive objects sharing a right-of-way to the mutual satisfaction of the parties involved.
12.	The project sponsors will continue to monitor studies performed to determine the effects of audible noise and electrostatic and electric and magnetic fields in order to ascertain whether these effects are significant.

TABLE 2-3 GENERIC MITIGATION	
13.	Roads will be built at right angles to the streams and washes to the extent practicable. Culverts will be installed where needed. All construction and maintenance activities will be conducted in a manner that will minimize disturbance to vegetation, drainage channels, and intermittent or perennial streambanks. In addition, road construction will include dust-control measures during construction in sensitive areas. All existing roads will be left in a condition equal to or better than their condition prior to the construction of the transmission line.
14.	All requirements of those entities having jurisdiction over air quality matters will be adhered to and any permits needed for construction activities will be obtained. Open burning of construction trash will not be allowed unless permitted by appropriate authorities.
15.	Fences and gates will be repaired or replaced to their original condition prior to project disturbance as required by the landowner or the land-management agency if they are damaged or destroyed by construction activities. Temporary gates will be installed only with the permission of the landowner or the land-managing agency.
16.	Transmission line materials will be designed and tested to minimize corona. A bundle configuration (three conductors per phase) and larger diameter conductors will be used to limit the audible noise, radio interference, and television interference due to corona. Tension will be maintained on all insulator assemblies to assure positive contact between insulators, thereby avoiding sparking. Caution will be exercised during construction to avoid scratching or nicking the conductor surface, which may provide points for corona to occur.
17.	Nonspecular conductors and ground wires will be used to reduce visual impacts.
18.	No nonbiodegradable debris will be deposited in the right-of-way. Slash and other biodegradable debris will be left in place or disposed of in accordance with requirements of the land-managing agency.
19.	The primary focus of paleontological mitigation efforts should be areas of greatest disturbance and areas likely to have significant fossils. Preconstruction surveys of such areas may be conducted as agreed upon by the land-managing agency and lead Federal agency.
20.	Mitigation measures developed during the consultation period under Section 7 of the Endangered Species Act (1974) will be adhered to as specified in the Biological Opinion of the U.S. Department of the Interior Fish and Wildlife Service. Also, mitigation developed in conjunction with state and tribal authorities will be adhered to.
21.	Hazardous materials will not be drained onto the ground or into streams or drainage areas. Totally enclosed containment will be provided for all trash. All construction waste including trash and litter, garbage, other solid waste, petroleum products, and other potentially hazardous materials will be removed to a disposal facility authorized to accept such materials.
22.	At residences, the right-of-way will be aligned, to the extent practicable, to reduce impact on the residences and inhabitants.
23.	Special status species or other species of particular concern will continue to be considered during post-EIS phases of project implementation in accordance with management policies set forth by the appropriate land-managing agency. This may entail conducting surveys for plant and wildlife species of concern along the proposed transmission line route and associated facilities (i.e., access and spur roads, staging areas) as agreed upon by the land-managing agency and lead Federal agency. In cases where such species are identified, appropriate action will be taken to avoid adverse impacts on the species and its habitat and may include altering the placement of roads or towers as practicable and monitoring construction activities.



Typical Helicopter Construction Activities

Navajo Transmission Project

Figure 2-7

In certain areas, it could be necessary to block roads after construction to restrict future access for general and undesired use. Such areas would be identified in coordination with the landowner or land-managing agency. However, blocked access routes would have to be reopened when necessary where right of access is being impeded.

For the NTP EIS studies, the amount of ground disturbance from upgrading or constructing access was estimated. Six levels of ground disturbance were defined as summarized in Table 2-4. An aerial reconnaissance of all of the alternative routes was conducted to identify potential needs for access. Existing roads suitable for access and the general condition of each were mapped. This information was combined with slope data to provide an estimate of the potential ground disturbance that could result from upgrading existing roads or constructing new roads. These results were used as part of the impact assessment.

TABLE 2-4
GROUND DISTURBANCE/ACCESS LEVELS

Level 1	***Improved Roads*** Roads generally in good condition, but may need to be improved selectively. An average of 200 to 300 feet of spur road would be required to access each tower site. Spur roads would disturb about 0.3 acre per mile of transmission line.
Level 2	***Roads that Require Improvement*** Two-track and other unimproved roads that would require substantial improvement prior to construction. An average of 200 to 300 feet of spur roads would be required for each tower site. Spur roads would disturb about 0.3 acre per mile of transmission line.
Level 3	***Construct Road in Flat Terrain (0 to 5 percent)*** Approximately 1.0 to 1.1 miles of new road would be required for each mile of transmission line. Road construction would disturb approximately 1.5 acres per mile of transmission line.
Level 4	***Construct Road in Sloping Terrain (5 to 10 percent)*** Approximately 1.1 to 1.3 miles of new road would be required for each mile of transmission line. Road construction would disturb approximately 1.7 acres per mile of transmission line.
Level 5	***Construct Road in Steep Terrain (10 to 35 percent)*** Approximately 1.3 to 1.8 miles of new road would be required for each mile of transmission line. Road construction would disturb approximately 2.3 acres per mile of transmission line.
Level 6	***Construct Road in Very Steep Terrain (over 35 percent)*** Approximately 1.8 to 2.5 miles of new road would be required for each mile of transmission line. Road construction would disturb approximately 3.1 acres per mile of transmission line.

Clearing—Clearing of natural vegetation would be required for construction purposes (access and tower sites), land surveying activities, clearances for electrical safety, long-term maintenance, and reliability of the transmission line.

Within or adjacent to the right-of-way, mature vegetation would be removed under or near the conductors to provide adequate electrical clearance as required by NESC and DOE order WAPA 6460.1. Trees that could fall onto the transmission line, affect the transmission line during wind-induced conductor swing, or otherwise present an immediate hazard to the transmission line or have the potential to encroach within the safe distance to the conductor as a result of bending, growing, swinging, or falling toward the conductor would be removed. The normal procedure is to top or remove only large trees. If a conflict were to arise regarding clearance procedures, the conflict would be reviewed and agreed on by the project proponents and land managers or owners.

At each tower site, leveled areas, or pads (approximately 30 by 40 feet), would be needed to facilitate the safe operation of construction equipment, such as cranes. At each tower site, a work area of approximately 200 by 200 feet would be required for the location of tower footings, assembly of the tower, and necessary crane maneuvers. The work area would be cleared of vegetation only to the extent needed. After construction, all pads not needed for normal maintenance of the transmission line would be graded to blend as near as possible with the natural contours, and revegetated with indigenous plant species. Areas would be reseeded prior to the season(s) when precipitation is normally received. For example, BLM Farmington District would require reseeding prior to the rainy season, which is July through September.

Temporary material staging sites would be located near each end of the transmission line and approximately every 40 miles along the route. These would be located in previously disturbed areas or in areas of minimal vegetative cover where possible and would require about five acres of land. The location of all sites would be determined through discussions with landowners or the land-managing agency.

Concrete used to construct foundations would be dispensed from a portable concrete batch plant. Approximately two acres of land would be required for each site. A rubber-tired flatbed truck and tractor would be used to relocate each plant along the right-of-way at 30-mile intervals. Where economically feasible, commercial ready-mix concrete could be used.

The construction yards and batch plants also would serve as field offices, reporting locations for workers, parking space for vehicles and equipment, sites for material storage, and stations for equipment maintenance. Facilities would be fenced and gates locked. Security guards would be assigned where needed.

Installing Foundations—Vertical excavations for foundations would be made with power drilling equipment. Where soils permit, a vehicle-mounted power auger or backhoe would be used. In rocky areas, the foundation holes would be excavated by drilling, blasting, or installing special rock anchors. All safeguards associated with using explosives (e.g., blasting mats) would be employed. Blasting activities would be coordinated with the appropriate land-managing agency, particularly for purposes of safety and protection of sensitive areas (e.g., springs, cultural resources). In extremely sandy areas, water or a gelling agent could be used to stabilize the soil before excavation.

Concrete footings would be cast in place following excavation. Steel grillage foundations would be specified in mountainous areas. Cast-in-place footings would be installed by placing reinforcing steel and a tower stub into the foundation hole, positioning the stub, and encasing it in concrete. Spoil material (excavated soil) would be used for fill where suitable and the remainder would be spread at the tower site.

The foundation excavation and installation would require access to the site by a power auger or drill, crane, material trucks, and ready-mix concrete trucks.

Assembling and Erecting Towers—Bundles of steel members and associated hardware would be shipped to each tower site by truck. Steel members would be assembled into subsections of convenient size and weight. The assembled subsections would be hoisted into place by a large crane and then fastened together to form a complete tower.

Stringing Conductors and Ground Wires—Insulators, hardware, and stringing sheaves would be delivered to each tower site. The towers would be rigged with insulator strings and stringing sheaves at each ground wire and conductor position.

For protection of the public during wire installation, guard structures would be erected over highways, railroads, power lines, structures, and other barriers. Guard structures would consist of H-frame wood poles placed on either side of barriers. These structures would prevent ground wires, conductors, or equipment from falling across obstacles. Equipment for erecting guard structures would include augers, line trucks, pole trailers, and cranes. Guard structures might not be required for small roads. In such cases other safety measures such as barriers, flagmen, or other traffic control would be used. Following stringing and tensioning of all conductors, the guard structures would be removed.

Pilot lines would be pulled (strung) from tower to tower by a helicopter and threaded through the stringing sheaves at each tower. Following pilot lines, a larger diameter, stronger line would be attached to conductors to pull them onto towers. This process would be repeated until the ground wire or conductor is pulled through all sheaves.

Ground wire and conductors would be strung using powered pulling equipment at one end and powered braking or tensioning equipment at the other end of a conductor segment as shown in Figure 2-6. Sites for tensioning equipment and pulling equipment would be approximately three miles apart. The tensioning site would be an area approximately 200 by 200 feet. Tensioners, line trucks, wire trailers, and tractors needed for stringing and anchoring the ground wire or conductor would be located at this site. The tensioner, in concert with the puller, would maintain tension on the ground wire or conductor while they were fastened to the towers. The pulling site would require approximately half the area of the tension site. A puller, line trucks, and tractors needed for pulling and temporarily anchoring the counterpoise, ground wire, and conductors would be located at this site.

Installing Ground Rods—Part of standard construction practices prior to conductor installation would involve measuring the resistance of the ground to electrical current near the tower structures. If the resistance were greater than 10 ohms, counterpoise (grounds) would be installed to lower the resistance to less than 10 ohms. Counterpoise would consist of a bare copper clad or galvanized steel cable buried a minimum of 12 inches deep, extending horizontally away from one or more tower legs for approximately 200 feet. If the counterpoise were to extend outside of the 250-foot right-of-way (which is anticipated to be infrequent), additional right-of-way to accommodate the counterpoise would be acquired.

Cleanup—Construction sites, material storage yards, and access roads would be kept in an orderly condition throughout the construction period. Refuse and trash would be removed from the sites and disposed of in an approved manner (e.g., in an approved landfill). In remote areas, trash and refuse could be removed to a construction staging area and contained temporarily until such time as it could be hauled to an approved site. No open burning of construction trash would occur without the appropriate landowners or land-managing agency approval.

Reclamation of Affected Areas—The right-of-way would be restored as near to its original condition as practicable. All practical means would be made to restore the land to its original contour and to restore natural drainage patterns along the right-of-way. Because revegetation would be difficult in many areas of the project where precipitation is normally minimal, every effort would be made to minimize disturbance during construction. All practical means would be made to increase the chances of vegetation re-establishment in disturbed areas (e.g., use of native plants, or seed mix specified by land-managing agency).

Construction Work Force and Schedule

It is anticipated that total construction time for the transmission line would be two and one-half years. Substation additions or new substations would be constructed concurrently. To facilitate management of construction, the transmission line could be constructed in segments. For example, construction of the line could be divided in four equal segments and awarded as four separate contracts; each could be awarded for a performance time of one year successively every six months. The total work force required to complete construction would be approximately 225 people. Equipment size would range from light to heavy duty. Table 2-5 lists the personnel and equipment needed for construction of the transmission line, substation, and communication facility. Figure 2-8 illustrates work force requirements during construction.

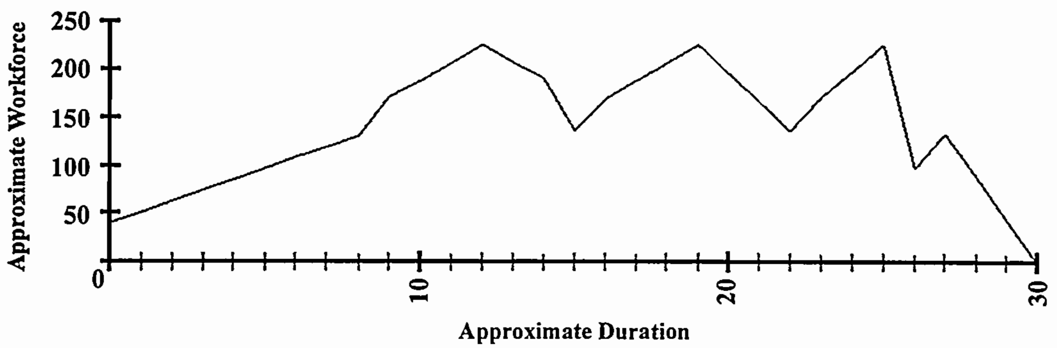


FIGURE 2-8
CONSTRUCTION WORK FORCE SCHEDULING

TABLE 2-5
CONSTRUCTION WORK FORCE AND EQUIPMENT

Transmission Line		
Access Road Construction		
■ work force	12 people (including maintenance)	
■ equipment	2 bulldozers (D-6 or D-8) 2 motor graders 2 pickup trucks 2 water trucks (for construction and maintenance)	
Footing Installation		
■ work force	32 people	
■ equipment	2 hole diggers 1 bulldozer (D-6) 1 truck (2 ton) 6 concrete trucks 6 hydro crane (15 ton)	2 pickup trucks 2 carry alls 1 batch plant 2 dump trucks 2 wagon drills
Structure Steel Haul		
■ work force	12 people	
■ equipment	6 steel haul trucks 1 yard crane (heavy duty)	2 pickup trucks
Structure Assembly		
■ work force	32 people	
■ equipment	4 carry alls 4 pickup trucks	4 cranes (rubber tired) 4 trucks (2 ton)
Survey		
■ work force	6 people	
■ equipment	1 helicopter	2 pickups
Structure Erection		
■ work force	12 people	
■ equipment	2 cranes (60 ton) 2 trucks (2 ton)	2 pickup trucks

TABLE 2-5 CONSTRUCTION WORK FORCE AND EQUIPMENT	
Transmission Line	
Conductoring ■ work force ■ equipment	 48 people 1 helicopter and fly ropes 3 drum pullers (1 light, 1 medium, 1 heavy) 2 splicing trucks 2 double-wheeled tensioners (1 light, 1 heavy) 6 wire reel trailers 2 diesel tractors 1 crane (2 to 4 ton) 1 sagging equipment 4 trucks (5 ton) 6 pickup trucks
Clean-up ■ work force ■ equipment	 15 people 2 pickup trucks 2 trucks (2 ton)
Road Rehabilitation ■ work force ■ equipment	 6 people 1 bulldozer (D-8) 1 pickup truck 2 motor graders
Total Personnel Required = 175	
Substation and Communication Facility	
Work Force Equipment	50 people 1 yard crane 1 bulldozer 1 road grader 2 pick-up trucks 1 water truck 1 concrete truck 1 dump truck

It is estimated that up to about 50 percent of this work force could be hired locally (including American Indians). This percentage is dependent on skills and manpower requirements. It is anticipated that hiring of construction workers would comply with the Tribal Employment Rights Ordinance and other tribal preference employment acts, as appropriate. Non local people would be expected to utilize temporary housing in nearby communities and commute to and from the job site on a daily basis. Some may own mobile homes and park them where connection facilities are available (special use permits may be required on American Indian reservations). Others would occupy rental houses and apartments.

Construction activities would be anticipated to commence in late 1998. Typical time frames to construct the proposed transmission line would be anticipated to be as follows:

■ tower pad construction	5 towers per day (1 mile per day)
■ tower erection	2 towers per day (by crane)
■ conductor stringing	1 mile per day (triple conductor)
■ restoration	5 miles per day

Typically, transmission line construction is staged such that all elements are completed at approximately the same time. Surveying and staking of structure sites can be expected to be an ongoing process for the life of each individual 52-week contract. Placement of concrete tower foundations would commence immediately and continue for 50 weeks on any 100-mile portion of the line. After 16 weeks, steel hauling and tower erection would commence and continue for 36 weeks. Cleanup, building fences and gates, and installing culverts and cattle guards are continuing operations over the length of the transmission line. Construction of a new substation or major addition can be accomplished in 50 to 80 weeks and is accomplished concurrently with transmission line construction. The target year for commercial operation of the project would be 2001.

There is the potential that the transmission line could be constructed in phases; for example, the eastern portion of the project area would be built, then the western portion could be built a number of months or even years later. Reasons for phasing construction of the overall project could include the following: response to changing market for transmission capacity, conditions and status of financing, socioeconomic objectives, and/or jurisdictional constraints (e.g., Bennett Freeze).

Health and Safety

Fire Protection—All applicable fire laws and regulations would be observed during construction. All Federal and contractor employees would be advised of their responsibilities under the applicable fire laws and regulations, including training and taking practical measures to prevent, suppress, and report fires.

Hazardous Materials—Petroleum products such as gasoline, diesel fuel, helicopter fuel, crankcase oil, lubricants, and cleaning solvents would be present on site during construction. These products would be used to fuel, lubricate, and clean vehicles and equipment. These products would be contained within fuel trucks or in approved containers. When not in use, such materials would be stored properly to prevent drainage or accidents.

All construction, operation, and maintenance activities would comply with all applicable Federal, state, tribal, and local regulations regarding the use of hazardous substances. Hazardous materials would not be drained onto the ground or into streams or drainage areas. Totally enclosed containment would be provided for all trash. All construction waste including trash and litter, garbage, other solid waste, petroleum products, and other potentially hazardous materials would be removed and transported to a disposal facility authorized to accept such materials.

The construction or maintenance supervisor would ensure that all applicable Federal, state, tribal, and local laws are obeyed. These would include, but not be limited to, the Resource Conservation and Recovery Act; Comprehensive, Environmental Response, Compensation, and Liability Act; Toxic Substance Control Act; Department of Transportation regulations; Clean Air Act; Clean Water Act; and Emergency Planning and Community Right-to-Know. In addition, regulations of the Occupational Safety and Health Administration would be followed. A health and safety plan addressing procedures to respond to accidental release of hazardous materials would be developed as part of the COMP during the engineering-design phase of the project. The project proponents would coordinate with the land-managing agencies to incorporate specific agency requirements into the COMP.

Operation, Maintenance, and Abandonment

Permitted Uses—After construction, compatible uses in the right-of-way on public lands would be considered and approved by the project proponents and the land-managing agency. Permission to use the right-of-way on private lands would have to be obtained from the owner of the transmission line. Generally, the individual landowner or land user retains the right to use the land in ways that do not interfere with the rights granted for the transmission line and consider the safety of humans and animals. Examples of uses generally permitted within the right-of-way include grazing, most crop production, vehicle access, low-growing trees, open storage areas, corrals, and stock tanks. Examples of prohibited uses include buildings or closed structures frequented by humans such as residences and any use requiring changes in surface elevation that would affect electrical clearances of existing or planned facilities.

Safety and Grounding—The design, operation, and maintenance of the project would meet or exceed all applicable criteria and requirements of FERC, WSCC, NESC, and U.S. Department of Labor Occupational Safety and Health Standards for safety and protection of landowners and their property. The transmission line would be protected with power circuit breakers and line relay protection equipment. If conductor failure occurred, power would be automatically removed from the line. Lightning protection would be provided by overhead ground wires along the line.

All buildings, fences, and other structures with metal surfaces located within 200 feet of the centerline of the right-of-way would be grounded. Typically, residential buildings located 200 feet from the centerline would not require grounding. Other buildings or structures beyond 200 feet would be reviewed in accordance with the NESC to determine grounding requirements. Also, all metal irrigation systems that parallel transmission lines for distances of 1,000 feet or more within 100 feet of the centerline would be grounded. If grounding were required outside the right-of-way, a temporary use permit or landowner consent would be obtained as necessary.

Maintenance—The 500kV transmission line would be inspected annually or as required by both ground and air patrols. Maintenance would be performed as needed, and the comfort and safety of local residents would be provided for by limiting noise, dust, and the danger caused by maintenance vehicle traffic.

Where access is required for nonemergency maintenance and repairs, the same precautions against ground disturbance that were taken during the original construction would be followed. The project proponents would comply with requirements of the land-managing agencies regarding management of noxious weeds within the right-of-way and transmission line access roads.

Emergency maintenance would involve prompt movement of repair crews to repair or replace any damaged equipment. Although restoration of the line would have priority, an effort would be made to protect crops, plants, wildlife, and other resources of significance. Restoration and reclamation procedures following completion of repair work would be similar to those prescribed for construction. Details would be provided in the COMP prior to construction of the transmission line.

Land within rights-of-way would not be chemically treated with herbicides or pesticides unless needed and only upon prior approval of the land manager or owner. The project proponents would comply with requirement of the land-managing agencies regarding management of noxious weeds along access roads, within the right-of-way, and at temporary use areas (e.g., cleaning equipment to prevent spread of noxious weeds). Chemical treatment within or adjacent to the right-of-way generally would be limited only to areas with noxious weeds.

Inspection and maintenance of the building, communication tower, and other physical equipment would occur periodically. Maintenance of the communication facilities would consist of testing, repairing, and replacing electronic equipment located within the building at the communication site. Sites accessible by road would be patrolled and monitored by maintenance personnel.

The 500kV substation yards are inspected weekly, requiring one person one day to accomplish. Each gas circuit breaker undergoes routine annual inspections and maintenance, requiring three people one day to accomplish. The power transformers receive annual maintenance taking two people about one-half day to complete. Capacitors are maintained annually, requiring three people one day to complete.

Abandonment—At the end of the useful life of the proposed project (estimated to be at least 50 years), if the transmission line and associated facilities were no longer needed, the facilities would be abandoned. The project proponents would coordinate with the appropriate land-managing agencies to develop a plan for the abandonment. For example, all equipment not needed would be dismantled and removed, and tower structures would be removed and foundations broken off below ground surface. If the line and associated right-of-way were abandoned at some future date, the right-of-way would be available for the same uses that existed before construction of the project. Following abandonment and removal of the transmission line from the right-of-way, any areas disturbed would be restored and rehabilitated as near as possible to their original condition.

ESTIMATED COST

Cost estimates have been prepared and updated throughout the development of NTP. The route preferred by the proponents for construction has not been selected; however, cost estimates for alternative routes addressed in this DEIS have been prepared, and the average cost (in constant 1995 dollars) for the alternative routes would be approximately $332 million ($248 million for the transmission line and $84 million for the substations). The cost estimates were prepared using unit costs and assumptions typical for estimating such facilities. The cost estimates were reviewed by independent consultants and updated by Western.

ALTERNATIVE ROUTES

A number of alternative routes for the proposed transmission line were identified, studied, assessed, and compared. The objective was to identify the environmentally preferred route from Shiprock Substation in northwestern New Mexico to either the Mead or the Marketplace substation in southeastern Nevada. This section summarizes the process followed and the results leading to and included in the comparison of alternative routes, presents the environmentally preferred route, and explains the decisions to be made regarding the proposed action. The information here focuses on only the alternative routes addressed and compared in this DEIS (approximately 1,022 miles of routes), and does not address any of the alternatives that were studied but eliminated from further consideration (see Appendix B).

Environmental analyses also were completed for the substation sites and communication site being considered. The substation site selected would depend on the route selected for construction of the transmission line. At the western terminus, both the Mead and the Marketplace substations remain as options until utility participation in one or the other of the substations is determined. As mentioned previously, the only microwave communication facilities needed would be to support the potential Red Lake Substation. If the Red Lake Substation were selected, microwave equipment would be installed at existing microwave communication facilities and within the Red Lake Substation yard. For these reasons, only the alternative routes are addressed.

Process

Each step of the process, as shown in Figure 2-9, is briefly summarized below and explained in more detail in Appendix A.

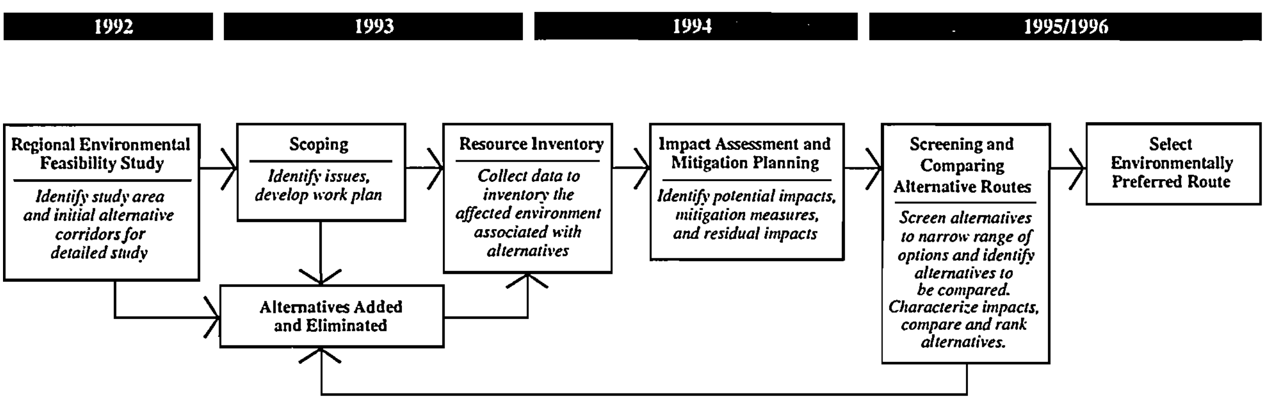


FIGURE 2-9
ENVIRONMENTAL PROCESS

Regional Environmental Feasibility Study The environmental work began with a regional environmental feasibility study to identify potential corridors feasible for constructing a transmission line. The majority of the corridors identified parallel existing linear facilities such as transmission lines, pipelines, or fiber optic cable. The results of the study were documented in the *Navajo Transmission Project Environmental Feasibility Study* (June 1992).

Scoping The locations of the alternative routes were refined and then reviewed by the public and relevant agencies through scoping (Chapter 5), which initiated the NEPA process. The process and results are documented in the *Navajo Transmission Project Scoping Report* (January 1994). As a result of scoping, several alternative routes were eliminated and others were added (Appendix B) to establish the network of alternative routes and ancillary facilities (substations and a communication site) to be studied.

Resource Inventory Each alternative route was inventoried to establish a baseline of existing environmental resources. Through scoping and resource inventory, a number of environmental issues were identified (Table 2-6). These environmental issues influenced the direction of the analyses and criteria for assessing impacts.

Impact Assessment and Mitigation Planning The alternative routes were assessed to identify the potential effects that the proposed project could have on the resources. Where warranted, measures to mitigate the impacts were selectively recommended. Table 2-7 (at the end of this chapter) provides a list of the selective mitigation measures, a general description of each measure's effectiveness, and the resources for which each measure was employed. The impacts remaining after mitigation was applied are referred to as residual impacts. The *Navajo Transmission Project Mitigation Plan* (September 1996) was prepared to document the environmental impacts and the mitigation measures committed to in the DEIS.

Screening and Comparison Through a systematic analysis, all of the alternative routes studies were screened and compared in order to narrow the number of alternative routes (Appendix B) and determine the most environmentally acceptable routes addressed in the DEIS.

Selection of Environmentally Preferred Route The remaining alternatives were ranked for preference. The alternative routes in the east and west with the least overall impact on the environment were selected as the environmentally preferred.

TABLE 2-6 ENVIRONMENTAL ISSUES AND CONCERNS	
Eastern Area	
Resource Issue	**Comment/Concern**
Water and Soils	■ impacts at river crossings (San Juan River, Colorado River, Little Colorado River)
Biological	■ riparian areas ■ habitat fragmentation ■ threatened and endangered fish species at river crossings ■ special status species ■ big game habitat ■ effects on biodiversity and habitat in the Chuska Mountains ■ Glen Canyon NRA - impacts on peregrine falcon, goshawk, threatened and endangered species plants ■ The Hogback Area of Critical Environmental Concern (ACEC) (sensitive plant species)
Land Use	■ follow existing corridors ■ develop reasonable range of alternatives as Navajo-Hopi land dispute could affect implementation of the project ■ residences and agriculture ■ proximity to towns of Waterflow, Lukachukai, Many Farms, Page, and Lechee ■ timber management area in Buffalo Pass ■ Turquoise planning area - Hopi comprehensive plan ■ future development in Page ■ restrictions of right-of-way on future land uses ■ uranium mining reclamation areas
Parks, Preservation, and Recreation	■ Monument Valley Tribal park ■ recreational uses around Page
Visual	■ Class A scenery in Buffalo Pass, Marsh Pass/northern Black Mesa ■ views from State Register District at Mitten Rock ■ views from NPS administered lands - Glen Canyon NRA, the Flagstaff areas, National Monuments ■ visual concerns in the Page area ■ visual effects - presence of line
Cultural	■ areas of regional customary and ceremonial significance (Marsh Pass area, Chuska Mountains, Chuska Valley, Black Mesa) ■ Navajo (Comb Ridge) and Hopi traditional cultural places (eagle nesting, pilgrimage trails) ■ The Hogback National Register District, Chaco Protection Site
Other	■ electric and magnetic field (EMF) effects on humans and animals

TABLE 2-6 ENVIRONMENTAL ISSUES AND CONCERNS	
Western Area	
Resource Issue	**Comment/Concern**
Water and Soils	■ river crossings (Colorado River) ■ erosive soils in Truxton Plain area
Biological	■ sensitive habitat for desert bighorn sheep, desert tortoise, nesting bald eagles in Lake Mead NRA ■ raptor habitat in the Aubrey Cliffs ■ black-footed ferret reintroduction in Aubrey Valley ■ Wright Canyon ACEC ■ Cottonwood-Wright Creek ACEC ■ Black Mountain ACEC (bighorn sheep) ■ habitat fragmentation ■ big game (pronghorn antelope) habitat in Truxton Plain area ■ Eldorado Mountains (wild burros) ■ Eldorado Valley (desert tortoise)
Land Use	■ follow existing corridors ■ Chemstar Lime Mine ■ conflicts in Hackberry area
Parks, Preservation, and Recreation	■ impacts on Arizona Trail and Moqui Stage Station ■ Lake Mead NRA
Visual	■ views from NPS administered lands (Lake Mead NRA, Grand Canyon, and Flagstaff areas) ■ visual effects - presence of lines ■ US 180/AZ 64, Diamond Creek Road, Beale Wagon Road ■ Grand Canyon Railroad ■ visual quality in Truxton Plains
Cultural	■ areas of regional customary and ceremonial significance to Hualapai and Navajo tribes (traditional cultural places) ■ Milkweed Canyon ceremonial site ■ Grand Canyon Railroad and Beale Wagon Road ■ Historic Route 66
Other	■ EMF effects on humans and animals

Results

For ease of comparison and presenting the results, the project area was divided into two areas of alternatives: eastern and western. The Moenkopi Substation represents the endpoint of the eastern alternatives and beginning point of western alternatives in the network of alternative routes. The alternative routes addressed in the DEIS are shown in Figures 2-10 and 2-11 (at the end of this chapter). Table 2-8 lists the alternative routes and the links (segment of route between two nodes) that make up each route (the links are labeled with numbers from east to west). A description of each alternative route accompanied by representative photographs is provided in Appendix C.

TABLE 2-8
ALTERNATIVE ROUTES COMPARED

Alternative Route	Length (miles)	Links
Eastern Area Alternatives		
Glen Canyon 1 (GC1)	260.6	100, 120, 460, 461, 463, 501, 502, 504, 561, 580, 581, 586, 587, 620, 621, 627 ,1389, 1393, 1397, 1383,1384, 1386
Kaibito 1 (K1)	244.7	100, 120, 460, 461, 463, 501, 502, 504, 561, 580, 581, 586, 1390, 1391, 1393, 1397, 1383, 1384, 1386
Central 1 (C1)	186.7	180, 240, 300, 360, 640, 700, 701, 780
Central 2 (C2)	211.0	100, 120, 460, 462, 780
Western Area Alternatives		
Moenkopi to Marketplace		
Northern 1 West (N1W)	217.0	1400, 1401, 1660, 1740, 1741, 1790, 2060, 2200, 2180
Northern 2 (N2)	225.1	1400, 1401, 1660, 1740, 1741, 1742, 1800, 1980, 2020, 2060, 2200, 2180
Southern 2 (S2)	247.7	1420, 1421, 1480, 1520, 1640, 1680, 1720, 1960, 2000, 2002, 2006, 2020, 2060, 2200, 2180
Moenkopi to Mead		
Northern 3 (N3)	199.3	1400, 1401, 1660, 1740, 1741, 1790, 2040, 2080
Northern 4 (N4)	207.4	1400, 1401, 1660, 1740, 1741, 1742, 1800, 1980, 2020, 2040, 2080
Southern 4 (S4)	230.0	1420, 1421, 1480, 1520, 1640, 1680, 1720, 1960, 2000, 2002, 2006, 2020, 2040, 2080
Note: A link is a segment of route between two nodes.		

The study results are shown in a number of tables and figures at the end of this chapter. The tables and figures reflect the inventory data, impact data, and key issue areas that were integral elements in comparing and ranking the alternative routes. Table 2-9 summarizes the total number of miles for which each was recommended and committed along each alternative route. The remainder of the tables and figures are at the end of this chapter. Tables 2-10 and 2-11 summarize the inventory of resources present along each alternative route. This information served as the baseline indication of the condition of the environment as it currently exists. Tables 2-12 and 2-13 summarize the potential impacts on the resources that could result from the proposed project. Figures 2-12 and 2-13 show key issue areas. These areas are based on (1) areas of concern or interest expressed by agencies, the public, and/or project team resource specialists; and (2) locations of high and/or potentially significant adverse impacts. The issues and impacts were addressed and mitigated through use of selective mitigation measures. Only a few issue areas that could not be wholly resolved at this stage of the project are shown on Figures 2-12 and 2-13. Issue areas were examined as the alternative routes were compared and ranked for preference.

The results of comparing and ranking the alternative routes are shown in Tables 2-14 and 2-15. (Refer to Tables A-2 and A-3 for more detailed descriptions of the alternative routes for each resource.) The tables show the rankings of each alternative for each resource, as well as overall preferences for each alternative route. The overall preference is a combination of preferences for (1) traditional cultural places and (2) all other environmental resources. The route comparisons based on potential impacts on traditional cultural places were separately displayed because of the particular concern of the Navajo Historic Preservation Department, Hopi Tribe, and Hualapai Tribe.

Consideration of impacts on traditional cultural places was based on three special studies that addressed traditional Navajo, Hopi, and Hualapai cultural places. Inventory information is incomplete and often confidential, but with involvement of members of each tribe, the best available information was compiled and sensitivity and impact models were developed for valued traditional cultural places. More detailed inventory, evaluation, and impact assessment would be required along any route approved for construction, and potential mitigation measures would be investigated further. The potential for mitigating impacts on traditional cultural places is poorly understood at this time, and many impacts may be largely unmitigable. Therefore, the impacts on traditional cultural places were given more consideration than more readily mitigable potential impacts on other types of environmental resources.

Through siting and mitigation, the majority of impacts on resources would be low with some moderate, except for visual resources and traditional cultural places. This is illustrated in the shaded columns of Tables 2-14 and 2-15. Residual high impacts on areas of visual resources and traditional cultural places were important in considering the overall ranking of the alternatives because these impacts reflect locations where, even with mitigation applied, impacts remain high.

Environmentally Preferred Alternative Route

In the eastern area, the environmentally preferred route is Kaibito 1 (K1), which would connect the Shiprock Substation with either the Red Mesa, Copper Mine, or Moenkopi Substation site. K1 would parallel the Shiprock-to-Glen Canyon 230kV line and the Glen Canyon-to-Pinnacle Peak 345kV line for

TABLE 2-9 MILES OF MITIGATION ALONG THE ALTERNATIVE ROUTES													
Alternatives (length in miles)	Selective Mitigation Measures (refer to Table 2-7)												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Eastern Area Alternatives													
GC1 (260.6)	31.1	41.7	34.7	—	209.5	11.5	8.2	3.8	253.6	8.8	15.4	15.5	—
K1 (244.7)	27.9	55.2	50.2	—	175.1	10.7	3.8	3.3	237.7	8.8	15.4	13.2	—
C1 (186.7)	113.5	9.5	25.4	—	177.8	11.0	170.1	2.0	186.7	14.6	2.0	14.4	6.8
C2 (211.0)	103.4	62.8	47.5	—	140.9	7.9	96.5	3.3	204.0	3.8	2.4	3.0	—
Western Area Alternatives													
Moenkopi to Marketplace													
N1W (217.0)	72.1	27.4	23.8	14.5	151.3	13.6	150.4	3.1	150.4	32.8	—	16.1	50.9
N2 (225.1)	54.7	44.7	57.8	30.5	126.5	12.1	125.2	2.5	166.7	38.6	5.5	22.6	26.5
S2 (247.7)	47.3	43.0	42.1	14.5	134.0	13.8	127.4	3.4	208.0	42.7	0.6	17.4	20.4
Moenkopi to Mead													
N3 (199.3)	61.2	17.5	10.3	—	144.1	13.2	144.1	3.4	144.1	18.0	—	2.4	50.9
N4 (207.4)	43.8	34.8	44.3	16.0	119.3	11.7	118.9	2.8	160.4	23.8	5.5	8.9	26.5
S4 (230.0)	36.4	33.1	28.6	—	126.8	13.4	121.1	3.7	201.7	27.9	0.6	3.7	20.4

Note: This table summarizes the total number of miles for which each measure was recommended and committed along each alternative route.

the majority of its length (about 73 percent). High adverse impacts on visual resources would be concentrated in the Kayenta area resulting from introduction of a new transmission line corridor in an area of high scenic quality and potential foreground views from residences. High adverse impacts on Navajo and Hopi traditional cultural places would be minimized using K1 by avoiding the issue areas of the Chuska Valley, Chuska Mountains, and southern portion of Black Mesa, but would result in the area of northern Black Mesa and Marsh Pass. K1 was ranked the second preference for environmental resources (without consideration of traditional cultural places), first for traditional cultural places, and first overall.

In the western area, two environmentally acceptable routes were identified—Northern 1 West (N1W) and Northern 3 (N3). The two alternatives share the same route for about 152 miles of the eastern majority of the alternative and then diverge to either the Mead or the Marketplace substation. Both of these alternatives would parallel existing transmission lines over their entire lengths. N1W would parallel a 500kV line and connect the Moenkopi Substation site with the Marketplace Substation. Lake Mead NRA prefers N1W (the southern crossing of the Colorado River) because the terrain is less rugged, there is less sensitive habitat, and there is one existing 500kV transmission line crossing the river. N3 would connect the Moenkopi Substation site with the Mead Substation and uses the northern crossing of the Colorado River, which is traversed by two lines. N3 would parallel the Mead-to-Liberty 345kV line and the recently constructed Mead-to-Phoenix 500kV line, the access road of which was upgraded during construction. No high impacts would result along either of these alternatives, and both are preferred for traditional cultural places.

Decisions to Be Made

The final route for the transmission line has not been selected. Following the review of the DEIS, the comments on the DEIS and proposed action received from the public and agencies will be reviewed, analyzed, and incorporated as appropriate into the FEIS. The FEIS will be distributed to the public with a Record of Decision by the Administrator of Western.

The Record of Decision will:

a) state what the decision is

b) identify all alternatives considered in reaching the decision. The Record of Decision will describe preferences among alternatives based on relevant factors including the following:
   - environmental acceptability
   - regulatory permitting (e.g., Federal, state, tribal, and local)
   - public, tribal, and agency preferences (e.g., DPA's initial position is to support the environmentally preferred alternative route pending final input from the public and Navajo chapters, committees, Council, President, etc.)
   - engineering (e.g., system considerations such as power flow and interconnections, length of route, construction difficulty, accessibility, extent of mitigation required, extent of design modifications)
   - right-of-way acquisition considerations (e.g., difficulty in acquisition, difficulty in scheduling)
   - agency statutory obligations

c) state whether all practical means to avoid or minimize harm from the alternative selected were adopted, and if not, why they were not. Also, once the final route has been selected a COMP would be developed, which will include mitigation and monitoring.

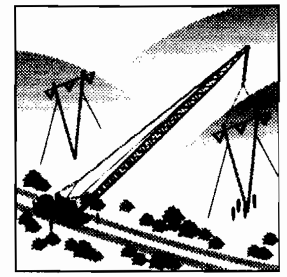
The Administrator will ensure that the decision is consistent with sound professional, business, and technical practices and that the decision is executed as stipulated.

MITIGATION EFFECTIVENESS

Mitigation Measure	Water Resources: Perennial Streams	Water Resources: Springs	Water Resources: 100-Year Floodplains	Earth Resources: Soils	Biological Resources: Vegetation	Biological Resources: Special Status Plants	Biological Resources: Big Game	Biological Resources: Special Status Wildlife	Land Use: Existing Land Use	Land Use: Residential	Land Use: Grazing	Land Use: Timber	Land Use: Future Land Use	Land Use: Parks, Preservation, and Recreation	Visual Resources: Scenic Quality	Visual Resources: Views from Residences	Visual Resources: Views from High Sensitivity Roads	Visual Resources: Views from Moderate Sensitivity Roads	Visual Resources: Views from Recreation Areas
1				●	●		●	●				●		●	●	●			
2	●				●	●	●	●	●		●	●			●	●	●	●	●
3				●	●		●				●			●	●	●	●	●	●
4							●	●			●			●					
5			●						●						●	●	●	●	●

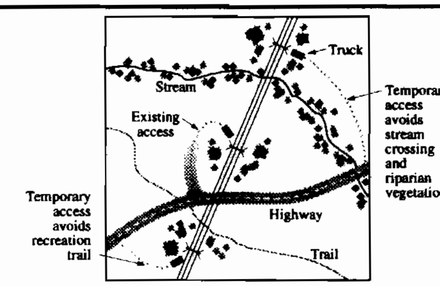
MITIGATION MEASURE / MITIGATION EXAMPLES

1. In areas where soils and vegetation (including timber) are particularly sensitive to disturbance, existing access roads will not be widened or otherwise upgraded for construction and maintenance, except in areas where repairs are necessary to make existing roads passable.



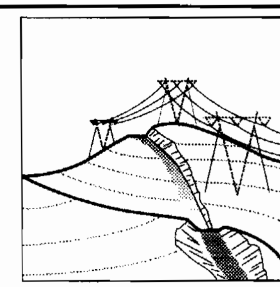
Avoiding unnecessary access road upgrades leaves vegetation in place, thereby limiting the amount of habitat disturbed or removed and protecting underlying soil from accelerated erosion. In addition, not improving existing access roads, vehicular traffic does not increase appreciably and indirect effects such as damage or loss of vegetation, harassment of wildlife, vandalism of cultural resources, and disturbance of sensitive land uses (e.g., parks, preservation, recreation areas) are limited.

2. To avoid disturbance to sensitive features (e.g., perennial streams, recreation trails, irrigation canals), access roads will not be constructed in those areas. Rather, construction and maintenance traffic will use existing roads or cross-country access routes (including the right-of-way). To minimize ground disturbance, construction traffic routes must be clearly marked with temporary markers such as easily visible flagging. The construction routes or other means of avoidance must be approved in advance of use by the authorized officer.

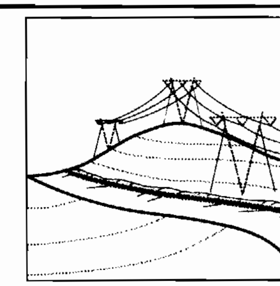


Mitigation 2 is effective for the same reasons as Mitigation 1. In addition, minimizing ground-disturbing construction activities in the vicinity of streams or canals would protect the integrity of the riparian areas, stream banks, and streambeds, and avoid turbidity and sedimentation, which could affect aquatic ecology. Minimizing interference with certain land uses (e.g., recreation trails) and disruption of sensitive views also would occur.

3. To minimize ground disturbance and/or reduce scarring (visual contrast) of the landscape, the alignment of any new access roads or cross-country route will follow the landform contours in designated areas where practicable, providing that such alignment does not impact resource values additionally.



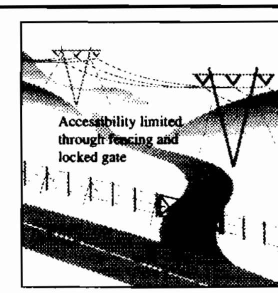
Without mitigation

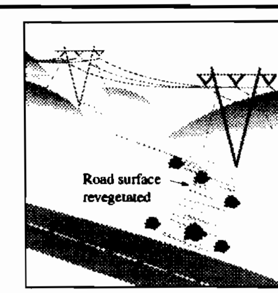


With mitigation

Following the natural contour of the land, particularly in steep terrain, minimizes the cutting and filling of slopes, and ensures that the form and line of the landscape is not visually interrupted. This results in reducing visual contrast between the exposed ground of the road and the surrounding environment (e.g., adjacent vegetation). Also, water runoff is less likely to accelerate soil erosion (minimizing potential damage from rutting, rilling), which in turn protects adjacent vegetation.

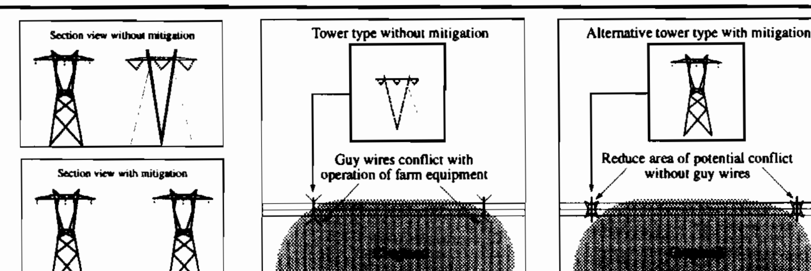
4. To limit new or improved accessibility into the area, all new access that is undesired or not required for maintenance will be closed using the most effective and least environmentally damaging methods appropriate to that area and developed with concurrence of the landowner or land manager.





Closing access roads where they are not needed after construction protects the resources in that area from further disturbance for the reasons described for Mitigation 1. Methods for road closure or management include installing and locking gates, obstructing the path (e.g., earthen berm, boulders), revegetating the surface of the roadbed to make it less apparent, or obliterating the road and returning it to its natural contour and vegetation.

5. To minimize ground disturbance, operational conflicts, and/or visual contrast, the tower design will be modified or an alternative tower type will be used.



Flexibility in designing the tower or use of different tower types allows tower structures to be adapted to specific site situations. Examples follow. In agricultural areas, different tower types could be used to minimize interference with agricultural operations (e.g., a four-legged or H-frame structure would interfere less with operation of farm equipment than a structure requiring guy wires). In areas where there are sensitive views and the proposed line would parallel an existing line, matching the type of tower used along the existing line minimizes visual contrast; whereas two different tower types adjacent to one another would create a noticeable contrast in the landscape.

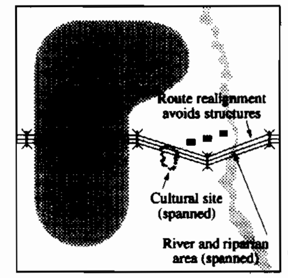
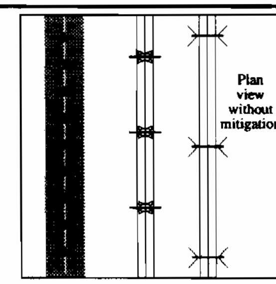
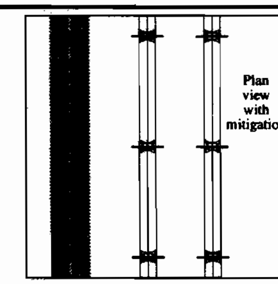
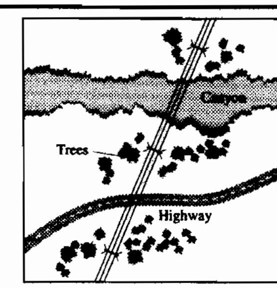
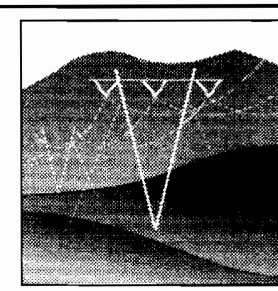
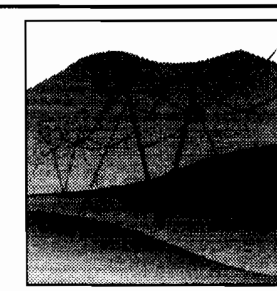
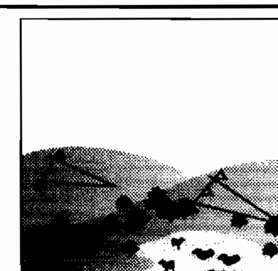
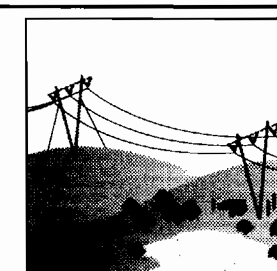
● indicates that the measure is employed to mitigate impacts on the resource

Selective Mitigation

Navajo Transmission Project

Table 2-7

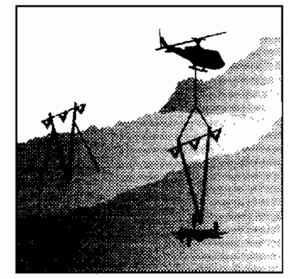
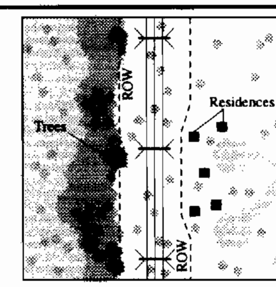
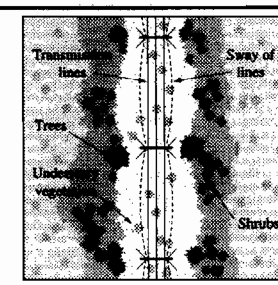
MITIGATION EFFECTIVENESS

No.	MITIGATION MEASURE	MITIGATION EXAMPLES	Water Resources: Perennial Streams	Water Resources: Springs	Water Resources: 100-Year Floodplains	Earth Resources: Soils	Biological Resources: Vegetation	Biological Resources: Special Status Plants	Biological Resources: Big Game	Biological Resources: Special Status Wildlife	Land Use: Existing Land Use	Land Use: Residential	Land Use: Grazing	Land Use: Timber	Land Use: Future Land Use	Land Use: Parks, Preservation, and Recreation	Visual Resources: Scenic Quality	Visual Resources: Views from Residences	Visual Resources: Views from High Sensitivity Roads	Visual Resources: Views from Moderate Sensitivity Roads	Visual Resources: Views from Recreation Areas	Effectiveness
6.	To minimize amount of sensitive features disturbed in designated areas structures and access roads will be placed so as to avoid sensitive features such as, but not limited to, riparian areas, water courses, agricultural lands, residential uses, and cultural sites, and/or to allow conductors to clearly span the features, within limits of standard tower design. Avoidance may be accomplished by spanning sensitive features, shifting the alignment to the opposite side of an existing line, or realigning the route.	 Construction with mitigation	●	●	●		●	●		●	●	●										Flexibility in the placement of towers allows for sensitive features to be avoided. Examples follow. Placing towers outside and on either side of a sensitive feature, the conductors span over the sensitive area. Spanning perennial streams, springs, and 100-year floodplains minimizes potential degradation of the water quality from increased sedimentation in drainages, stream-bank erosion, and possible adverse changes to river flow and depositional patterns in the drainages. Minimizing disturbance to highly erosive soils, sensitive vegetation, habitat, or special status plants by spanning or using fewer towers reduces possible loss. Also, realigning the towers along a route or realigning the route can result in avoiding or minimizing direct impacts on resources such as cultural and biological resources, and land uses such as residences, parks, and preservation and recreation (e.g. trails) areas.
7.	To reduce visual contrast and/or potential operational conflicts, standard tower design will be modified to correspond with spacing of existing transmission line structures where feasible and within limits of standard tower design. The normal span will be modified to correspond with existing towers, but not necessarily at every location.	 															●	●	●	●	●	Matching tower spacing with existing parallel lines reduces the visual space occupied by the towers and minimizes the amount of contrast between the man-made structures and the landscape.
8.	To reduce visual impacts, potential impacts on recreation values and safety at highway, canyon, and trail crossings, towers are to be placed at the maximum feasible distance from the crossing within limits of standard tower design.	 Towers placed maximum distance from canyon and highway crossings														●			●	●	●	Placing towers a maximum distance from major or sensitive crossings (e.g., roads, trails) reduces the impact of the structure on the viewers (e.g., motorists, recreationists) and reduces potential safety hazards (e.g., vehicle colliding into tower).
9.	"Dulled" metal finish on towers will be used to reduce visual impacts.	 Without mitigation shiny towers are more visible  With mitigation dulled towers blend into background															●	●	●	●	●	Use of specially treated or coated tower components to dull the surfaces of the towers decreases reflection, minimizes the contrast of the transmission line in the landscape, and reduces impacts on viewers.
10.	With the exception of emergency repair situations, the construction, restoration, maintenance, and termination activities in designated areas will be modified or curtailed during sensitive periods (e.g., nesting and breeding periods) for candidate, proposed threatened and endangered, or other sensitive animal species. Sensitive periods and areas of concern would be approved in advance of construction or maintenance by the authorized officer.	 Construction activities suspended during sensitive breeding periods  Construction activities resumed following calving period							●	●						●						Curtailing construction activities during breeding, lambing, and nesting periods eliminates potential disturbance of special status wildlife or big game during these critical periods of their life cycles.

● indicates that the measure is employed to mitigate impacts on the resource

Selective Mitigation
Navajo Transmission Project
Table 2-7

MITIGATION EFFECTIVENESS

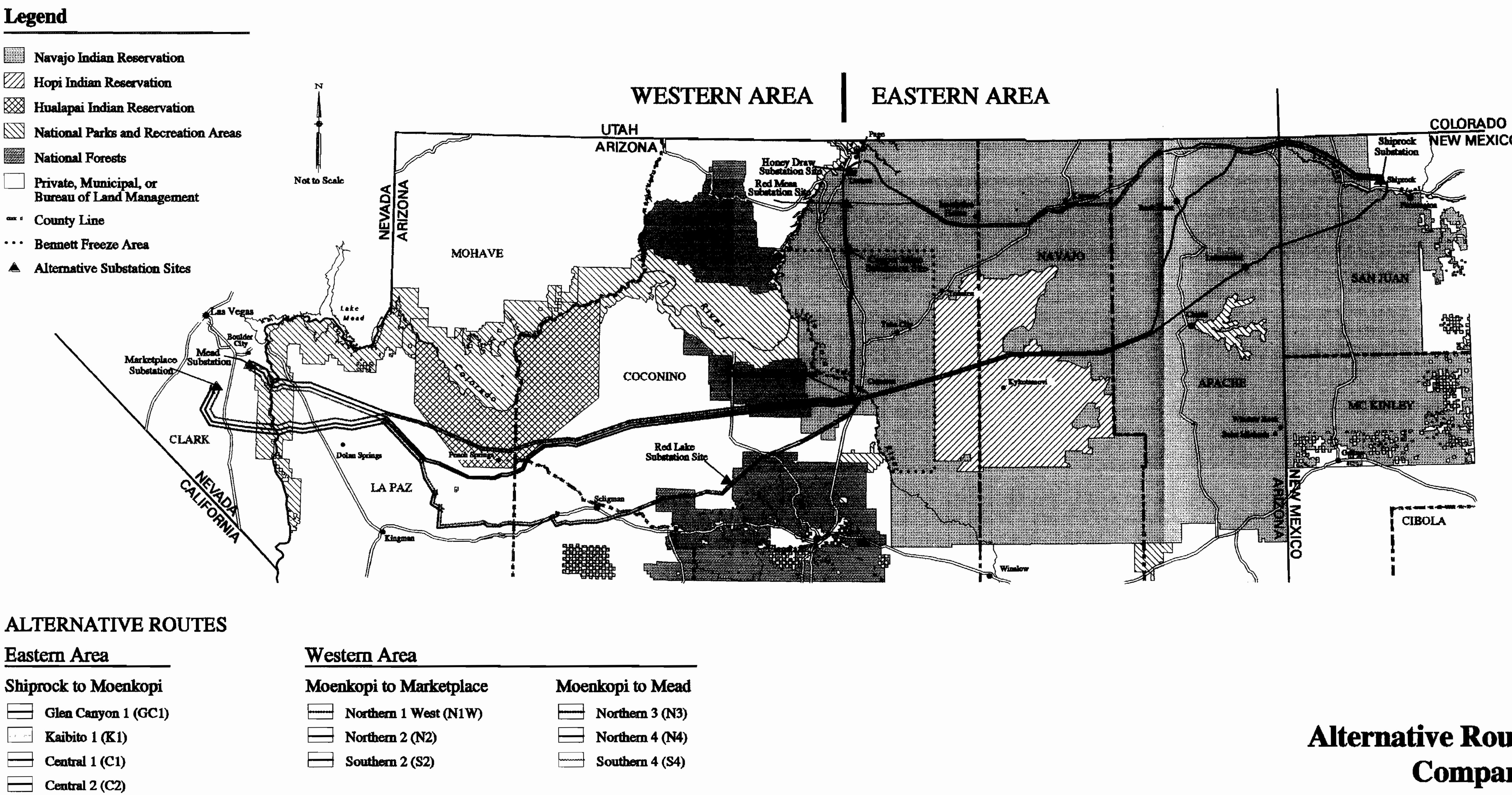
MITIGATION MEASURE	MITIGATION EXAMPLES	Water Resources			Earth Resources	Biological Resources				Land Use						Visual Resources					Description
		Perennial Streams	Springs	100-Year Floodplains	Soils	Vegetation	Special Status Plants	Big Game	Special Status Wildlife	Existing Land Use	Residential	Grazing	Timber	Future Land Use	Parks, Preservation, and Recreation	Scenic Quality	Views from Residences	Views from High Sensitivity Roads	Views from Moderate Sensitivity Roads	Views from Recreation Areas	
11. Helicopter placement of towers will be used to reduce impacts subject to field review.																●	●	●	●	●	Using helicopters to place towers in steep terrain or otherwise sensitive areas greatly reduces the amount of area and resources disturbed by construction activities. Reducing ground disturbance reduces the loss of vegetation, accelerated soil erosion, potential damage to cultural resources, and scarring of the land surface, thereby reducing visual contrast.
12. To reduce visual contrast or avoid features (such as, but not limited to, land uses, jurisdiction, biological or cultural resources sites), clearing of the right-of-way will be minimized or in limited instances the right-of-way may be reduced (within the limits of conductor-clearance requirements and standard tower design).	 Right-of-way reduced to avoid residences and reduce vegetation clearing					●		●	●	●				●	●						Limiting the width of the area cleared in the right-of-way reduces the amount of vegetation (including trees) removed at the edges of and within the right-of-way, minimizing the loss of habitat and reducing visual contrast between the cleared areas and the surrounding environment. In limited circumstances, the width of the right-of-way may be reduced to accommodate a land use.
13. To minimize disturbance to timber resources and reduce visual contrast, clearing of trees in and adjacent to the right-of-way will be minimized to the extent practicable to satisfy conductor-clearance requirements (National Electric Safety Code and 10 years of timber growth). Trees and other vegetation will be removed selectively (e.g., edge feathering) to blend the edge of the right-of-way into adjacent vegetation patterns, as practicable and appropriate.	 Clearing of trees minimized												●			●	●	●	●	●	Selectively removing vegetation (including trees) within and along the edges of the right-of-way reduces disruption of habitat, minimizes removal of timber resources, and reduces the visual contrast between the right-of-way and the surrounding environment. Rather than cutting trees and other vegetation in straight lines along the edges of the right of-way, "feathering" the edges results in a more gradual, imperceptible modification of the environment.

● indicates that the measure is employed to mitigate impacts on the resource

Selective Mitigation

Navajo Transmission Project

Table 2-7



Alternative Routes Compared

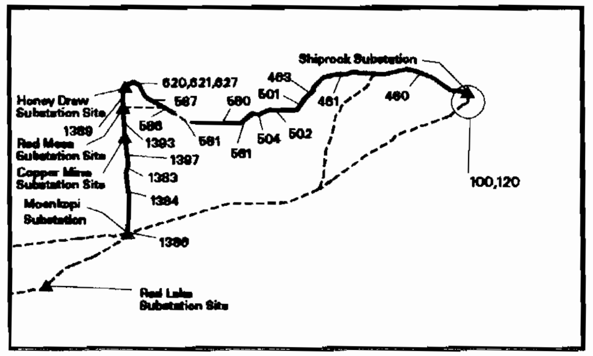
Navajo Transmission Project

Figure 2-10

EASTERN AREA

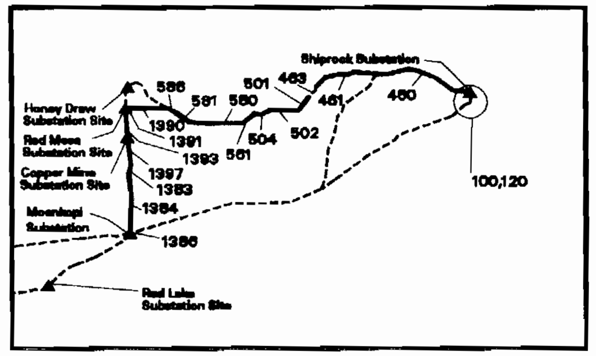
Shiprock to Moenkopi

GC1 100,120,460,461,463,501,502,504,561,580,581,586 587,620,621,627,1389,1393,1397,1383,1384,1386



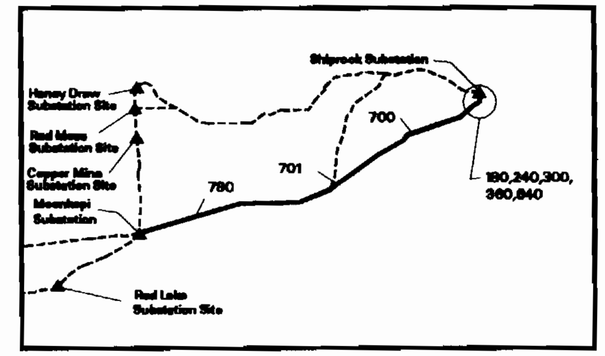
Total Length = 260.6 miles

K1 100,120,460,461,463,501,502,504,561,580,581 586,1390,1391,1393,1397,1383,1384,1386



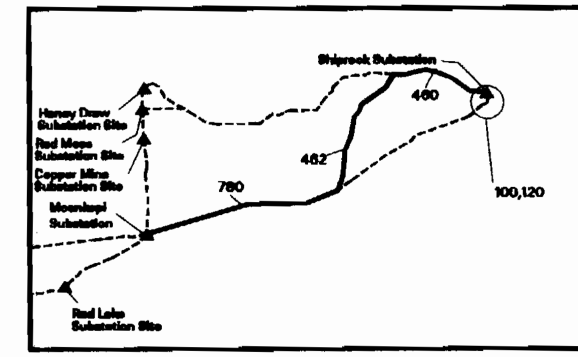
Total Length = 244.7 miles

C1 180,240,300,360,640,700,701,780



Total Length = 186.7 miles

C2 100,120,460,462,780

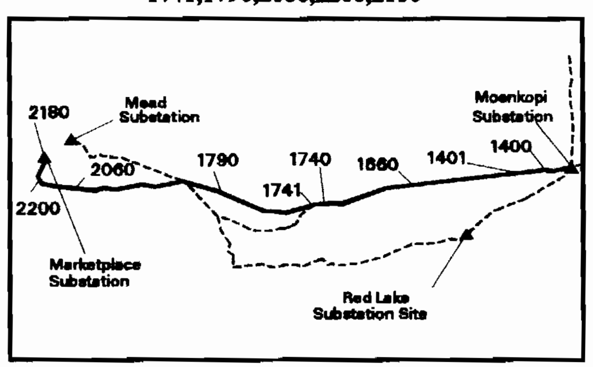


Total Length = 211.0 miles

WESTERN AREA

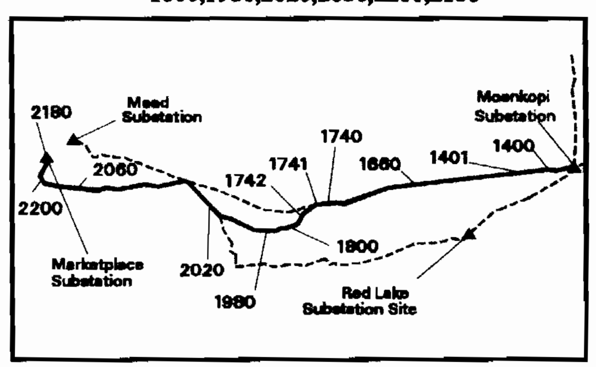
Moenkopi to Marketplace

N1W 1400,1401,1660,1740 1741,1790,2060,2200,2180



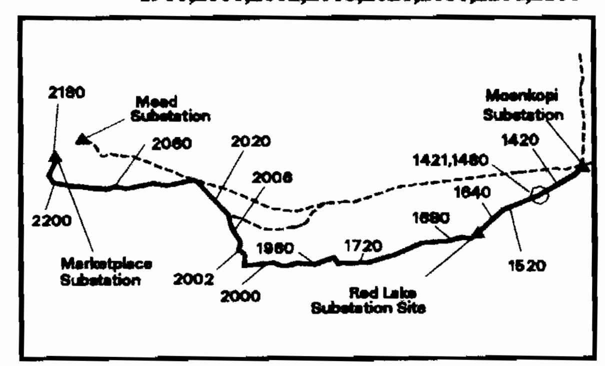
Total Length = 217.0 miles

N2 1400,1401,1660,1740,1741,1742 1800,1980,2020,2060,2200,2180



Total Length = 225.1 miles

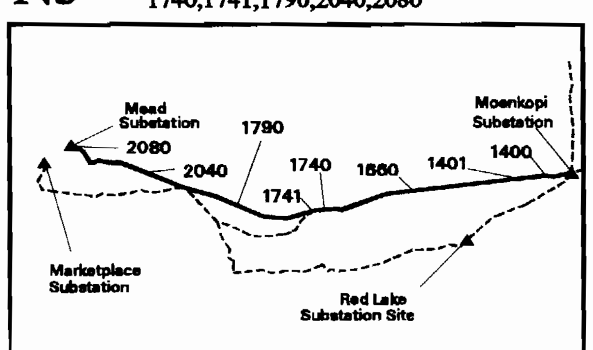
S2 1420,1421,1480,1520,1640,1680,1720 1960,2000,2002,2006,2020,2060,2200,2180



Total Length = 247.7 miles

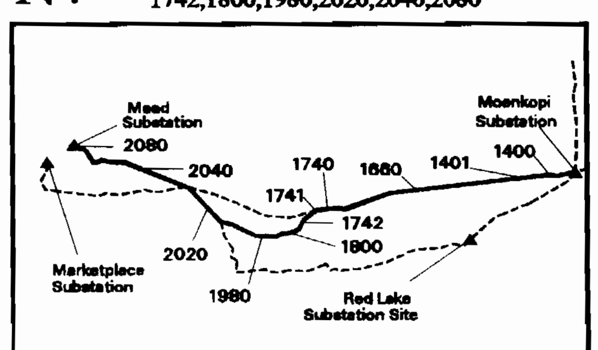
Moenkopi to Mead

N3 1400,1401,1660, 1740,1741,1790,2040,2080



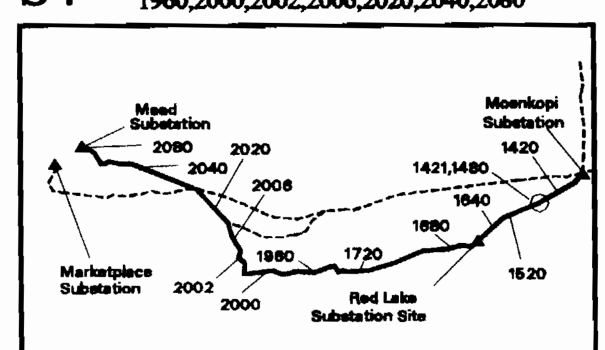
Total Length = 199.3 miles

N4 1400,1401,1660,1740,1741 1742,1800,1980,2020,2040,2080



Total Length = 207.4 miles

S4 1420,1421,1480,1520,1640,1680,1720 1960,2000,2002,2006,2020,2040,2080



Total Length = 230.0 miles

Alternative Route Schematics

Navajo Transmission Project

Figure 2-11

Alternative Routes	GENERAL				JURISDICTION								
	Length	New Corridor	Existing Transmission Line Corridor *	Other Linear Facilities (includes pipeline and fiber optic)	Private	State	Bureau of Land Management (includes land sale withdrawals)	Forest Service	National Park Service	Bureau of Reclamation	Navajo Nation	Hopi Tribe	Hualapai Tribe
GC1	260.6	49.7	210.9	–	1.9	0.2	3.4	–	–	–	255.1	–	–
K1	244.7	65.9	178.8	–	–	0.2	3.4	–	–	–	241.1	–	–
C1	186.7	8.9	176.3	1.5	1.7	–	2.1	–	–	–	150.7	33.1	–
C2	211.0	65.7	145.3	–	–	0.2	3.4	–	–	–	175.2	33.1	–

Alternative Routes	NATURAL ENVIRONMENT																
	Water Resources			Soils	Biological Resources											Paleontological Resources
					Vegetation				Wildlife							
	Number of Perennial Stream Crossings	Number of Springs within 600 feet	100-Year Floodplain Crossings	High/Severe Erosion Potential	Riparian Areas	Ponderosa Pine	Known Habitat - Candidate Plant Species	Known Listed Plant Species	Number of River Crossings Supporting Listed Species	Known Listed Species	Known Candidate/Other Species	Mojave Desert Tortoise Habitat	Sonoran Desert Tortoise Habitat	Black-footed Ferret - Reintroduction Area	Big Game Habitat	Deposits of High Paleontologic Potential
GC1	1	2	2.2	181.5	3.5	–	2.6	4.4	1	6.5	10.2	–	–	–	62.6	196.7
K1	1	3	2.0	172.6	3.4	–	2.6	4.4	1	6.5	10.2	–	–	–	62.6	194.7
C1	1	5	4.1	126.2	1.9	6.8	1.6	2.1	1	9.5	14.5	–	–	–	103.9	160.5
C2	1	2	3.6	116.9	1.7	–	2.6	4.4	1	0.9	7.6	–	–	–	87.5	170.9

Alternative Routes	HUMAN ENVIRONMENT																						
	Land Use											Visual Resources											
	Productivity				Existing and Future					Recreation		Scenic Quality		Foreground Views (0-0.5 mile)					Management Objectives			
	Grazing (in acres)	Timber Production (in acres)	Irrigated Farmland	Nonirrigated Farmland	Number of Houses - 0 to 500-foot Corridor	Planned Industrial/Commercial	Planned Open Space	Community Planning Areas	Subdivided Lands	Designated Recreation Areas	Designated Preservation Areas	Class A Scenic Quality	Class B Scenic Quality	Views from Residences	Views from High Sensitivity Roads	Views from Moderate Sensitivity Roads	Views from Recreation Areas	Views from Recreation Trails	Retention Areas (Forest Service)	Partial Retention Areas (Forest Service)	Class I Areas (BLM)	Class II Areas (BLM)
GC1	134.9	–	–	–	21	0.9	0.8	4.4	–	–	3.6	19.2	122.0	72.5	15.7	27.0	–	3.2	–	–	–	–
K1	152.3	–	–	–	19	–	–	–	–	–	3.6	18.3	108.6	63.8	5.9	27.0	–	3.2	–	–	–	–
C1	86.2	50.9	1.6	0.8	32	–	–	21.8	–	–	1.1	10.4	53.7	67.1	3.3	6.2	0.1	1.0	–	–	–	0.6
C2	153.4	–	–	0.3	10	–	–	21.8	–	–	3.6	5.2	84.3	58.3	1.1	12.1	0.1	1.0	–	–	–	–

Alternative Routes	CULTURAL ENVIRONMENT									
	Archaeology and History		Special Status Sites (occurrences)			Traditional Cultural Places				
							Hopi			
	High Sensitivity Areas	Moderate Sensitivity Areas	National Monuments, Landmarks, Historic Roads, and Chaco Protection Sites	National Register Sites, Tribal Parks, Chaco Canyon Protection Site Candidates	State Register Sites/Other Protected Areas	Navajo - High Sensitivity Areas	High Sensitivity Areas	Number of Ritual Places	Number of Nonritual Places	Hualapai - High Sensitivity Areas
GC1	75.4	113.1	–	1	–	54	114	48	12	–
K1	75.4	97.2	–	1	–	54	99	44	13	–
C1	76.8	103.9	–	2	2	91	170	64	5	–
C2	27.2	154.0	–	2	–	88	162	66	4	–

Numbers represent miles crossed unless otherwise indicated.
* May include portions of pileline and/or fiber optic line corridor.

Summary of Inventory Data
Eastern Area Alternatives
Navajo Transmission Project
Table 2-10

	Alternative Routes	GENERAL				JURISDICTION										NATURAL ENVIRONMENT: Water Resources			Soils
		Length	New Corridor	Existing Transmission Line Corridor *	Other Linear Facilities (includes pipeline and fiber optic)	Private	State	Bureau of Land Management (includes land sale withdrawals)	Forest Service	National Park Service	Bureau of Reclamation	U.S. Army Corp of Engineers	Navajo Nation	Hopi Tribe	Hualapai Tribe	Number of Perennial Stream Crossings	Number of Springs within 600 feet	100-Year Floodplain Crossings	High/Severe Erosion Potential
Moenkopi to Marketplace	N1W	217.0	--	217.0	--	71.5	16.7	49.2	19.1	10.9	0.4	0.3	13.3	--	35.1	1	1	9.4	37.5
Moenkopi to Marketplace	N2	225.1	41.5	183.6	--	87.3	20.1	73.2	19.1	10.9	0.4	0.3	13.3	--	--	1	--	10.2	39.6
Moenkopi to Marketplace	S2	247.7	15.9	161.4	70.4	81.7	56.1	58.2	20.6	10.9	0.4	0.3	19.5	--	--	1	--	5.7	29.8
Moenkopi to Mead	N3	199.3	--	199.3	--	61.6	18.2	33.4	19.1	13.3	4.6	0.2	13.3	--	35.1	1	1	8.9	39.6
Moenkopi to Mead	N4	207.4	41.5	165.9	--	77.4	21.6	57.4	19.1	13.3	4.6	0.2	13.3	--	--	1	--	9.7	41.7
Moenkopi to Mead	S4	230.0	15.9	143.7	70.4	71.8	57.6	42.4	20.6	13.3	4.6	0.2	19.5	--	--	1	--	5.2	31.9

	Alternative Routes	NATURAL ENVIRONMENT: Biological Resources — Vegetation				Biological Resources — Wildlife							Paleontological Resources
		Riparian Areas	Ponderosa Pine	Known Habitat - Candidate Plant Species	Known Listed Plant Species	Number of River Crossings Supporting Listed Species	Known Listed Species	Known Candidate/Other Species	Mojave Desert Tortoise Habitat	Sonoran Desert Tortoise Habitat	Black-footed Ferret - Reintroduction Area	Big Game Habitat	Deposits of High Paleontologic Potential
Moenkopi to Marketplace	N1W	2.0	--	2.7	--	1	23.2	15.0	21.1	1.0	20.7	139.4	78.5
Moenkopi to Marketplace	N2	2.0	--	2.7	--	1	38.8	20.1	21.1	1.0	15.3	148.3	75.6
Moenkopi to Marketplace	S2	2.3	--	6.8	--	1	23.2	22.5	21.1	1.0	--	113.3	62.3
Moenkopi to Mead	N3	3.3	--	2.7	--	1	8.3	20.1	5.7	6.4	20.7	140.4	78.5
Moenkopi to Mead	N4	3.3	--	2.7	--	1	8.4	25.2	5.7	6.4	15.3	148.9	75.6
Moenkopi to Mead	S4	3.6	--	6.8	--	1	8.3	27.6	5.7	6.4	--	113.9	62.3

	Alternative Routes	HUMAN ENVIRONMENT: Land Use — Productivity				Land Use — Existing and Future					Land Use — Recreation	
		Grazing (in acres)	Timber Production (in acres)	Irrigated Farmland	Nonirrigated Farmland	Number of Houses - 0 to 500-foot Corridor	Planned Industrial/Commercial	Planned Open Space	Community Planning Areas	Subdivided Lands	Designated Recreation Areas	Designated Preservation Areas
Moenkopi to Marketplace	N1W	105.9	56.4	--	--	--	--	--	8.6	0.2	11.6	8.6
Moenkopi to Marketplace	N2	155.3	56.4	--	--	1	--	--	8.6	1.0	11.6	8.6
Moenkopi to Marketplace	S2	166.2	60.7	--	--	7	--	--	19.6	1.9	11.6	8.6
Moenkopi to Mead	N3	78.8	56.4	--	--	--	--	--	--	--	16.3	--
Moenkopi to Mead	N4	128.2	56.4	--	--	1	--	--	--	0.8	16.3	--
Moenkopi to Mead	S4	139.2	60.7	--	--	7	--	--	11.0	1.7	16.3	--

	Alternative Routes	HUMAN ENVIRONMENT: Visual Resources — Scenic Quality		Foreground Views (0-0.5 mile)					Management Objectives			
		Class A Scenic Quality	Class B Scenic Quality	Views from Residences	Views from High Sensitivity Roads	Views from Moderate Sensitivity Roads	Views from Recreation Areas	Views from Recreation Trails	Retention Areas (Forest Service)	Partial Retention Areas (Forest Service)	Class I Areas (BLM)	Class II Areas (BLM)
Moenkopi to Marketplace	N1W	15.8	98.9	2.4	14.8	1.1	1.0	1.1	0.8	13.4	--	4.9
Moenkopi to Marketplace	N2	14.3	89.6	4.8	5.1	1.1	1.0	4.8	0.8	13.4	--	7.7
Moenkopi to Marketplace	S2	10.8	130.5	15.0	7.1	4.1	--	4.6	0.2	23.5	--	4.9
Moenkopi to Mead	N3	17.3	87.5	2.2	18.6	--	1.0	1.1	0.8	13.4	--	--
Moenkopi to Mead	N4	15.8	78.2	4.6	8.9	--	1.0	4.8	0.8	13.4	--	2.8
Moenkopi to Mead	S4	12.3	119.1	14.8	10.9	3.0	--	4.6	0.2	23.5	--	--

	Alternative Routes	CULTURAL ENVIRONMENT: Archaeology and History		Special Status Sites (occurrences)			Traditional Cultural Places	Hopi			
		High Sensitivity Areas	Moderate Sensitivity Areas	National Monuments, Landmarks, Historic Roads, and Chaco Protection Sites	National Register Sites, Tribal Parks, Chaco Canyon Protection Site Candidates	State Register Sites/Other Protected Areas	Navajo - High Sensitivity Areas	High Sensitivity Areas	Number of Ritual Places	Number of Nonritual Places	Hualapai - High Sensitivity Areas
Moenkopi to Marketplace	N1W	--	89.6	--	--	1	16	24	1	1	60
Moenkopi to Marketplace	N2	--	37.4	2	--	3	16	24	1	1	50
Moenkopi to Marketplace	S2	--	60.1	3	--	4	20	19	2	1	82
Moenkopi to Mead	N3	--	89.6	--	1	1	16	24	1	1	60
Moenkopi to Mead	N4	--	37.4	2	1	3	16	24	1	1	50
Moenkopi to Mead	S4	--	60.1	2	1	4	20	19	2	1	82

Numbers represent miles crossed unless otherwise indicated.
* May include portions of pileline and/or fiber optic line corridor.

Summary of Inventory Data

Western Area Alternatives

Navajo Transmission Project

Table 2-11

			NATURAL ENVIRONMENT									HUMAN ENVIRONMENT								CULTURAL ENVIRONMENT					
			Water Resources			Soils	Biological Resources				Paleontological Resources	Land Use			Visual Resources					Traditional Cultural Places					
																							Hopi		
Alternative Routes	Length	Impact Level	100-Year Floodplain Crossings	Number of Springs Within One-mile Corridor	Perennial Streams (number crossed)	Soils	Vegetation	Special Status Plants	Wildlife	Special Status Wildlife	Paleontological Resources	Existing Land Use	Future Land Use	Parks, Preservation, and Recreation	Views from Residences	Scenic Quality	Views from High Sensitivity Roads	Views from Moderate Sensitivity Roads	Views from Recreation Areas	Archaeology and History [1]	Number of Special Status Sites	Navajo	Ritual Places [2]	Nonritual Places [2]	Hopi Impact Score	Hualapai
GC1	260.6	H	--	--	--	--	--	--	--	--	--	--	--	--	[redacted]	[redacted]	[redacted]	--	--	--	--	[redacted]	[redacted]	[redacted]	185	--
		M	--	--	--	15.0	0.3	--	--	--	15.3	--	1.7	--	45.4	6.6	19.8	10.1	3.2	96.8	--	168.2	36	6		--
		L	2.2	12	1	245.6	260.3	3.4	62.6	16.7	245.3	260.6	5.3	3.6	189.4	239.5	239.6	250.5	257.4	163.8	1	83.0	--	--		--
K1	244.7	H	--	--	--	--	--	--	--	--	--	--	--	--	[redacted]	[redacted]	[redacted]	--	--	--	--	[redacted]	[redacted]	[redacted]	168	--
		M	--	--	--	16.8	0.3	--	--	--	17.1	--	--	--	57.2	5.0	7.8	10.1	3.2	112.3	--	161.9	32	6		--
		L	2.0	10	1	227.9	244.4	3.4	62.6	16.7	227.6	244.7	--	3.6	163.1	224.9	235.7	234.6	241.5	132.4	1	73.4	--	--		--
C1	186.7	H	--	--	--	--	--	--	--	--	--	--	--	--	[redacted]	--	--	--	--	--	--	[redacted]	[redacted]	--	134	--
		M	--	--	--	2.5	--	0.1	--	--	2.3	--	--	--	16.0	6.3	1.5	--	1.3	76.8	1	107.7	63	5		--
		L	4.1	12	1	184.2	185.8	2.8	103.9	2.4	184.4	186.7	21.8	2.1	170.1	180.4	185.2	186.7	185.4	109.9	3	5.0	--	--		--
C2	211.0	H	--	--	--	--	--	--	--	--	--	--	--	--	[redacted]	--	--	[redacted]	--	--	--	[redacted]	[redacted]	--	169	--
		M	--	--	--	3.0	--	--	--	--	4.5	--	--	--	49.2	28.2	--	6.6	1.3	91.4	1	163.7	65	4		--
		L	3.6	12	1	208.0	211.0	3.4	87.5	8.5	206.5	211.0	21.8	3.6	138.0	182.8	211.0	203.3	209.7	119.6	1	1.3	--	--		--

Numbers represent miles crossed unless otherwise indicated.

[1] Assumes helicopter construction in unroaded, high sensitivity zones.

[2] High impacts assigned to places that could be crossed, moderate impacts to other places in six-mile study corridor.

23.5 High Residual Impact

Summary of Impacts

Eastern Area Alternatives

Navajo Transmission Project

Table 2-12

				NATURAL ENVIRONMENT									HUMAN ENVIRONMENT								CULTURAL ENVIRONMENT						
				Water Resources			Soils	Biological Resources				Paleontological Resources	Land Use			Visual Resources					Traditional Cultural Places						
																								Hopi			
Alternative Routes		Length	Impact Level	100-Year Floodplain Crossings	Number of Springs Within One-mile Corridor	Perennial Streams (number crossed)	Soils	Vegetation	Special Status Plants	Wildlife	Special Status Wildlife	Paleontological Resources	Existing Land Use	Future Land Use	Parks, Preservation and Recreation	Views from Residences	Scenic Quality	Views from High Sensitivity Roads	Views from Moderate Sensitivity Roads	Views from Recreation Areas	Archaeology & History[1]	Number of Special Status Sites	Navajo	Ritual Places[2]	Nonritual Places[2]	Hopi Impact Score	Hualapai
Moenkopi to Marketplace	N1W	217.0	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	--
			M	--	--	--	2.7	--	--	--	0.2	4.2	--	--	--	0.6	--	1.4	--	0.6	--	1	24	1	1		176
			L	9.4	2	1	214.3	217.0	2.7	139.8	58.7	212.8	217.0	8.8	23.2	216.4	217.0	215.6	217.0	216.4	217.0	--	67	--	--		--
	N2	225.1	H	--	--	--	--	--	--	--	--	--	--	--	--	2.6	8.1	1.1	--	0.3	--	1	--	--	--	3	[illegible]
			M	--	--	--	3.6	--	--	--	0.2	4.3	--	--	--	15.2	13.4	9.4	--	12.1	37.0	3	24	1	1		135
			L	10.2	3	1	221.5	223.4	2.7	148.3	58.5	220.8	225.1	9.6	23.2	207.3	203.6	214.6	225.1	212.7	188.2	--	67	--	--		--
	S2	247.7	H	-	--	--	--	--	--	--	--	--	--	--	--	10.2	--	5.1	1.7	3.1	--	1	--	1	1	6	[illegible]
			M	--	--	--	1.8	--	--	--	0.2	6.4	--	--	--	23.8	58.1	12.0	12.7	14.1	5.9	2	48	1	--		79
			L	5.7	2	1	245.9	246.6	6.8	113.3	45.5	241.3	247.7	39.0	23.2	213.7	189.6	230.6	233.3	230.5	241.8	3	--	--	--		--
Moenkopi to Mead	N3	199.3	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	--
			M	--	--	--	0.9	--	--	--	--	3.8	--	--	--	0.6	--	--	--	0.6	--	1	24	1	1		175
			L	8.9	1	1	198.4	199.3	2.7	140.4	49.1	195.5	199.3	--	16.3	198.7	199.3	199.3	199.3	198.7	199.3	--	67	--	--		--
	N4	207.4	H	--	--	--	--	--	--	--	--	--	--	--		2.6	8.1	1.1	--	0.3	--	1	--	--	--	3	[illegible]
			M	--	--	--	1.8	--	--	--	--	3.9	--	--	--	15.2	13.4	8.0	--	12.1	37.0	3	24	1	1		133
			L	9.7	2	1	205.6	205.7	2.7	148.9	48.9	203.5	207.4	0.8	16.3	189.6	185.9	198.3	207.4	195.0	170.5	--	67	--	--		--
	S4	230.0	H	--	--	--	--	--	--	--	--	--	--	--		10.2	--	5.1	1.7	3.1	--	1	--	1	1	6	[illegible]
			M	--	--	--	--	--	--	--	--	6.0	--	--	--	23.8	58.1	10.6	12.7	14.1	5.9	2	48	1	--		78
			L	5.2	1	1	230.0	228.9	6.8	113.9	35.9	224.0	230.0	30.2	16.3	196.0	171.9	214.3	215.6	212.8	224.1	3	--	--	--		--

Numbers represent miles crossed unless otherwise indicated.

[1] Assumes helicopter construction in unroaded, high sensitivity zones.

[2] High impacts assigned to places that could be crossed, moderate impacts to other places in six-mile study corridor.

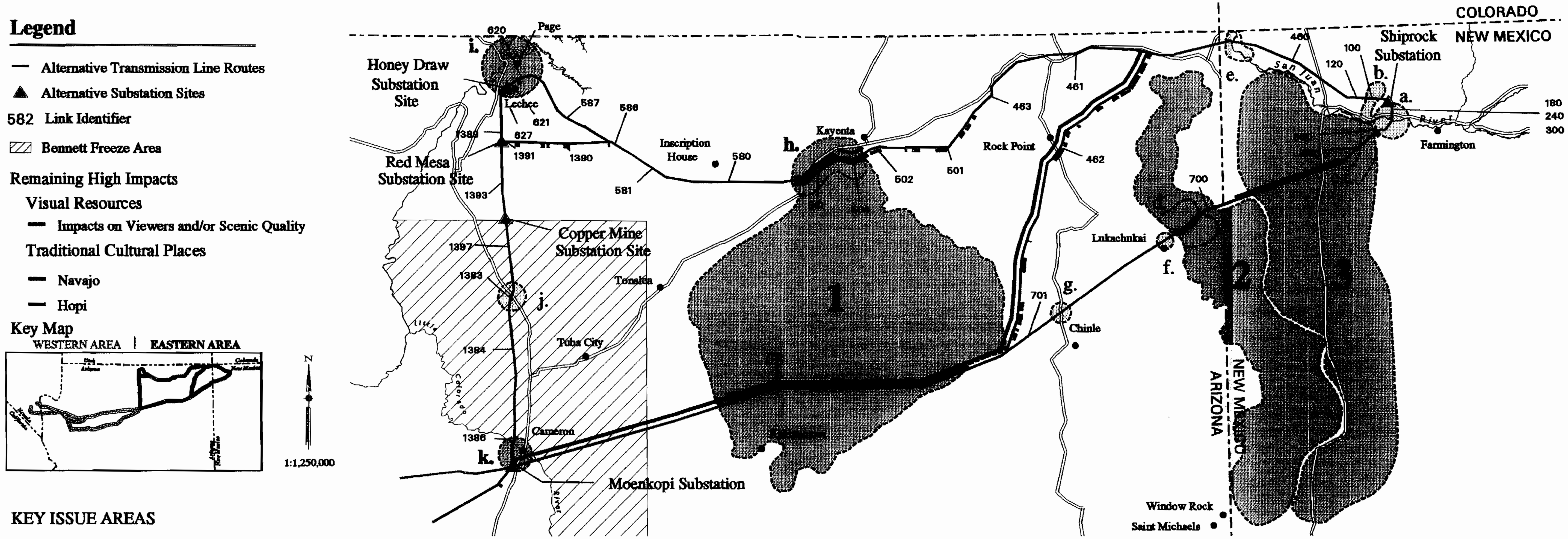
8.1 High Residual Impacts

Summary of Impacts

Western Area Alternatives

Navajo Transmission Project

Table 2-13



KEY ISSUE AREAS

Areas where key issues could not be wholly resolved at this stage of the project are shown in red.

Regional Areas

1. **Black Mesa:** An area of traditional Navajo and Hopi cultural significance and customary land use, including portions of the Marsh Pass Area. Impacts on traditional cultural places would be high.

2. **Chuska Mountains:** An area of traditional Navajo cultural significance and customary land use and biological concern. Impacts on traditional cultural places would be high. Impacts on sensitive species and big game habitat would be mitigated by paralleling the existing transmission line; limiting new access, tree clearing, and ground disturbance; and adhering to ESA Section 7 requirements.

3. **Chuska Valley:** An area of traditional Navajo cultural significance and customary land use. Impacts on traditional cultural places would be high.

Local Areas

a. **Town of Waterflow, San Juan River Valley:** Impacts on residences, agriculture, and the San Juan River would be mitigated by paralleling existing facilities, judicious placement of towers, and spanning sensitive features.

b. **The Northern Hogback Area:** Impacts on sensitive plants and the ACEC would be mitigated by limiting access, specifying construction practices, and spanning sensitive areas in an existing corridor. This crossing of The Hogback rather than the southern area is preferred by the BLM.

c. **The Southern Hogback Area:** Impacts on The Hogback National Register District, Chaco Protection Site, and sensitive plants would be mitigated by avoidance, limiting access, specifying construction practices, visual mitigation measures, and spanning sensitive areas.

d. **Buffalo Pass:** Impacts on biological resources (sensitive species and habitat, timber management, and Class A scenery) would be mitigated by paralleling the existing 500kV line, specifying construction practices, limiting access and tree clearing, matching stuctures, using nonspecular conductors, and adhering to ESA Section 7 requirements.

e. **San Juan River Crossing:** Impacts on proposed critical habitat for special status fish species and riparian areas would be mitigated by spanning the river and riparian habitat, and specifying construction practices in the existing utility corridor.

f. **Lukachukai:** Proximity to the town and residences. Impacts would be mitigated by using the existing utility corridor and judicious placement of towers.

g. **Chinle Valley, Many Farms:** Impacts on agricultural lands and existing residences would be mitigated by judicious placement of towers and spanning of cultivated lands in the existing utility corridor.

h. **Marsh Pass/Northern Black Mesa:** Navajo and Hopi traditional cultural places, Class A Scenery, residential views, archaeological resources, raptor habitat, and soil erosion. Impacts on traditional cultural places would be high. Visual impacts would remain high in certain areas, but would be reduced overall through the use of nonspecular conductors, dulled tower finishes, and judicious placement of towers. Archaeological, biological, and soil impacts would be mitigated by limiting access, constructing using helicopter, spanning sensitive areas, and judicious placement of towers.

i. **Page and Lechee Area:** Proximity to Lechee and outlying residences, existing recreational use, future development plans, and visual concerns. Impacts would be partially mitigated by locating this alternative in a new corridor that would cross the edge of the city, judicious placement of towers, and visual mitigation measures. Planned open space and industrial areas could not be avoided.

j. **The Gap:** Potential land use impacts would be mitigated by locating facilities between two existing transmission lines and spanning water-treatment ponds.

k. **Cameron:** Using existing corridors and judicious placement of towers would reduce site-specific impacts; however, the cumulative effects of multiple transmission lines and restrictions on future land use would remain.

Issues Areas

Eastern Area Alternatives

Navajo Transmission Project

Figure 2-12

Legend

— Alternative Transmission Line Routes

▲ Alternative Substation Sites

1660 Link Identifier

Remaining High Impacts

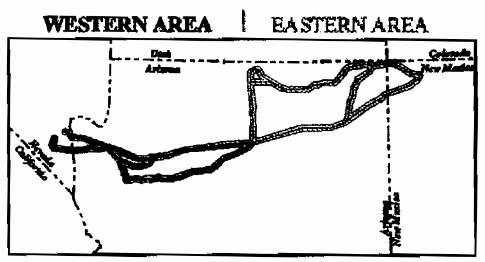
Visual Resources

— Impacts on Viewers Scenic Quality

Traditional Cultural Places

— Hualapai

Key Map



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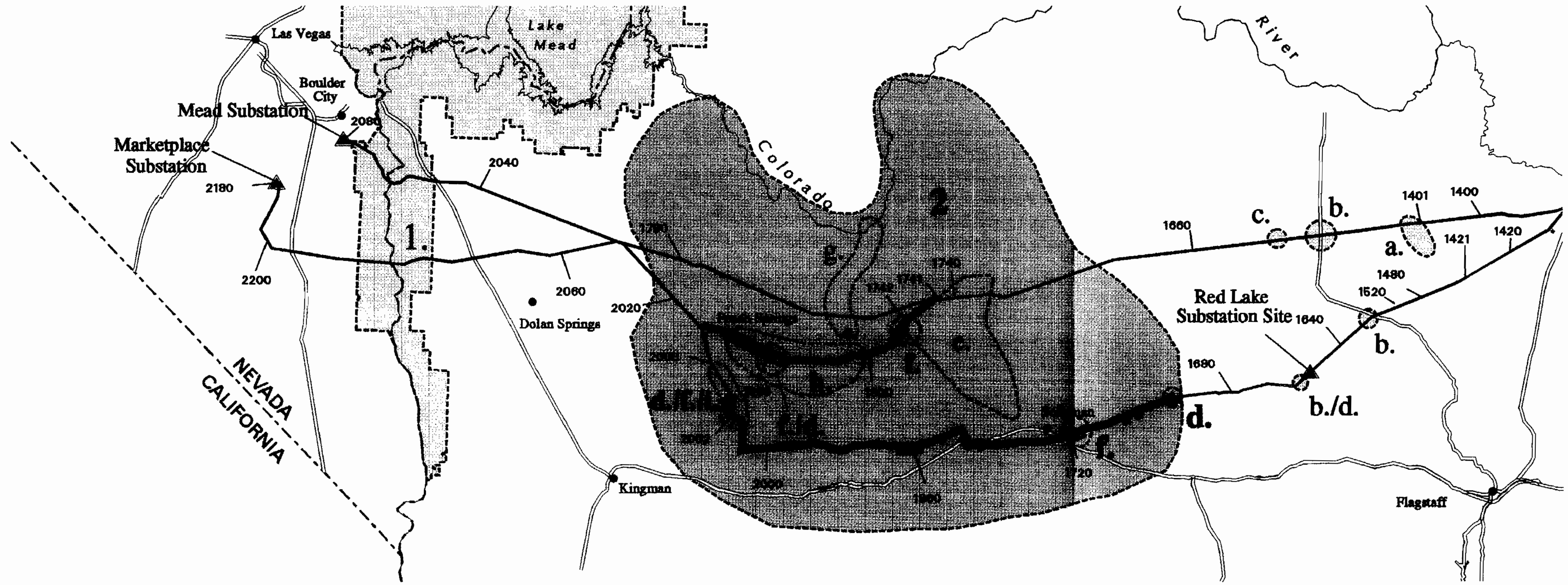


KEY ISSUE AREAS

Areas where key issues could not be wholly resolved at this stage of the project are shown in red.

Regional Areas

1. Lake Mead NRA: Two alternative routes cross the Lake Mead NRA and Colorado River. Areas east and west of the river provide sensitive habitat for desert bighorn sheep, desert tortoise, and nesting bald eagles along the river. The Lake Mead NRA is an important recreational amenity. Impacts in this area would be mitigated by locating the alternatives in designated utility corridors, specifying construction practices, spanning the river, and using measures to reduce visual impacts. The NPS prefers the southern river crossing because the terrain is less rugged, there is less sensitive habitat, and there is only one existing line crossing the river. However, the access road along the northern route (Link 2040) has recently been upgraded and parts of Link 2060 are rugged and require upgrading.

2. Vicinity of the Hualapai Indian Reservation: An area of traditional Hualapai cultural significance. Impacts would be high along new corridors in this area.

Local Areas

a. Arizona Trail and Moqui Stage Station: Historic features at this location provide interpretative and recreational opportunities where impacts on views would be mitigated by using an existing utility corridor, nonspecular conductors, and judicious placement of towers.

b. US 180/AZ 64: This travel route provides access to the south rim of the Grand Canyon. Visual impacts would be mitigated by using nonspecular conductors and judicious placement of towers, and spanning this road within an existing utility corridor.

c. Grand Canyon Railroad: Visual impacts at the crossing of this historic railroad would be mitigated by using non-specular conductors and judicious placement of towers, and spanning the railroad within an existing utility corridor.

d. Beale Wagon Road: Visual and cultural impacts at the crossing of this historic trail would be mitigated in areas where an existing corridor is used. In areas of new corridor, at Russell Tank and on the Truxton Plain, visual impacts would be high.

e. Aubrey Valley - Black-footed Ferret Management Area: The FWS has initiated the reintroduction of a nonessential, experimental population of black-footed ferret in this area. The most critical areas have been avoided and the remaining alternatives are located near the edge of the reintroduction area or are located within an existing utility corridor. Impacts would be mitigated by specifying construction practices and timing, and limiting access.

f. Historic Route 66: Route 66 would be crossed in a new corridor resulting in high impacts on highway views at four locations, and also would result in high impacts on cultural resources at the crossing in the Truxton Plain area.

g. Diamond Creek Road: This road provides limited access to the Colorado River and Grand Canyon. Visual impacts would be mitigated by using nonspecular conductor and judicious placement of towers in the existing corridor, and matching structures.

h. Truxton Plains: BLM has expressed concern for impacts on visual quality, big game habitat, and highly erosive soils in this area. Impacts on soils and fragmentation of big game habitat would be mitigated by specifying construction practices and limiting access. Impacts on visual quality would be reduced by mitigation measures; however, a small amount of high residual impact would remain in crossing the Music Mountains.

i. Hackberry: Potential land use impacts in and around the town of Hackberry would be mitigated by selecting an alternative route that avoids the community; however, high impacts on residential viewers and viewers on Route 66 would remain.

Issues Areas

Western Area Alternatives

Navajo Transmission Project

Figure 2-13

ALTERNATIVE ROUTES	CORRIDOR CHARACTERISTICS: Overall Length (miles)	CORRIDOR CHARACTERISTICS: Existing Transmission Line Corridor* (miles and percent)	CORRIDOR CHARACTERISTICS: New Transmission Line Corridor* (miles and percent)	NATURAL: Paleontology	NATURAL: Water Resources	Soils	Biology	HUMAN: Land Use	Visual Resources	CULTURAL: Archaeology and History	Special Status	Preference without TCPs	Traditional Cultural Places: Navajo	Traditional Cultural Places: Hopi	Traditional Cultural Places: Hualapai	TCP Preference	Combined Preference	Overall Environmental Preference	SUMMARY EXPLANATION
Glen Canyon 1 (GC1)	260.6	210.9 (81%)	49.7 (19%)	2	1	2	1	2	3	2	1	3	1	3	-	2	3/2	2	Being north of the Chuska Mountains and Black Mesa, GC1 avoids many sensitive traditional cultural places, and other areas of significant impact in the Chuska Valley, Chuska Mountains, and southern portion of Black Mesa. High impacts on visual resources would occur primarily along new corridor located south of Kayenta in the Marsh Pass area, a route that avoids Monument Valley. GC1 crosses short distances of areas designated for future industrial development and open space in the Page and Lechee areas. The northern crossing of The Hogback ACEC on this route is preferred by the BLM.
Kaibito 1 (K1)	244.7	178.8 (73%)	65.9 (27%)	2	1	2	1	1	3	2	1	2	1	2	-	1	2/1	1	K1, although similar to GC1, is considered the overall environmentally preferred route. This route is approximately 16 miles shorter than GC1 and would avoid potential future land use impacts in the Page and Lechee areas. K1 also ranked second preference for Hopi traditional cultural places over the third place ranking for GC1. The northern crossing of The Hogback ACEC on this route is preferred by the BLM.
Central 1 (C1)	186.7	176.3 (94%)	10.4 (6%)	1	1	1	2	1	1	1	2	1	3	1	-	4	1/4	4	C1 parallels an existing 500kV transmission line for a greater distance than any of the other eastern area alternative routes. Consequently, impacts on most resources would be minimized. However, it is the least preferred overall for the following reasons. Adverse impacts on cultural traditional places would be very high crossing the Chuska Valley, Chuska Mountains, and southern portion of Black Mesa. Also, it is the least preferred for biological resources because of concerns in the Chuska Mountains. Based on input from the Navajo Historic Preservation Department and Fish and Wildlife Department, the Chuska Mountains area is considered a unique and an important feature and resource within the boundaries of the Navajo Reservation.
Central 2 (C2)	211.0	145.3 (69%)	65.7 (31%)	1	1	1	1	1	2	1	2	1	2	2	-	3	1/3	3	C2 avoids the Chuska Valley and Chuska Mountains; thereby avoiding high adverse impacts on traditional cultural places in those areas. However, C2 crosses sensitive traditional cultural places located on the southern portion of Black Mesa. C2 parallels the least distance of existing transmission lines. High impacts on visual resources would occur selectively along the new corridor in the vicinity of Sweetwater, Carson Mesa, and Chinle Valley. The northern crossing of The Hogback ACEC on this route is preferred by the BLM.

ENVIRONMENTAL FACTORS AND PREFERENCE

Summary Key

1 Most preferable
2
3
4 Least preferable

High impacts on these resources remain after mitigation for a portion of the alternative route.

Notes:

- * May include portions of existing pipeline and/or fiber optic line corridor
- TCP – Traditional cultural places
- Appendix A provides a table summarizing the comparison of alternatives for each resource.

Preference Summary
Eastern Area Alternatives

Navajo Transmission Project

Table 2-14

ALTERNATIVE ROUTES		CORRIDOR CHARACTERISTICS			ENVIRONMENTAL FACTORS AND PREFERENCE: NATURAL				HUMAN		CULTURAL			Traditional Cultural Places						
		Overall Length (miles)	Existing Transmission Line Corridor* (miles and percent)	New Transmission Line Corridor* (miles and percent)	Paleontology	Water Resources	Soils	Biology	Land Use	Visual Resources	Archaeology and History	Special Status	**Preference without TCPs**	Navajo	Hopi	Hualapai	**TCP Preference**	**Combined Preference**	**Overall Environmental Preference**	**SUMMARY EXPLANATION**
Moenkopi – Marketplace	Northern 1 (N1W)	217.0	217.0 (100%)	–	1	1	1	1	1	1	1	1	1	1	1	1	1	1 / 1	1	N1W parallels existing transmission lines for its entire length, would avoid high impacts, and is a first preference for all resources and the overall first preference. N1W is first preference for traditional Hualapai cultural places–impacts would be only moderate because it parallels existing facilities. N1W avoids issues associated with the development of new corridor in the Truxton Plain, Seligman, and Hackberry areas; and high visual impacts associated with the crossing of historic U.S. Route 66, the Music Mountains, the Beale Wagon Road, and scattered rural residences.
	Northern 2 (N2)	225.1	183.6 (82%)	41.5 (18%)	2	1	2	3	2	2	3	2	2	1	1	2	2	2 / 2	2	N2 would require approximately 60 miles of new transmission line corridor along the edge of the Aubrey Valley and across the Truxton Plain and Music Mountains. N2 was ranked first or second for all resources with the exception of biology, and archaeology and history; however, impacts associated with these resources could be mitigated. High impacts would remain on scenic quality, views from residences, and historic U.S. Route 66 as well as on Hualapai traditional cultural places.
	Southern 2 (S2)	247.7	161.4 (65%)	86.3 (35%)	3	1	3	2	3	3	2	3	3	2	2	3	3	3 / 3	3	S2 is the longest of the routes from Moenkopi to Marketplace, would require approximately 89 miles of new transmission line corridor, and also would result in the greatest amount of high impact. High impacts on views from residences in the Seligman and Hackberry areas, views from high and moderate sensitivity roads including U.S. Route 66, and views from recreational areas or trails such as the Beale Wagon Road could result. S2 would result in the greatest amount of high impact on Hualapai traditional cultural places.
Moenkopi – Mead	Northern 3 (N3)	199.3	199.3 (100%)	–	1	1	1	1	1	1	1	1	1	1	1	1	1	1 / 1	1	Among the Moenkopi-to-Mead alternatives, the preference rankings for N3, N4 and S4 are the same as those described above for N1W, N2, and S2. The primary difference between the alternative routes into Marketplace and Mead is that the alternative routes into Mead would parallel two existing lines across the Colorado River and Lake Mead NRA in a rugged canyon setting along the recently constructed Mead-to-Phoenix 345kV line, which has an upgraded access road; whereas the alternative routes into Marketplace parallel a single transmission line to the south, across the river in an area of more moderate terrain. NPS has expressed a preference for the southern crossing based on the number of existing lines, terrain, construction difficulty, and higher quality desert tortoise habitat associated with the northern crossing.
	Northern 4 (N4)	207.4	165.9 (80%)	41.5 (20%)	2	1	2	3	2	2	3	2	2	1	1	2	2	2 / 2	2	
	Southern 4 (S4)	230.0	143.7 (62%)	86.3 (38%)	3	1	3	2	3	3	2	3	3	2	2	3	3	3 / 3	3	

Summary Key

1 Most preferable
2 ↕
3
4 Least preferable

[shaded] High impacts on these resources remain after mitigation for a portion of the alternative route.

Notes:

- * May include portions of existing pipeline and/or fiber optic line corridor
- TCP – Traditional cultural places
- Appendix A provides a table summarizing the comparison of alternatives for each resource.

Preference Summary
Western Area Alternatives

Navajo Transmission Project

Table 2-15

CHAPTER 3 - AFFECTED ENVIRONMENT

INTRODUCTION

The purpose of this chapter is to describe the existing environment potentially affected by the alternative routes in the eastern and western portions of the project area. Resources inventoried include air quality, water, earth, biology, paleontology, land use, socioeconomics, visual, and cultural. Overviews of climate, air quality, and socioeconomics are provided in a regional context, which is more appropriate than description by alternative.

For the other resources there is a brief introduction, an overview of the project area, and a summary description for each alternative route, substation, and the microwave communication facility. The summary descriptions have been organized to provide an understanding of the key resource characteristics along each alternative by state. Maps illustrating the inventory for each resource are provided in the separately bound map volume. A reference map of the alternatives is provided in the index at the end of this document. This map has been designed as a fold-out, which allows the reader to follow the alternative route discussions in Chapters 3 and 4.

The methods employed to conduct the inventory of resources are summarized as part of the environmental process in Appendix A. A list of the agencies contacted and consulted is provided in Chapter 5 and a comprehensive list of bibliographic references is provided by resource in the section entitled References. Locational descriptions for each alternative route and photographs depicting typical conditions and key areas are provided in Appendix C. Detailed resource data supporting this DEIS are on file at Western.

KEY FOR ALTERNATIVE ROUTE DESCRIPTIONS

Several of the alternative routes in the eastern and western portions of the project area are similar; many share common links with one another. Rather than repeating information, the descriptions of the alternative routes primarily focus on the link segments that are unique to each. Diagrams illustrating each alternative route and highlighting these segments are shown on a fold-out reference key in the index at the end of the DEIS immediately following the alternatives reference map.

The alternative routes in the eastern area are discussed consistently throughout the text in the following order: GC1, K1, C1, and C2. A description of GC1 is provided for the entire length of the route in New Mexico and Arizona. Alternative route K1 is very similar to GC1; therefore, the description provided for K1 focuses on the segment of the route that differs from GC1, that is, the Kaibito Plateau area (Links 1390 and 1391). Alternative route C1 is described for its entire length. The eastern portion of alternative route C2 differs from C1. In New Mexico, the description of C2 is the same as GC1 and K1 along Links 100, 120, and 460. In Arizona, the description of C2 focuses on Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa.

The alternative routes in the western area are described in the following order—the three alternative routes that terminate at the Marketplace Substation (N1W, N2, and S2), and the three alternatives that terminate at the Mead Substation (N3, N4, and S4).

Marketplace Substation—A description of N1W is provided for the entire length of the route in Arizona and Nevada. While N1W would cross the Hualapai Reservation, N2 would cross the Aubrey Valley and Truxton Plain areas to the south; therefore, descriptions of N2 focus on Links 1742, 1800, 1980, and 2020. Alternative S2, a more southerly route, shares Links 2020, 2060, 2200, and 2180 with alternative route N2, but not Links 1420, 1421, 1480, 1520, 1640, 1680, 1720, 1960, 2000, 2002, and 2006 which are described separately.

Mead Substation—Alternative routes N3, N4, and S4 into Mead Substation are identical to alternative routes N1W, N2, and S2 into the Marketplace Substation, respectively, with the exception of the westernmost portions of the routes west of the Hualapai Valley. Links 2040 and 2080 connect into the Mead Substation, whereas Links 2060, 2200, and 2180 connect into the Marketplace Substation. Descriptions for these three alternatives into the Mead Substation focus on Links 2040 and 2080 only.

CLIMATE

The climates in northwestern New Mexico, northern Arizona, and southern Nevada are influenced by regional weather systems, elevation, and topographic orientation. The entire area is characterized by low relative humidity, a high percentage of sunshine, and relatively large annual and diurnal temperature ranges. Wind flows are driven by passage of frontal systems, but also are strongly influenced by local topography. Because of the clear, dry air, the earth's surface warms rapidly during the day and cools rapidly at night.

Average and extreme temperatures depend primarily on elevation. Temperatures in the lowest elevations in the Las Vegas and Lake Mead area average in the low 90s (Fahrenheit) in July and in the mid 40s in January. Maximum temperatures above 100 degrees are common throughout the summer season in this region. The highest elevations in the project area are in the Flagstaff area and in the Chuska Mountains near the New Mexico and Arizona border. At Flagstaff, average temperatures are in the mid 60s in July and the upper 20s in January. In northwestern New Mexico at Farmington, the temperature averages in the high 90s and low 100s in summer and in the low 30s in January.

In the lower elevations precipitation falls mostly as rain during frontal passages or during brief, but sometimes intense, summer convective thunderstorms. At higher elevations, a significant portion of the annual precipitation falls as snow in the winter and as rain during the summer thunderstorms. Average annual precipitation in the Las Vegas area is less than 4.2 inches. In the Flagstaff area, the average annual precipitation is 22.8 inches. In the Farmington area of northwestern New Mexico, average annual precipitation is 8.7 inches.

AIR QUALITY

The existing air quality along the alternative routes is characteristic of rural areas with the exception of some influence from industrial areas such as the coal-fired San Juan and Four Corners generating stations, which are located at the eastern end of the project area. The western end of the project area is south of Las Vegas, the largest population center near any of the alternatives. The northernmost alternative route, GC1, would pass the coal-fired Navajo Generating Station near Page, Arizona. In remote locations, air quality is generally very good and is affected primarily by long-range transport of pollutants from distant areas. Since much of the project area is arid with sandy or silty soils and low vegetative cover, windblown dust from natural sources contributes to local and regional suspended particulate concentrations.

The EPA has established three air quality classes. Class I is identified as an area where the cleanest and most stringent degree of protection from air quality degradation applies, and Class III is the least stringent. The closest Class I area to any alternative route is Glen Canyon NRA, which is 1.5 miles away from GC1 at its nearest point south of Page. The remainder of the project area is designated Class II. One area within the project area does not currently meet National Ambient Air Quality Standards (NAAQS). This area is located in a portion of Clark County, Nevada, which is classified as a nonattainment area for carbon monoxide and particulate matter (PM_{10}).

WATER RESOURCES

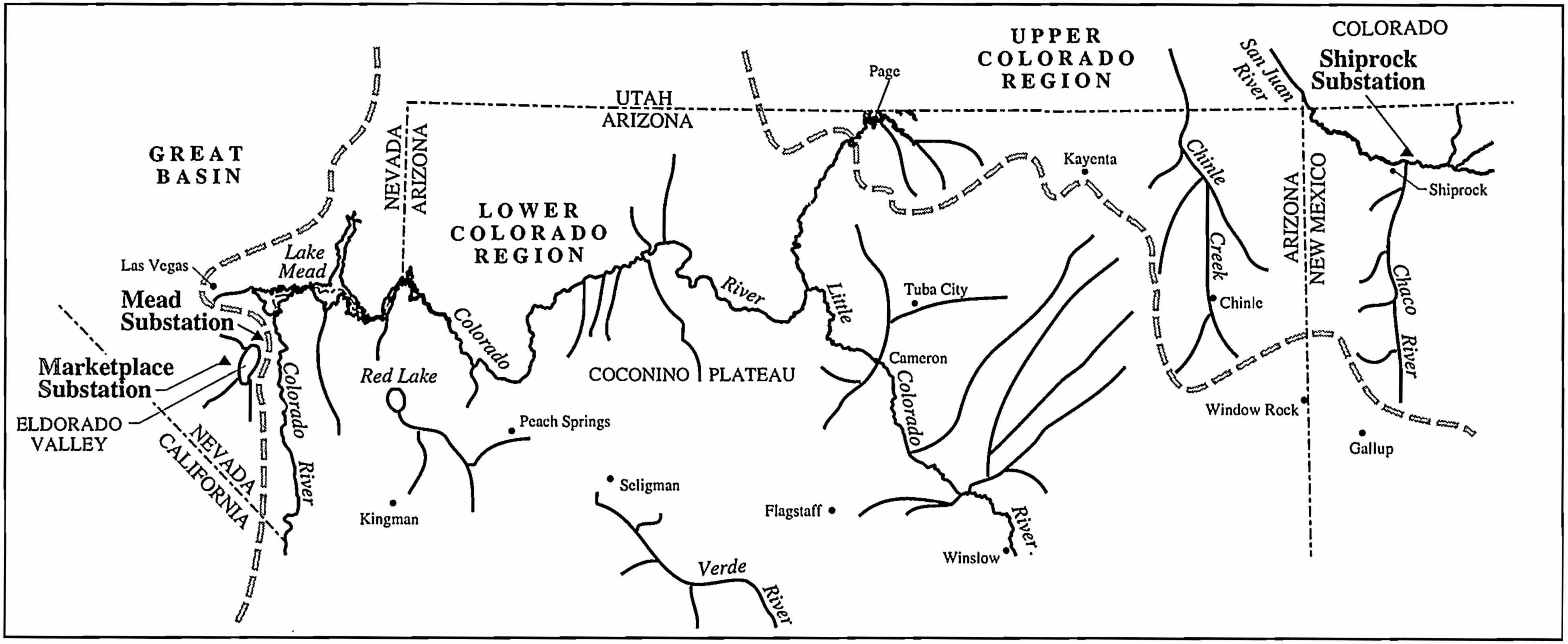
The results of the inventory are summarized below in an overview that describes hydrologic regions of the project area including perennial streams, springs, and floodplains. The overview is followed by descriptions of the water resources for alternative routes.

OVERVIEW

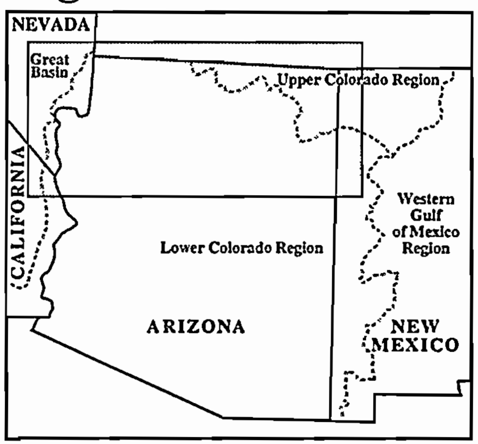
Regional Hydrology—The project area is generally arid and lies within parts of two major hydrologic regions: the Colorado River system and the Great Basin system (Figure 3-1). The Colorado River system, which includes the Upper and Lower Colorado River systems, covers a large portion of the western United States including Arizona and parts of New Mexico and Nevada. The Great Basin system consists of a network of closed drainage basins and includes most of Nevada.

Within the project area, the Upper Colorado River system includes the San Juan River watershed in northwestern New Mexico, the Chinle Creek watershed in northeastern Arizona, and several small streams in northeastern Arizona that flow northward to join the main stem of the Colorado River in Utah. The Lower Colorado River system includes the Little Colorado River watershed in northeastern Arizona and western New Mexico, the northern part of the Verde River watershed and several small streams on the Coconino Plateau in north-central Arizona, and the main stem of the Colorado River at the Arizona and Nevada border. The Great Basin system includes most of the Nevada portion of the project area and is represented by the Eldorado Valley, a closed basin that drains into a normally dry playa near the western edge of the project area.

Study Area



Regional Area



Hydrologic Regions

Navajo Transmission Project

Figure 3-1

The project area includes portions of the Plateau Uplands (northwestern New Mexico and northern Arizona) and the Basin and Range (western Arizona and southern Nevada) water provinces. In the Plateau Uplands Province, ground-water development (e.g., wells) has been fairly minimal because of excessive depths to ground water. Depth to ground-water is variable throughout the area ranging from about 20 feet along some major surface water drainages (such as Chinle Creek) to more than 200 to 300 feet throughout most of the region. In the Basin and Range Province, depth to ground water from the surface ranges from a few feet near major perennial drainages to more than several hundred feet in portions of the alluvial basins in western Arizona and southeastern Nevada.

Perennial Streams—The only major perennial streams within the project area, as shown on Figures MV-1E and MV-1W, are the San Juan and Colorado rivers. In the eastern area, several minor spring-fed perennial streams drain the Chuska and Carrizo mountains. Minor perennial streams also are found in the northern portion (primarily northwestern New Mexico and northeastern Arizona) of the project area and drain the west side of the Defiance Plateau. Major ephemeral streams include the Chaco and Little Colorado rivers. Major ephemeral streams and washes have been identified and mapped throughout the project area.

Floodplains—Areas of potential flooding (including 100-year floodplains) occur along most of the major stream courses (e.g., perennial streams and tributaries). Project alternative routes would cross floodplain areas ranging in width from 0.1 mile to 1.4 miles. Areas prone to significant flash flooding include larger intermittent or ephemeral drainages throughout the project area. The larger floodplains have been mapped within a one-mile-wide corridor (one-half mile on either side of the reference centerline) as shown in Figures MV-1E and MV-1W in the map volume.

Springs—Springs occur throughout the project area, but are more concentrated in the eastern area (northwestern New Mexico and northeastern Arizona). The springs are located along stream courses, and some of these springs contribute flow to perennial streams. Although springs along the alternative routes are mapped within a one-mile-wide corridor as shown in Figures MV-1E and MV-1W, only those springs within 600 feet of the reference centerline are reported here.

ALTERNATIVES

The water resources inventory results summarized below include a description of perennial streams, floodplains, and springs.

Eastern Area Transmission Line Alternatives

Glen Canyon 1 (GC1)

New Mexico

GC1 crosses the San Juan River, a perennial stream and an area of potential flooding, on Link 460. Links 100 and 460 cross small floodplain areas associated with ephemeral drainages (e.g., Salt Creek) that are typically 0.1 to 0.2 mile wide. There are no springs within 600 feet of the reference centerline of GC1.

Arizona

Link 461 crosses Chinle Creek near areas of perennial flow and there are two springs along Link 461 that are within 600 feet of the reference centerline. Links 460, 461, 580, 581, 586, 587, 620, 1383, and 1386 cross several ephemeral drainages and small areas of 100-year floodplains; the crossings are typically 0.1 to 0.2 mile wide.

Kaibito 1 (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1). No perennial streams or floodplains would be crossed in this area. One spring along Link 1390 is within 600 feet of the reference centerline of K1 near Choal Canyon.

Central 1 (C1)

New Mexico

C1 crosses the San Juan River, a perennial stream and an area of potential flooding, on Link 240. Floodplain crossings are 0.1 to 0.2 mile wide. There are no springs along this portion of C1.

Arizona

C1 crosses several areas of broad floodplain at Lukachukai Wash and Chinle Wash (Link 700); and Oraibi Wash, Dinnebito Wash, and the Little Colorado River (Link 780). Other crossings of ephemeral drainages are about 0.1 to 0.2 mile wide. There are three springs along Link 700 and two springs along Link 780 that are within 600 feet of the reference centerline of alternative C1.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains along Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1. No perennial streams would be crossed in this area. One broad floodplain would be crossed near the convergence of Chinle Wash and Lukachukai Wash on Link 462. There are no springs within 600 feet of the reference centerline in this area.

Substation Alternatives

No water resource issues were identified at any of the substation sites.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace

Northern 1 West (N1W)

Arizona

N1W crosses the Colorado River, a perennial river with a broad floodplain along Link 2060. There are crossings of other floodplains along Red Horse Wash (Links 1401 and 1660), at Detrital Wash (Link 2060), near Red Lake (Link 2060), and at Miller Wash (Link 1660). One spring located north of Peach Springs along Link 1790 is located within 600 feet of the reference centerline.

Nevada

N1W crosses the Colorado River along Link 2060. Broad floodplains would be crossed at tributaries to Dry Lake in the Eldorado Valley along Link 2200. No springs were identified along this alternative.

Northern 2 (N2)

Arizona

The Arizona portion of N2 is the same as N1W with the exception of Links 1742, 1800, 1980, and 2020, which are located to the south of the Hualapai Indian Reservation and replace Link 1790 on N1W. Link 1980 crosses floodplain areas in the Truxton Wash and this route is adjacent to Red Lake on Link 2020. No springs were identified within 600 feet of the reference centerline of this alternative.

Nevada

The Nevada portion of N2 is the same as N1W.

Southern 2 (S2)

Arizona

In Arizona, S2 varies from N2 beginning at the Moenkopi Substation and continuing west through Link 2006. At this point, S2 is then the same as N2 proceeding north and west along Links 2020 and 2060 to the crossing of the Colorado River and the Nevada border. This portion of S2 crosses broad floodplains along a tributary to Partridge Creek (Link 1680), at Hackberry Wash (Link 2000), and at Truxton Wash (Link 2006). No springs are within 600 feet of the reference centerline of this alternative.

Nevada

The Nevada portion of S2 is the same as N1W and N2.

Western Area Transmission Line Alternatives - Moenkopi to Mead

Northern 3 (N3), Northern 4 (N4), and Southern 4 (S4)

Alternatives N3, N4, and S4 are identical to alternatives N1W, N2, and S2, respectively, with the exception of Links 2040 and 2080, which connect into the Mead Substation rather than the Marketplace Substation (replacing Links 2060, 2200, and 2180). The following description focuses on Links 2040 and 2080.

Arizona and Nevada

Link 2040 crosses the Colorado River in a canyon setting in Arizona and Nevada. The Detrital Wash, a broad floodplain, is crossed by Link 2040 in Arizona. No springs were identified along Links 2040 and 2080.

Substation Alternatives and Microwave Communication Facility

No water resource issues were identified at any of the substation sites or at the communication site.

EARTH RESOURCES

The inventory of earth resources is summarized below in an overview that describes the geology, soils and erosion potential, mineral resources, seismicity and faults, and unique geologic features. The overview is followed by descriptions of the alternative substation sites, and the communication facility.

OVERVIEW

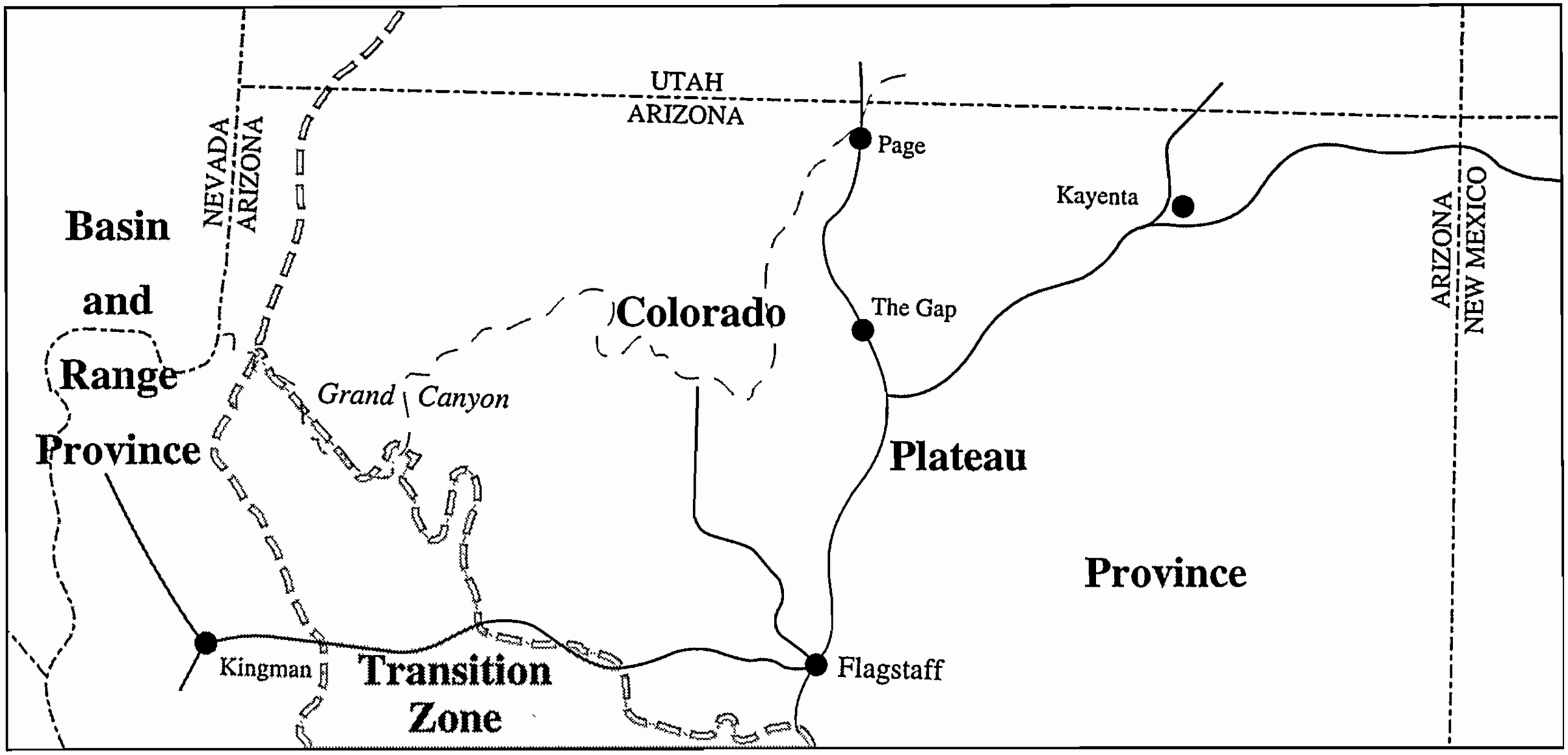
Geology—The project area includes portions of three physiographic provinces: the Colorado Plateau, the Transition Zone, and the Basin and Range, as shown in Figure 3-2. The Colorado Plateau includes northwestern New Mexico, as well as most of northern and northeastern Arizona. It is characterized by generally flat-lying sedimentary strata divided by faults and monoclines that form cliffs and individual plateaus. Mesas and buttes are common, capped by erosion-resistant rock layers. Volcanoes and extensive lava flows also are common. The western edge of the Colorado Plateau in Arizona is defined by the Aubrey Cliffs, part of the Mogollon Escarpment (Peirce 1984).

The Transition Zone is a 50- to 150-mile-wide northwest- to southeast-trending band across Arizona that separates the Colorado Plateau from the Basin and Range. The Transition Zone is characterized by northwest-southeast trending, subparallel, fault-bordered mountains separated by alluvial-filled valleys, as well as exposed flat-lying sedimentary rocks. The Transition Zone is bounded on the west by the Grand Wash Cliffs, which were formed by the Grand Wash Fault (Peirce 1985).

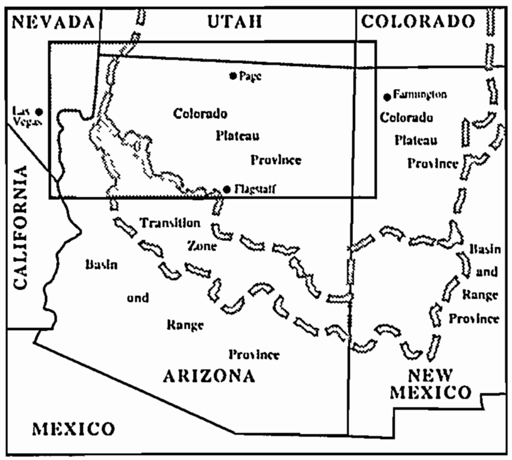
The Basin and Range Physiographic Province includes southern New Mexico, southern and western Arizona, and Nevada. The province is characterized by steep, discontinuous, subparallel mountain ranges separated by broad, alluvial-filled valleys. In Arizona and southern Nevada, these fault-bounded mountain ranges typically trend northwest-southeast or north-south.

Mineral Resources—Mineral resources of economic importance (e.g., resources that have currently or recently been mined) in the eastern area include coal, oil, natural gas, uranium, industrial rock (gypsum, clay, sand and gravel, crushed stone, bentonite), helium, and vanadium. In the western area, mineral

Study Area



Regional Area



Physiographic Provinces

Navajo Transmission Project

Figure 3-2

resources include metals (gold, lead, silver, zinc, mercury), salt, rock (cinder, flagstone, sand and gravel, dolomite, limestone), uranium, thorium, and beryllium. None of the alternative routes would cross through active mining operations.

Seismicity and Faults—Seismic activity in the New Mexico portion of the Colorado Plateau primarily occurs in the area surrounding the San Juan Basin. Recorded earthquake magnitudes generally have been less than 4.0 on the Richter scale.

Historic earthquake activity in northern Arizona has occurred at the Grand Canyon, in Big Chino Valley north of Prescott, and in the San Francisco Volcanic Field around the city of Flagstaff to the Utah border. Several Quaternary faults have been mapped along the Colorado River in the Arizona and Nevada portions of the project area. Earthquake magnitudes along the Colorado River are generally less than 5.0 (Nakata et al. 1982). Faults showing movement during the Quaternary period include the Grand Wash Fault and the Aubrey Fault (Schell and Wilson 1981). A Maximum Magnitude Earthquake of Richter magnitude 6.1 to 7.3 has been identified for the Arizona portions of the project area (Algermissen et al. 1982; DuBois et al. 1982).

Unique Geologic Features—Although there are many areas of spectacular beauty and geologic interest, there are no designated national natural landmarks along alternative routes in the project area. Geologic features in the project area making visual and/or cultural significance are discussed as part of those resources.

Soils and Erosion Potential—The soils throughout the project area are quite variable because of different climates, parent materials, topography, and other factors affecting the formation of soils. On the Colorado Plateau, broad areas are subject to high wind and water erosion because of sparse vegetation cover and soil type. The soils on plateaus, mesas, hillsides, and fan terraces range from very shallow (a few inches) to deep (greater than five feet) and are generally well drained. In these areas, the water erosion potential is typically slight to moderate, while wind erosion potential is often moderate to severe. In several broad volcanic portions of the Colorado Plateau, many of the soils have formed in basalt and pyroclastics and are very cindery. The erosion potential in these areas is usually slight to moderate, but may be high in areas with steeper slopes and severe in a few areas.

In the Transition Zone and Basin and Range Province, the soils in the valleys have generally formed from mixed alluvium. The soils 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 and typically increases with greater slope. In floodplains, terraces, and alluvial fans in the Colorado River area, the soils have formed in alluvium derived from igneous and sedimentary rocks. These deep soils 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 again slight to moderate, increasing with greater slope. Some broad areas are subject to high or severe wind erosion.

ALTERNATIVES

The results of the earth resources inventory are summarized below for each alternative route, substation, and the communication site. Figures MV-2E and MV-2W illustrate soil associations and erosion potential, mapped within a one-mile-wide corridor.

Eastern Area Transmission Line Alternatives

Glen Canyon 1 (GC1)

New Mexico

Soils along GC1 in New Mexico are typically loams and clay loams with moderate to high water erosion potential and/or high to severe wind erosion potential along Links 100, 120, and 460. Badlands are common in the region. Link 460 crosses a portion of the Shiprock uranium district.

Arizona

The soils associated with this portion of the alternative are typically loamy, clayey, or sandy soils. High to severe wind and/or water erosion potentials are evident in broad areas. Erosion potential of the soils along this alternative are generally high to severe and moderate to high except for portions of Links 460 and 461 near Red Mesa and Links 463 and 501 near Dennehotso, where the erosion potentials are slight and slight-moderate; and small sections of Links 581, 586, 587, 1393, 1397, and 1383 where there is low or no erosion potential. Links 504 and 561 have very steep and rocky areas along Black Mesa. Badlands are common in various locations. Links 1383, 1384, and 1386 would cross a portion of the Painted Desert between The Gap and Cameron.

To the north of the Carrizo Mountains, Link 460 crosses over or adjacent to Twin Falls Creek, Teec Nos Pos, the Bita Peak oil and gas fields, and the Black Rock Point uranium district. Near Red Mesa, Link 461 crosses a portion of the East Boundary Butte oil field. At Black Mesa, Links 504 and 561 are to the north of the Kayenta and Black Mesa coal mines. Links 587 and 1389 are adjacent to the White Mesa mining district northeast of Copper Mine and Links 1384 and 1386 are adjacent to the Cameron uranium district.

Kaibito 1 (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1). The majority of the soils along this section of alternative route K1 consist of sand dunes or rock outcrops with sparse vegetation. Wind erosion potential is severe and water erosion potential is slight. Link 1390 is adjacent to the southern part of the White Mesa mining district.

Central 1 (C1)

New Mexico

The soils in the area are typically loamy, sandy, or clayey soils with high to severe wind and/or water erosion potential. Only a small segment of Link 240 near the San Juan River has a slight-moderate erosion potential. Badlands are common in the region. Link 640 crosses through The Hogback, a prominent geologic feature of the area.

Near Fruitland, Links 180, 240, 300, 360, and 640 cross through or adjacent to a portion of the Navajo, Fruitland, and Hogback coal fields. The San Juan Coal Mine is located north of the town of Fruitland and east of Link 240. The Navajo Coal Mine is located southwest of Fruitland southeast of Links 300 and 360. Link 640 crosses through a portion of the Chuska uranium district. Oil and gas fields are located near Link 640 in the vicinity of The Hogback and along Link 700 near the Chuska Mountains.

Arizona

Links 700 and 701 generally cross sandy, loamy, clayey, and stony soils. The erosion potential varies from slight, to moderate-high, and high-severe in the Chuska Mountains (Link 700) and Ventana Mesa (Link 701 and part of 700), and from slight to slight-moderate in the Chinle Valley and areas north of Canyon de Chelly and west of Lukachukai. Link 780 generally crosses sandy loams, fine sands, loams, and rock outcrop. The erosion potential of the soils along Link 780 are predominantly high-severe with several broad areas of moderate potential in some of the major drainages. There are large areas of badlands, and the western portion of Link 780 crosses a part of the Painted Desert.

Link 700 crosses the Dineh-Bi-Keyah oil field in the Chuska Mountains, and is adjacent to the Red Rock (near Red Valley), Lukachukai (in the Chuska Mountains), and Chinle (north of Canyon de Chelly) uranium districts. The western portion of Link 780 crosses the Cameron uranium district.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains along Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1. The soils along Link 460 are generally sands, clay loams, and sandy loams with slight or moderate-high erosion potential. Areas of high-severe erosion occur in part in the Walker Creek drainage and on Carson Mesa south of Rock Point (Link 462).

C2 crosses through or adjacent to the Twin Falls, Bita Peak, and Teec Nos Pos oil and gas fields as well as the Black Rock Point uranium district to the north of the Carrizo Mountains, and would cross the Dry Mesa and Black Rock oil fields located to the northwest of the Carrizo Mountains. Near the town of Rough Rock, C2 is adjacent to the Black Mountain uranium district and the Rough Rock uranium district, which includes breccia pipes with copper (Link 462).

Substation Alternatives

Shiprock Substation—At the existing Shiprock Substation, the soils consist of clay loams with moderate-severe wind erosion potential and moderate water erosion potential. Coal resources are abundant in the area.

Honey Draw Substation Site—At the Honey Draw Substation site, the soils in the area include loamy sands and fine sands, which have a severe wind erosion potential and a slight water erosion potential.

Red Mesa Substation Site—In the area of the Red Mesa Substation site, the soils consist of loamy sands and fine sands, which have a severe wind erosion potential and a slight water erosion potential.

Copper Mine Substation Site—The Copper Mine Substation site is located in an area consisting primarily of rock outcrop and shallow soils, low or no soil erosion is expected.

Moenkopi Substation—In the area of the existing Moenkopi Substation, the soils consist of sandy or clayey loams. The wind erosion potential is severe, and the water erosion potential is slight. The site is adjacent to the Cameron uranium district.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace

Northern 1 West (N1W)

Arizona

The soils in the area of N1W include limey gravelly loams, sandy loams, clay loams, gravels, and cinders, with predominantly slight to moderate erosion potential. The Aubrey Valley and Peach Springs area (Link 1790) has some moderate-high and high-severe potential for erosion. Near Moenkopi, the soils also have a high-severe erosion potential. Other limited areas with high-severe erosion potential include portions of the Music Mountains (Link 1790), the White Hills, Detrital Valley, and the Black Mountains (Link 2060).

Link 1400 is adjacent to the Cameron uranium district. Link 1660 crosses near the Francis and Valle uranium districts, and there are known manganese deposits in an area near the Aubrey Cliffs. There are known deposits of gold and tungsten in the Music Mountains near Link 1790, and gold, copper, and silver deposits along Link 2060 in the White Hills and Black Mountains. Active mines in the area include the Outland Resources Shipley Pit northwest of Links 1740 and 1741.

Nevada

The soils along this portion of N1W are typically extremely cobbly to very gravelly, loamy, or sandy. The erosion potential is mostly moderate throughout the area along Links 2060 and 2200 with high-severe erosion potential at the crossing of the Colorado River on Link 2060. Link 2060 crosses part of the Eldorado mining district with known deposits of gold, silver, lead, zinc, copper, mercury, uranium, thorium, and beryllium.

Northern 2 (N2)

Arizona

The Arizona portion of N2 is the same as N1W with the exception of Links 1742, 1800, 1980, and 2020, which are located to the south of the Hualapai Indian Reservation and replace Link 1790 on N1W. This segment of N2 has high-severe erosion potential areas in the Hualapai Valley and Truxton Wash areas (Links 2020 and 1980). Active mines in the area include the Nelson Quarry north and west of Link 1742, and Outland Resources Shipley Pit northwest of Link 1742.

Nevada

The Nevada portion of N2 is the same as N1W.

Southern 2 (S2)

Arizona

In Arizona, S2 varies from N2 beginning at the Moenkopi Substation and continuing west through Link 2006. At this point, S2 is then the same as N2 proceeding north and west along Links 2020 and 2060 to the crossing of the Colorado River and the Nevada border. Unique portions of this route are characterized by soils that are generally gravelly loams or cindery, clayey, or sandy soils. The erosion potential is typically slight or slight-moderate across the alternative. Areas with moderate-high erosion occur in Big

Chino Valley (Link 1720), and areas with high-severe erosion potential are primarily located along Link 1420 southwest of the Moenkopi Substation and north of Hackberry (Link 2006). Near Cameron, Link 1420 is adjacent to the Cameron uranium district. Gold is known to be present in portions of the Cottonwood Mountains; and lead, zinc, and silver in the Peacock Mountains near Hackberry.

Nevada

The Nevada portion of S2 is the same as N1W and N2.

Western Area Transmission Line Alternatives - Moenkopi to Mead

Northern 3 (N3), Northern 4 (N4), and Southern 4 (S4)

Alternatives N3, N4, and S4 are identical to alternatives N1W, N2, and S2, respectively, with the exception of Links 2040 and 2080, which connect into the Mead Substation rather than the Marketplace Substation (replacing Links 2060, 2200, and 2180). The following description focuses on Links 2040 and 2080.

Arizona and Nevada

Soils along Link 2040 in Arizona are generally sandy loams, gravelly loams, loamy sands, and loams, with slight to moderate erosion potential. At the Colorado River crossing and into Nevada (Links 2040 and 2080), the mountainous areas are characterized by very cobbly loams to very gravelly loams and steep rock outcrops with erosion potential ranging from moderate to high and severe.

There are known deposits of gold, copper, and silver along Link 2040 in the White Hills and Black Mountains in Arizona.

Substation Alternatives

Red Lake Substation Site—Soils in the area include gravelly or cindery loams. The water erosion potential is moderate and the wind erosion potential is slight.

Marketplace Substation—Soils in the area are sandy loams. Erosion potential is slight to moderate.

Mead Substation—Soils in the area of the existing Mead Substation are gravelly, sandy, and loamy with high-severe erosion potentials.

Microwave Communication Facility

The existing Bill Williams Mountain communication site is located on an inactive cinder cone volcano. The ground's surface is cindery, and erosion potential increases with greater slope, ranging from slight to moderate.

BIOLOGICAL RESOURCES

The results of the inventory are summarized below in an overview that describes vegetation types, wildlife, and special status species. The inventory was completed from available data with a field survey conducted only in The Hogback ACEC for special status plants. In the absence of special status species data for much of the area, habitat suitable for supporting such species was identified to predict the presence of special status plant and wildlife species. This information is intended as a guideline for areas that may require biological resources surveys prior to construction.

OVERVIEW

Vegetation Types—There are eight major vegetation types present within the project area (Table 3-1, Figures MV-3E and MV-3W) (Brown et al. 1979). Great Basin desertscrub, Great Basin/Plains grasslands, and Great Basin conifer woodlands (e.g., piñon-juniper woodlands) occur as ecotones throughout much of the New Mexico and eastern Arizona portions of the project area. The Rocky Mountain montane conifer forest (e.g., ponderosa pine), and mixed conifer forests (e.g., spruce-fir) are limited to the Chuska Mountains along the New Mexico and Arizona border. While no well-developed mixed conifer forests are present along the alternative routes, individual elements (e.g., Douglas fir) are present locally at higher elevations. Grasslands characterize the valleys of central Arizona (e.g., Aubrey and Hualapai valleys), and Great Basin conifer woodlands occur at higher elevations. Western Arizona and Nevada are characterized primarily by Mohave desertscrub. Riparian and broadleaf communities exist along permanent and ephemeral streams (e.g., San Juan, Colorado, and Little Colorado rivers) at all elevations within the project area. Wetlands are limited, occurring at springs or in association with other permanent water bodies. Sand dune scrub is limited to one area west of Cameron and north of Hackberry, Arizona. Miles of vegetation types found along each of the eastern and western alternative routes are presented in Table 3-2.

Wildlife—There are approximately 473 species of vertebrates within the project area, including 95 species of mammals, 268 species of birds, 71 species of reptiles and amphibians, and 39 species of fish. While some animals, like the coyote, are highly adaptive and can live in a variety of habitats, many others are characteristic of particular vegetation types. Some wildlife species are migratory, meaning that they reside within the project area for only a portion of the year (e.g., raptors), or that they use different habitats seasonally within the project area (e.g., big game). Characteristic species within various habitat types are presented in Table 3-1.

TABLE 3-1
BIOTIC COMMUNITIES
Vegetation Types and Representative Wildlife and Plant Species

Vegetation Type	Elevation (feet)	Plants and/or Series	Representative Wildlife
Great Basin Desertscrub (AZ, NM)	5,000 to 8,000	sagebrush series, shadscale series, blackbrush series	pronghorn, sagebrush vole, dark kangaroo mouse, sage thrasher, sage sparrow, spadefoot toad, sagebrush lizard
Great Basin/Plains Grasslands (AZ, NM)	4,500 to 7,500	blue grama, galleta, Indian ricegrass, snake-weed, rabbitbrush, winterfat, four-wing saltbush, juniper	pronghorn, Gunnison's prairie dog, spotted ground squirrel, horned lark, meadowlark, great plains toad, lesser earless lizard, western rattlesnake
Great Basin Conifer Woodland (AZ, NM)	4,500 to 8,000	piñon pine, one-seeded juniper, big sagebrush, boxthorn, snakeweed, Mormon tea, Spanish bayonet	mule deer, elk, piñon mouse, Stephen's woodrat, red spotted toad, plateau whiptail, night snake
Rocky Mountain Montane Conifer Forest (AZ, NM [Chuska Mountains])	6,000 to 8,000	ponderosa pine, Douglas fir, gambel oak, aspen, white fir, limber pine	black bear, mule deer, turkey, Nuttall's cottontail, Abert's squirrel, dwarf shrew, tiger salamander, ringneck snake
Rocky Mountain Montane Conifer Forest - Mixed Conifer Forest (AZ, NM, Chuska Mountains)	6,500	Douglas fir, aspen white fir, limber pine	black bear, mule deer, turkey, Abert's squirrel, dwarf shrew
Riparian Woodlands: Plains/Great Basin Grasslands (AZ, NM)	4,500 to 7,500	plains and narrow-leaf cottonwoods, rushes, sedges, cattails, tamarisk, camelthorn, Russian olive	raccoons, beavers, numerous songbirds
Riparian Woodlands: Montane Habitats (AZ, NM [Chuska Mountains])	>6,000	Texas mulberry, Arizona alder, narrowleaf cottonwood, boxelder, Rocky Mountain maple, sedges, flat sedges, bulrushes	raccoons, beavers
Mohave Desertscrub (NV, AZ)	2,500 to 5,000	creosotebush-bursage series, saltbush-greasewood series, Joshua tree-blackbrush series	desert bighorn sheep, gray fox, kit fox, red-tailed hawk, prairie falcon, Gila monster, chuckwalla, desert tortoise

1. Complete species lists are on file as part of the biological resources data supporting this DEIS.
2. Sensitivity levels assigned to biological resources are provided in Table D-4.

TABLE 3-2 MILES OF VEGETATION TYPES ALONG THE ALTERNATIVE ROUTES								
Alt.	Total Miles	Vegetation Type						
		MDS	GBDS	GBPGL	GBCW	PP	SDS	R/W
Eastern Alternative Routes								
GC1	260.6	-	177.9	48.2	30.7	-	-	3.4/0.1
K1	244.7	-	164.7	43.8	32.5	-	-	3.3/0.1
C1	186.7	-	50.7	99.9	26.5	6.8	-	1.8/0.1
C2	211.0	-	99.7	91.2	18.4	-	-	1.6/0.1
Western Alternative Routes								
N1W	217.0	74.2	5.1	86.2	49.3	-	0.2	1.0/1.0
N2	225.1	88.2	5.1	95.7	32.2	-	0.2	1.0/1.0
S2	247.7	84.6	4.2	92.0	58.9	-	4.6	2.2/0.1
N3	199.3	55.2	5.1	86.2	49.3	-	0.2	2.3/1.0
N4	207.4	69.2	5.1	95.7	32.2	-	0.2	2.3/1.0
S4	230.0	65.6	4.2	92.0	58.9	-	4.6	3.5/0.1

KEY:
MDS = Mohave Desertscrub
GBDS = Great Basin Desertscrub
GBPGL = Great Basin/Plains Grasslands
GBCW = Great Basin Conifer Woodlands
PP = Rocky Mountain Montane Conifer Forest (Ponderosa Pine Forests)
SDS = Sand Dune Scrub
R/W = Riparian/Wetlands

Mammals—Mammals within the project area include 20 species of bats, 4 lagomorphs, 3 insectivores, 16 carnivores, 7 hoofed mammals, and 45 rodents.

Suitable habitat exists within the project area for several big game species, including mule deer, which range from desertscrub and grassland to coniferous forests (Burt and Grossenheider 1976). Crucial winter habitat for mule deer exists near the New Mexico and Arizona border. Pronghorn are most prevalent in rolling or dissected hills and mesas with grasses and scattered shrubs (e.g., Aubrey Valley) (Hoffmeister 1986). Elk inhabit the Chuska Mountains and Gray Mountain on the Navajo Nation, and Blue Mountain, Red Tank, and Milkweed Canyon on the Hualapai Indian Reservation. Bighorn sheep are found in the Black Mountains of Arizona and the Eldorado Mountains of Nevada. Black bears inhabit the Chuska Mountains. Mountain lions prefer rocky or mountainous areas (e.g., The Hogback, Chuska Mountains, and Eldorado Mountains) where mule deer provide the main prey base (Whitaker 1980).

Small game and furbearers within the project area are diverse and include red fox, kit fox, gray fox, bobcats, and coyotes. Raccoons are typically found near permanent water bodies, while ringtails live in rocky canyons near cliffs. Gunnison's prairie dog inhabit grassland and are present in the Aubrey Valley. Western spotted, striped, and hog-nosed skunks; badgers; and Abert's tree squirrels inhabit ponderosa pine forests in the Chuska Mountains. Beavers exist along the San Juan River and on mountain streams in the Chuska Mountains, where aspen groves are prevalent. Other small mammals within the project area include rabbits, hares, shrews, and bats.

Populations of wild horses and burros exist on the Hualapai Reservation (Link 1790). Burros, which are protected by law, may be present in the Black Mountains of Arizona (Links 2040 and 2060). Burros also are present in the Eldorado Mountains of Nevada. A BLM herd management area extends to the Lake Mead NRA (Slone 1994).

Birds—Approximately 268 bird species may occur in the various habitats within the project area as wintering species, migrants, or permanent or summer-breeding residents. Several species of upland game birds are present within the project area. Wild turkeys inhabit high elevation montane conifer forests; band-tailed pigeons inhabit higher elevation oak woodlands; ring-necked pheasant, scaled quail, and mourning dove are open grassland species; Gambel's quail inhabit Mohave desertscrub; and white-winged doves summer along the Colorado River in western Arizona. Waterfowl including geese, ducks, and coots are found in the mountain and foothill lakes of the Chuska Mountains, along the Colorado River and its lakes, and at ponds and stock tanks. Many of these species are transients and use the San Juan and Colorado river corridors during migration, as well as ponds and lakes in the Chuska Mountains. All birds are protected by the Migratory Bird Treaty Act (MBTA), except house sparrows and starlings.

Suitable habitat for a number of raptor species exists within the project area. The red-tailed hawk is a year-round resident throughout the project area. Ferruginous hawks are permanent or winter residents throughout the project area and nest in badlands. Swainson and ferruginous hawks are known to nest in the Hualapai Valley. Peregrine falcons nest in steep cliffs near an abundant prey base, which are present along several alternative routes. Golden eagles inhabit sites (i.e., a large tree or cliff) where open expanses of land support a dependable prey base. Bald eagles migrate through the area, using the lakes and ponds in the Chuska Mountains and Defiance Plateau. They winter along the San Juan and Colorado rivers, and nest in riparian areas along perennial streams. Other raptors include the northern goshawk, northern harrier, prairie falcon, merlin, osprey, and turkey vulture. The great horned and western screech owls are found throughout the project area. The barn owl, flammulated owl, northern pygmy-owl, and northern saw-whet owl are found at higher elevations. The long-eared owl prefers riparian areas. Burrowing owls nest on the ground in open areas. Mexican spotted owls, a listed species, nest and forage throughout the Chuska Mountains which have been designated as critical habitat.

Reptiles and Amphibians—There are 71 species of reptiles and amphibians within the project area—1 salamander, 7 toads, 7 frogs, 1 turtle, 1 tortoise, 27 lizards, and 27 snakes. Although the amphibians and some of the reptiles are highly water-dependent, some of the terrestrial reptiles, including the horned lizards and several snake species, inhabit very arid areas. Populations of Sonoran and Mohave desert tortoises are present in Arizona and Nevada, respectively. Chuckwallas and Gila monsters are found in rocky areas within Mohave desertscrub. Historic records of chuckwalla exist from the vicinity of Page. The Arizona toad occupies Milkweed Canyon on the Hualapai Reservation.

Fishes—Fish species in the project area are associated with perennial waters, predominantly the rivers and lakes of the Colorado River system, and streams and lakes in the Chuska Mountains. Important components of this system are Lake Mohave, the Colorado and Little Colorado rivers, and the San Juan River. Ten species of fish are native to the project area and 28 have been introduced. The native species include speckled dace, bonytail chub, roundtail chub, humpback chub, Little Colorado River spinedace, Colorado squawfish, razorback sucker, flannelmouth sucker, white sucker, and bluehead mountain-sucker. Perennial streams within the Chuska Mountains, including Lukachukai Creek, also support fish populations.

Cold water sport fishes include rainbow, Arizona cutthroat, brown, and brook trout. Warm water sport fishes include northern pike, walleye; striped, smallmouth and largemouth bass; white and black crappie; green sunfish; bluegill; redear sunfish; blue and channel catfish; and yellow and black bullhead.

Special Status Species—The FWS, Navajo Nation, BLM, Forest Service, and the states of New Mexico, Nevada, and Arizona have devised codes for defining the extent of rarity and level of threat to biotic taxa. Definitions for the categorical ratings (e.g., endangered, threatened) are provided in Table D-1. Special status species are summarized by state in Table D-2. Detailed accounts of species with status at the Federal level are presented in the NTP biological resources data supporting this DEIS.

The FWS offices in Albuquerque, Phoenix, and Las Vegas provided regional lists of special status species. Information on specific locations of such species was provided by land-managing agencies when available; however, these data were limited. Wherever possible, known locations of special status plant and wildlife species were mapped. Specific locations of certain species (e.g., raptor nests) were not mapped due to the sensitive nature of this information.

The Federal, tribal, and state lists of species included 59 special status plant species and more than 100 special status wildlife species. Due to the distances covered by the eastern and western alternative routes, each of the alternative routes traverses a similar, wide diversity of habitat types. Habitat for special status wildlife species occurs along each of the alternative routes with the exception of species associated with higher elevation coniferous forests, which are present only in the Chuska Mountains (alternative route C1).

Some special status species are associated with unique habitats, areas that support an unusually diverse or highly restricted assemblage of plants and/or animals. These areas are regionally rare, uncommon, or largely diminished. Generally, there are specific biological issues associated with these unique habitats. Unique terrestrial habitats along alternative routes include The Hogback in New Mexico, the Chuska Mountains in New Mexico and Arizona, the Black Mountains in Arizona, the Aubrey and Hualapai valleys in Arizona, and the Eldorado Mountains in Nevada. Aquatic habitats supporting populations of special status fish and wetland/riparian habitats include the San Juan, Colorado, and Little Colorado rivers. Table D-3 summarizes special status species associated with unique habitats by state.

There are two Federally listed endangered species that historically occurred in the project area and for which suitable habitat exists. Black-footed ferrets inhabited grasslands that support Gunnison's prairie dogs. In March 1996, black-footed ferrets were released in the Aubrey Valley, which is traversed by several alternative routes. California condors are to be released in the Vermillion Cliffs west of Page.

Both are designated as nonessential, experimental populations, which reduce the level of protection afforded them under the Endangered Species Act (ESA).

The project area has not been systematically surveyed for special status species plants and wildlife. Because an analysis based solely on known presence of species does not accurately reflect the true distribution within the project area, potential habitat of special status plants and wildlife were identified. This information is intended to serve as a guideline for land-managing and/or regulatory agencies. Prior to construction, surveys would be conducted in areas the agencies consider sensitive.

Potential habitat was identified with the one-mile-wide corridor of alternative routes for 24 of the 59 species of special status plants listed by the various agencies. Potential habitats are shown on Figures MV-5E and MV-5W and included in the discussions below for each alternative.

ALTERNATIVES

The following summaries address vegetation types, wildlife, and special status species with emphasis on unique areas and Federally listed species most likely to be present. Figures MV-3E through MV-5W illustrate these resources within a one-mile-wide corridor. Additional information is provided in several tables in Appendix D.

Eastern Area Transmission Line Alternatives

Glen Canyon 1 (GC1)

New Mexico

Vegetation—This portion of GC1 (Links 100, 120, and 460) crosses areas of Great Basin desertscrub and Great Basin/Plains grasslands, both of which are common throughout northern New Mexico. Great Basin/Plains grasslands typically occur at slightly higher elevations.

GC1 crosses a relatively short expanse of riparian vegetation along the San Juan River (Link 460). This riparian area consists of willow thicket and scattered cottonwoods, and is crossed by an existing transmission line parallel to GC1.

The Hogback, a unique geologic formation located east of Shiprock, New Mexico, is partially within a designated BLM ACEC. The higher elevations of The Hogback are dominated by grassland habitat, with Great Basin desertscrub at the lower elevations. Partly due to its location at the interface of several biogeographical provinces, the vegetation in this region is relatively rich and supports a diverse number of plant species of special concern (Dunmire 1992). Vegetation is characterized by scattered sub-shrubs (saltbushes) and grasses (galleta and Indian ricegrass), and numerous annuals. Areas underlain by sandstone support small trees, including juniper, single-leaf ash, and mountain-mahogany. Piñon is very sparse.

Wildlife—Wildlife populations along the New Mexico portion of GC1 include various reptiles, birds, and small mammals. Mule deer are year-round residents of the San Juan River valley, and in winter migrate from Colorado into areas east and north of the river. Mule deer are the primary big game species in this area. Mountain lions may occasionally be present on the vicinity of The Hogback. Pronghorn are present in the general vicinity. Native fish species are present in the San Juan River.

Numerous bird species inhabit the riparian areas along the San Juan River and hunt over the open grasslands. Raptors are numerous, including ferruginous hawk, Swainson's hawk, northern harrier, prairie falcon, and barn owl. Waterfowl and shorebird species are found along the San Juan River (Link 460), especially during migration periods.

Special Status Species—A recent survey for Mesa Verde cactus (Federally listed as threatened) did not identify any individual plants along Link 100 within The Hogback ACEC, although the species has been known to be present there. No occurrences of special status wildlife species are known except for fish in the San Juan River, which is designated critical habitat for the razorback sucker and Colorado squawfish, both Federally listed as endangered. Also, the flannelmouth sucker, roundtail chub, and mottled sculpin inhabit the river.

Several special status plant species potentially occur along Links 100 and 120, including two that are Federally listed—Mesa Verde cactus (threatened) and Mancos milkvetch (endangered). No populations of Mesa Verde cactus or Mancos milkvetch were observed along Link 100 during surveys conducted within The Hogback ACEC (Ecosphere 1995). In addition, there is habitat suitable for Mesa Verde cactus along Link 460.

Potential habitat exists for the bald eagle and peregrine falcon, both of which are Federally listed endangered species. Although no nest sites have been identified, bald eagles inhabit riparian areas adjacent to the San Juan River during the winter months. Peregrine falcons nest in cliffs adjacent to open water (Link 460). The endangered southwestern willow flycatcher may inhabit riparian areas along the San Juan River. Golden eagles may nest along mesas or buttes that occur along this alternative route. Prairie dog colonies that exist along Link 460 may be large enough to support the endangered black-footed ferret.

Arizona

Vegetation—Vegetation along this portion of GC1 is similar to that found in the New Mexico portion, and is dominated by Great Basin desertscrub with scattered areas of Great Basin/Plains grasslands and piñon-juniper woodland. Narrow strands of riparian habitat, primarily tamarisk and camelthorn, are present along ephemeral drainages throughout the area as well as along the Little Colorado River near the Moenkopi Substation area.

Wildlife—Wildlife species along this portion of GC1 are similar to those found along the New Mexico segment and are characteristic of Great Basin desertscrub and Great Basin/Plains grassland habitat. In addition, wildlife in this area includes species typically associated with piñon-juniper woodlands, such as mule deer, golden eagle, cottontail, red-tailed hawk, and numerous rodents. Mule deer and antelope occur along this alternative route and use Marsh Pass during migration.

Special Status Species—There is known raptor habitat north of Black Mesa, golden eagle nesting habitat near The Gap, and Coconino Arizona pocket mouse habitat in the general area of the Moenkopi Substation.

Suitable habitat for special status species is present. Navajo sedge, Federally listed as threatened, inhabits seep springs on the vertical cliffs or benches of pink-red Navajo Sandstone. Populations of this sedge exist in the general area and others may exist along Links 501 and 581. Habitat exists that could support several Federal Candidate C2 species including the Roaring Springs prickly poppy, Nipple Beach phacelia, Tusayan flame flower, and Cameron water-parsley. Also, there is potential for the Fickeisen plains cactus, which is a Federal Candidate C1 species, to be present.

Peregrine falcons and bald eagles inhabit the riparian areas associated with the Colorado River and may forage in the vicinity of Page (Links 620 and 1389). Peregrine falcons may nest on steep cliffs of mesas and buttes (Links 504 and 561). Northern goshawks have the potential to occur throughout piñon-juniper woodlands and ponderosa pine forests. There is suitable habitat for other nesting raptors, including the ferruginous hawk in open badlands, as well as for golden eagles on cliff faces and buttes. No nest sites are known. Prairie dog colonies exist in the vicinity of Red Mesa and could support black-footed ferrets (Links 460 and 461). There is potential habitat for the Coconino Arizona pocket mouse along Link 1386. There are plans to release California condors, listed as endangered, west of Page and northwest of GC1.

Kaibito 1 (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1).

Vegetation—Vegetation along this segment of K1 is primarily a mosaic of Great Basin desertscrub and piñon-juniper woodland.

Wildlife—Wildlife in the area of K1 is characteristic of Great Basin desertscrub, Great Basin/Plains grasslands, and piñon-juniper woodlands summarized in Table 3-1.

Special Status Species—No known populations of special status species occur along this segment of alternative K1.

Potential Occurrences—Potential habitat for Navajo sedge was identified along Links 1390 and 1391.

Central 1 (C1)

New Mexico

Vegetation—This portion of C1 crosses a mosaic of Great Basin desertscrub and Great Basin/Plains grasslands on the flatlands, with piñon-juniper woodlands dominating the eastern edge of the Chuska Mountains and northern foothills of Beautiful Mountain (Link 700). This segment of C1 also crosses through The Hogback. Riparian vegetation, primarily cottonwood-willow with some exotics such as camelthorn and tamarisk, is present along the San Juan River (Link 240) and along drainages from the Chuska Mountains (Link 700).

Wildlife—Wildlife along C1 is characterized by those species inhabiting Great Basin desertscrub, Great Basin/Plains grasslands, and piñon-juniper woodlands (see Table 3-1). The foothills of the Chuska Mountains support numerous big game species and provide habitat for other small mammals and birds, including several raptor species. Big game include mule deer, black bear, mountain lion, and Merriam's turkey.

Special Status Species—Two special status plant species are known to be within the one-mile-wide study corridor of C1. A survey conducted in spring 1995 (Ecosphere 1995) located populations of Mesa Verde cactus on The Hogback ACEC along Link 180 (354 plants), and Link 240 (651 plants). Mancos milkvetch is present along C1 in the area of The Hogback, although no plants were located during surveys conducted within the ACEC boundaries (Ecosphere 1995). Both the riparian and aquatic habitats of the San Juan River and the foothills of the Chuska Mountains support wildlife species of concern. The San Juan River (downstream from where the river would be crossed by the line) is designated critical habitat for the Colorado squawfish and razorback sucker, which are Federally listed as endangered. Other special status fish species in the river are the flammulated sucker, roundtail chub, and mottled sculpin.

Habitat suitable for Mesa Verde cactus is present on Navajo lands (Links 360, 640, and 700). The cottonwood-willow riparian habitat associated with the San Juan River supports wintering bald eagles, peregrine falcons, and potentially the southwestern willow flycatcher. No nest or roost sites have been identified. Open grasslands west of The Hogback provide habitat for prairie dog colonies that could support black-footed ferrets.

Arizona

Vegetation—This segment of C1 crosses a variety of vegetation types including Great Basin desertscrub, Great Basin/Plains grasslands, piñon-juniper woodlands, and ponderosa pine woodlands at the higher elevations of the Chuska Mountains (Link 700). This is the only ponderosa pine along any of the alternative routes, making this area the most biologically diverse in the project area. C1 also crosses a small area of riparian vegetation adjacent to the Little Colorado River, east of the Moenkopi Substation area.

Wildlife—C1 crosses approximately six miles of ponderosa pine forest, which support a relatively large variety of wildlife species that are not found in other habitat types (e.g., Abert's squirrel, Mexican vole, and long-eared myotis). Big game species likely to occur include Merriams' turkey, black bear, mountain lion, and mule deer. Crucial winter habitat for mule deer exists on the eastern slope (McCoy 1996). Link 700 through the Chuska Mountains parallels an existing 500kV transmission line and access road.

Special Status Species—No special status plant species are known to exist along the Arizona portion of C1. The Chuska Mountains have been designated as critical habitat for the Mexican spotted owl, and the edge of one management territory for a spotted owl is adjacent to the corridor.

Suitable habitat exists for three Federal candidate C2 species: Tusayan rabbitbrush (Links 700 and 780), gladiator milkvetch (Link 700), and Tusayan flameflower (Link 780). Golden eagles and ferruginous hawks could occur, although no nest sites have been identified. Golden eagles are known to nest on mesas and buttes (Links 700 and 780), while ferruginous hawks are migratory or rare nesters in badlands. Suitable habitat for the Cononino Arizona pocket mouse exists in the vicinity of Cameron (Link 780).

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains on Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1.

Vegetation—Vegetation along Links 460 and 462 is dominated by Great Basin desertscrub with scattered areas of Great Basin/Plains grasslands and small areas of piñon-juniper woodlands. Riparian habitats characterized by tamarisk and greasewood exist along ephemeral drainages.

Wildlife—Wildlife along C2 (Links 460 and 462) is characteristic of Great Basin desertscrub, Great Basin/plains grasslands and piñon-juniper woodlands (see Table 3-1).

Special Status Species—No special status plant or wildlife species (except golden eagles) are known to exist along this segment of C2.

Habitat suitable for one Federally listed threatened species, Navajo sedge, exists along Link 462. Suitable habitat also exists for Tusayan rabbitbrush along Link 462. Goshawk may occur throughout piñon-juniper woodlands in winter. Golden eagles could nest on the cliffs of mesas and buttes throughout the area.

Substation Alternatives

Shiprock Substation—The existing substation is surrounded by The Hogback ACEC in an area of Great Basin desertscrub. Known habitat for Mesa Verde cactus and several populations of this cactus are present in the vicinity. No special status wildlife species are known to exist in the area.

Honey Draw Substation Site—The area of the site supports Great Basin desertscrub and wildlife species characteristic of this vegetation type; however, the area is degraded. Raptors, including the bald eagle and peregrine falcon, inhabit nearby Glen Canyon and potentially forage over the area.

Red Mesa Substation Site—The site is located adjacent to an existing 345kV transmission line in an area of Great Basin desertscrub habitat. No special status plants or wildlife species are known in the vicinity.

Copper Mine Substation Site—The site, also located adjacent to an existing 345kV line, is characterized by Great Basin plains/grasslands and piñon-juniper. No special status species are known in the vicinity; however, habitat suitable for Candidate C2 species, Tusayan flameflower, is present. There is moderate potential for pronghorn in the area.

Moenkopi Substation—The area of the existing substation is located within Great Basin desertscrub in an area that has been disturbed. No known or potential habitat exists for special status plants. One Federal Candidate C2 species, the Coconino Arizona pocket mouse, may be present in the vicinity.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace

Northern 1 West (N1W)

Arizona

Vegetation—Great Basin desertscrub is limited to the vicinity of Moenkopi (Link 1400). Great Basin/Plains grasslands characterize the Aubrey Valley (Links 1740 and 1741) and the Coconino Plateau (Link 1660). Piñon-juniper woodlands exist east and west of Aubrey Valley and on the Music Mountains and Grand Wash Cliffs (Link 1790). These two vegetation types are prevalent from Moenkopi west across the Hualapai Reservation (Links 1400, 1401, 1660, and 1790). The Hualapai Valley and the Black Mountains west to the Arizona and Nevada border are characterized by Mohave desertscrub (Link 2060). There is a stand of paloverde trees, which represents the northern limit of their range, located south of Link 2060 in Lake Mead NRA.

Wildlife—Wildlife along this segment of N1W is characteristic of Great Basin/Plains grasslands, piñon-juniper woodlands, and Mohave desertscrub (see Table 3-1). Pronghorn are present throughout the grasslands and are especially prevalent in the Aubrey Valley, Big Boquillas Ranch, and across portions of the Hualapai Indian Reservation. A movement corridor for pronghorn exists on the Truxton Plain. Elk also are present on the Hualapai Indian Reservation. Desert bighorn sheep and mountain lions inhabit the Black Mountains (Link 2060) and lambing grounds are located in the Fire Mountain complex north of the alternative route.

Special Status Species—Locations of Tusayan flameflower (Link 1400) and Tusayan rabbitbrush (Link 1660) are known along N1W. Known habitat exists for the Coconino Arizona pocket mouse (Link 1400), a candidate C2 species. The Hualapai Mexican vole, a Federally listed endangered species, is found in the Music Mountains on land administered by BLM, but is not known to be present along the alternative route. The vole may inhabit the adjacent Hualapai Reservation in the vicinity of Link 1790. Black-footed ferrets were reintroduced in the Aubrey Valley, which supports high quality habitat and healthy prairie dog colonies that provide the main prey base for the ferrets. Although the black-footed ferret is a Federally listed endangered species, in this case, the reintroduced population is designated as nonessential and experimental. Alternative N1W crosses the black-footed ferret management area in the existing utility corridor. Peregrine falcons nest in the Grand Wash Cliffs and may occur along the alternative route, although no nest sites have been identified. Arizona toad inhabits Milkweed Canyon on the Hualapai Indian Reservation (Link 1790). The Sonoran population of desert tortoise, a Federal candidate C2 species, is found throughout uplands in the Mohave Desert (Link 2060). The chuckwalla and banded Gila monster, both C2 species, are known to inhabit rocky areas in Mohave desertscrub.

The Colorado River supports a diverse fisheries population (Link 2060) and is designated critical habitat for two listed species, the Colorado squawfish and razorback sucker.

Potential habitat exists west of Moenkopi for several other candidate species including Welsh phacelia, Cameron water-parsley, Fickeisen plains cactus, and Roaring Springs prickly poppy. Suitable habitat exists for the Coconino Arizona pocket mouse west of Cameron (Link 1400). Swainson's and ferruginous hawks are known to nest in the Hualapai Valley (Links 1790 and 2060); although no nest sites have been identified along the alternative route. Northern goshawk may winter in piñon-juniper woodlands. The riparian habitat associated with the river supports wintering populations of bald eagles. Peregrine falcons use the cliffs in the vicinity of the river, but primarily on the Nevada side.

Nevada

Vegetation—This portion of N1W is characterized by Mohave desertscrub (Links 2060, 2200, and 2180) with the exception of a narrow riparian strip along the Colorado River.

Wildlife—Bighorn sheep inhabit the Eldorado Mountains along the alternative route (Link 2060); Aztec Spring provides a water source. Reptiles are prevalent throughout the desert habitat and include Gila monsters, chuckwalla, and several species of lizards and snakes.

Special Status Species—The Mojave population of the desert tortoise, a Federally listed threatened species, is known to inhabit the Mohave desert of southern Nevada. N1W traverses designated critical habitat for the Mojave population of desert tortoise. The Colorado River supports a diverse fisheries population (Link 2060) and is designated critical habitat for two listed species, the Colorado squawfish and razorback sucker.

There is a high potential for two Federal candidate C2 plant species, the rosy and twotone beardtongues, to be present along the gravelly, dry washes throughout the Eldorado Valley (Links 2180 and 2200). However, there are no known locations of these two subspecies along N1W. Riparian habitat associated with the river supports wintering populations of bald eagles. Peregrine falcons use cliffs in the vicinity of the river.

Northern 2 (N2)

Arizona

The Arizona portion of N2 is the same as N1W with the exception of Links 1742, 1800, 1980, and 2020, which are located to the south of the Hualapai Indian Reservation (and replace Link 1790 on N1W).

Vegetation—Vegetation along this segment of N2 is dominated by Great Basin/Plains grasslands and piñon-juniper woodlands to the east (Links 1742, 1800, and 1980), and Mohave desertscrub to the west (Link 2020).

Wildlife—Big game species of Great Basin/Plains grasslands include mule deer and pronghorn. Pronghorn inhabit the Truxton Plains area (Link 1980). Elk are present on the Hualapai Reservation, north of this alternative route.

Special Status Species—Several special status wildlife species are present along this alternative. Swainson's and ferruginous hawks are known to nest in the Hualapai Valley (Link 2020), although no nest sites have been identified within the one-mile-wide inventory corridor. Peregrine falcons are known to nest in the Grand Wash Cliffs (Link 1980) and may be present near the area crossed by N2. N2 crosses the black-footed ferret management area in the Aubrey Valley (Links 1740, 1741, and 1742).

Special status plant species that have the potential to exist along this alternative are the same as those discussed for N1W. One additional Federal candidate C2 species, the freckled milkvetch, is present in the area and may be present along Link 1980. Special status raptor species, including the northern goshawk, could be present in piñon-juniper woodlands scattered along the alternative route (Links 1742, 1800, and 1980).

Nevada

The Nevada portion of N2 is the same as N1W.

Southern (S2)

In Arizona, S2 varies from N2 beginning at the Moenkopi Substation and continuing west through Link 2006. At this point, S2 is then the same as N2 proceeding north and west along Links 2020 and 2060 to the crossing of the Colorado River and the Nevada border.

Arizona

Vegetation—The vegetation traversed by this segment of S2 is characterized by a mosaic of Great Basin/Plains grasslands and piñon-juniper woodlands (Links 1420, 1421, 1480, 1520, 1640, 1680, 1720, 1960, and 2006), piñon-juniper woodlands in the vicinity of Hackberry (Links 2000 and 2002), and a relatively short distance of sand dune scrub/bare sand (Link 2006). Similar to N1W and N2, this alternative crosses a small area of riparian vegetation along the Colorado River.

Wildlife—Big game present along this segment of S2 are characteristic of grassland and piñon-juniper woodland habitats. Mule deer are common in the more hilly eastern portion (Links 1640, 1680, and 1720), while pronghorn tend to inhabit grasslands in valleys (Links 1960, 2000, and 2020).

Special Status Species—No populations of listed endangered or threatened plant species are known along S2, although populations of Tusayan rabbitbrush, a Federal candidate C2 species, are present (Links 1640 and 1680). Peregrine falcons nest in the Cottonwood Cliffs (Link 2000), and Swainson's hawks nest in the Hualapai Valley (Link 2006).

Habitat suitable for several Federal candidate (C1 and C2) plant species exists, including Welsh phacelia (Link 1420), Cameron water-parsley (Link 1420), Fickeisen plains cactus (Link 1420), Tusayan flameflower (Links 1480, 1520, 1680, 1960, and 2000), Roaring Springs prickly poppy (Links 1720 and 2000), and freckled milkvetch (Link 2000). The Coconino Arizona pocket mouse may be present along S2 in the vicinity of the Moenkopi Substation (Link 1420). Northern goshawk may winter in the piñon-juniper woodlands.

Nevada

The Nevada portion of S2 is the same as N1W and N2.

Western Area Transmission Line Alternatives - Moenkopi to Mead

Northern 3 (N3), Northern 4 (N4), and Southern 4 (S4)

Alternatives N3, N4, and S4 are identical to alternatives N1W, N2, and S2, respectively, with the exception of Links 2040 and 2080, which connect into the Mead Substation rather than the Marketplace Substation (replacing Links 2060, 2200, and 2180). The following description focuses on Links 2040 and 2080.

Arizona

Vegetation—Vegetation along this segment from the Hualapai Valley west to the Colorado River (Link 2040) consists of Mohave desertscrub with several small areas of riparian vegetation associated with ephemeral drainages.

Wildlife—Desert bighorn sheep inhabit the Black Mountains (Link 2040), and lambing grounds are present along this link (Arizona and Nevada) within the Lake Mead NRA.

Special Status Species—Based on surveys within the Lake Mead NRA conducted for other projects concerning desert tortoise (Sonoran population), it appears that numbers of tortoises are denser along Link 2040 than along Link 2060 to the south. Populations of chuckwalla and banded Gila monsters are present in rockier areas.

The Colorado River supports a diverse fisheries population (Link 2040) and is designated critical habitat for two listed species, the Colorado squawfish and razorback sucker. The riparian habitat associated with the river supports wintering populations of bald eagles. Peregrine falcons use the cliffs in the vicinity of the river (primarily on the Nevada side). Swainson's and ferruginous hawks are present in the Hualapai Valley in the vicinity of Link 2040.

Nevada

Vegetation—Links 2040 and Link 2080 are characterized by Mohave desertscrub. Isolated patches of riparian vegetation exist along the Colorado River and may be present where the alternative route crosses the river.

Wildlife—The main big game species in the area is the desert bighorn sheep, which inhabit the Eldorado Mountains. Lambing grounds for bighorn sheep exist within the Lake Mead NRA.

Special Status Species—This alternative route traverses designated critical habitat for the Mojave population of the desert tortoise, a Federally listed threatened species present throughout the Mohave Desert of southern Nevada.

There is a high potential for two Federal candidate C2 plant species, the rosy and twotone beardtongues, to be present along the gravelly, dry washes associated with Links 2040 and 2080. However, there are no known specific locations for these two subspecies along these links. Populations of chuckwalla and banded Gila monsters inhabit rockier areas in the vicinity. The riparian habitat associated with the Colorado River (Link 2040) supports wintering populations of bald eagles. Peregrine falcons use the cliffs in the vicinity of the river.

Substation Alternatives

Red Lake Substation Site—The site is characterized by piñon-juniper woodlands and juniper grasslands that support populations of mule deer. No specific or potential locations of special status plants or wildlife are known at this site.

Marketplace and Mead Substations—The areas are characterized by Mohave desertscrub. The habitat is degraded because of existing facilities.

Microwave Communication Facility

The peak of Bill Williams Mountain is more than 9,000 feet in elevation and supports ponderosa pine forests. Big game and raptors may be present in this area. Potential habitat exists for special status plant species including the Arizona leatherflower and Tusayan flameflower.

PALEONTOLOGICAL RESOURCES

The inventory of paleontological resources has been limited to literature and records searches and review of previous field survey reports in parts of the area. No fieldwork was conducted specifically for this project. Scientifically significant fossil resources include the remains of large to small vertebrates, plants, and invertebrates, and the traces or tracks of these organisms. Particularly important are individual organisms or assemblages of plants and animals that are unique, rare, age diagnostic, or stratigraphically important, and that add to existing scientific knowledge of geology or evolutionary biology.

The purpose of the paleontological resources investigation is to identify areas with potential to produce fossils. Guidelines established by members of the paleontologic community and recognized by BLM (Society of Vertebrate Paleontologists 1990) consider fossils to be of significant scientific value if they (1) provide important information regarding the development of biological communities or interactions between botanical and zoological biotas; (2) demonstrate unusual or spectacular circumstances in the history of life; or (3) are in short supply and in danger of being depleted or destroyed by the elements, vandalism, or commercial exploitation. BLM recently adopted guidelines (March 1996) by which lands administered by BLM may be classified and ranked based on their likelihood to contain noteworthy occurrences of fossils.

The inventory of paleontological resources is reported by specific geologic deposits and the known potential of those deposits to yield scientifically important or significant fossils. For NTP, three levels of potential were used to evaluate paleontology: high, low or none, and unknown. An area of high paleontologic potential will usually only contain a small area of fossil productivity, so only detailed investigation, once a route is selected for construction, could reveal specific areas likely to yield significant fossil resources.

The results of the paleontological resources inventory are summarized below in an overview of the project area that describes fossil types associated with paleontologic ages and the paleontologic potential based on geologic deposits. Following the overview are descriptions of the paleontological resources along each alternative route. Figures MV-6E and MV-6W illustrate the potential for paleontological resources within a one-mile-wide corridor.

OVERVIEW

Paleontological Ages—The inventory documented the presence of diverse vertebrate, invertebrate, and plant fossils of scientific significance in sedimentary deposits of Paleozoic, Mesozoic, and Cenozoic ages underlying the alternative routes in northwestern New Mexico, northern Arizona, and southern Nevada.

Paleozoic Age—The early Paleozoic deposits include worms, sponges, corals, bryozoans, and other invertebrates. During this age Trilobite arthropods were particularly abundant in the oceans, while primitive fish and amphibians gave rise to modern amphibians, reptiles, and land vertebrates.

Mesozoic Age—Also of particular importance are fossils of terrestrial and marine vertebrates, invertebrates, and plants of the Mesozoic age. Deposits of this age are known worldwide for vertebrate fossils that have been the source of much of the body of scientific information about the evolution of life during the Triassic, Jurassic, and Cretaceous periods. The Triassic period was a critical time during the evolution of land vertebrates. It was during this time period that mammals evolved and dinosaurs inhabited the earth. Preserved within some of the deposits traversed by the alternative routes are the fossils of some of these early mammals and the abundant remains of their close therapsid (mammal-like) reptilian ancestors, as well as the well-preserved body fossils and trackways of some of the earliest dinosaurs. During the Jurassic period, dinosaurs gained mastery of the earth, gymnosperm plants continued to dominate the flora, and early birds evolved. The Cretaceous was a period of major changes including the extinction of the dinosaurs at the end of the period.

Cenozoic Age— The Cenozoic age is divided into the Tertiary and Quaternary periods. During the early Tertiary period, there was a rapid diversification of mammals and birds. Primitive mammals were progressively replaced by more advanced lineages. The Quaternary period was a time of climatic changes as glaciers expanded and receded during the Pleistocene. Larger mammalian fauna become dominant in North America.

Paleontologic Potential—Deposits underlying the alternative routes in New Mexico, Arizona, and Nevada include 52 different geologic units. Geologic deposits and their paleontologic potential are summarized by the state in Table 3-3. Twenty-five of these units have been assigned a high paleontologic potential, 13 have been assigned an unknown paleontologic potential, and 14 of the deposits have been assigned a low or no paleontologic potential.

ALTERNATIVES

<u>Eastern Area Transmission Line Alternatives</u>

Glen Canyon 1 (GC1)

<u>New Mexico</u>

GC1 (Links 100, 120, and 460) crosses Cretaceous and Jurassic deposits with a high potential for scientifically important fossils of dinosaurs, mammals, reptiles, fish, plants, and invertebrates.

TABLE 3-3 GEOLOGIC DEPOSITS AND PALEONTOLOGIC POTENTIAL	
High Potential Deposits	
New Mexico	older Quaternary sediments, Fruitland Formation, Pictured Cliffs Sandstone, Lewis Shale, Cliff House Sandstone, Menefee Formation, Crevasse Canyon Formation, Point Lookout Sandstone, Gallup Sandstone, Mancos Shale, Dakota Sandstone, Morrison Formation, Summerville Formation, Todilto Limestone, Wingate Sandstone
Arizona	older Quaternary sediments, Bidahochi Formation, Wepo Formation, Toreva Formation, Mancos Shale, Dakota Sandstone, Morrison Formation, Kayenta Formation, Moenave Formation, Navajo Sandstone, Wingate Sandstone, Chinle Formation, Moenkopi Formation, Kaibab Limestone, Coconino Sandstone
Unknown Potential Deposits	
New Mexico	Quaternary terrace deposits, Chuska Sandstone, Entrada Sandstone
Arizona	Chuska Sandstone, Rose Well-Frazier Well Gravels, Carmel Formation, Cow Springs Sandstone, Entrada Sandstone, De Chelly Sandstone, Toroweap Formation, Supai Formation (Group), Redwall Limestone, Temple Butte Limestone, Tonto Group
Low Potential Deposits	
New Mexico, Arizona, Nevada	recent alluvial, playa lake, and eolian sediments, volcanic deposits of Quaternary and Tertiary age, Precambrian granites and metamorphics

Arizona

GC1 crosses Jurassic, Triassic, and Cretaceous formations, most of which have a high potential for scientifically important paleontologic resources, such as dinosaur tracks, fossils of reptiles, turtles, dinosaurs, crocodiles, mammals, and fish. Known sites near the reference centerline are located in Tsegi Canyon, near Cameron, and near the Copper Mine Trading Post. Remains of invertebrate and vertebrate fossils have been found in the Mancos Shale at sites adjacent to Link 561. Links 1383 and 1384 cross the Chinle Formation, which is one of the major sources of Late Triassic vertebrate fossils in the western hemisphere. Early horse and mammoth remains have been found near Cameron (Link 1386).

Kaibito 1 (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1). The paleontological resources of K1 in this area are similar to the segment of GC1 to the north, consisting of high and unknown potential.

Central 1 (C1)

New Mexico

C1 crosses Cretaceous and Jurassic deposits with a predominantly high potential for scientifically important paleontological resources (Links 180, 240, 300, 360, and 640). Fossil remains of various dinosaurs, reptiles, mammals, fish, plants, and invertebrates are common in these formations.

Arizona

C1 crosses many formations with a high potential for important paleontological resources. Link 700 would cross Jurassic and Triassic formations including the Chinle Formation, one of the major sources of Late Triassic vertebrate fossils in the western hemisphere. Link 701 crosses Triassic deposits with fossil footprints and bone fragments. Link 780 crosses formations with high potential for fossils of reptiles, fish, dinosaurs (including dinosaur tracks), birds, crocodiles, mammals, plants, and invertebrates. There is a known fossil location in the Mancos Shale along Link 780. In the vicinity of Link 780, there are also 13 localities recorded by the Museum of Northern Arizona (MNA) on the flanks of Howell Mesa (south of Milepost 62), 2 MNA localities along Adeii Eechii Cliffs, and 2 MNA localities of early horse and mammoth remains near Cameron.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains along Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1. This portion of C2 crosses many formations with a predominantly high potential for scientifically important paleontological resources. Links 460 and 462 cross Jurassic and Triassic formations with high potential for fossils of dinosaurs (and dinosaur footprints), mammal-like reptiles, mammals, crocodiles, reptiles, fish, and invertebrates.

Substation Alternatives

Shiprock Substation—The site is located in an area underlain by potentially fossiliferous sediments of the Cretaceous Pictured Cliffs Sandstone, which has a high potential for fish, turtle, crocodile, plesiosaur, ornithischian (bird-hipped) and saurischian (lizard-hipped) dinosaurs, and mammals.

Honey Draw Substation Site—The area is underlain by Jurassic deposits of the Carmel Formation and Navajo Sandstone. The potential for fossils in the Carmel Formation is unknown. The potential for fossils in the Navajo Sandstone is high (dinosaur tracks and partial remains of dinosaurs have been found in Navajo Sandstone).

Red Mesa Substation Site—This area is underlain by Quaternary alluvial and eolian sediments overlying Triassic-Jurassic deposits of the Carmel Sandstone. The potential for important resources is unknown.

Copper Mine Substation Site—This area is underlain by Quaternary alluvial and eolian sediments overlying Triassic-Jurassic deposits of the Navajo Sandstone. Dinosaur tracks and partial remains of dinosaurs are known to exist in Navajo Sandstone and a known location is near the Copper Mine Trading Post approximately nine miles northeast of the substation site. Because these important paleontological resources exist in Navajo Sandstone, there is a high potential for fossils at this site.

Moenkopi Substation—The area is underlain by Triassic deposits of the Shinarump Member of the Chinle Formation, which has a high potential for paleontologic resources. The Chinle is one of the major sources of Late Triassic vertebrate fossils in the western hemisphere. Known fossil localities in this formation are southwest of Cameron.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace

Northern 1 West (N1W)

Arizona

N1W crosses the Shinarump Member of the Chinle Formation, Kaibab Limestone, and Coconino Sandstone with high potential for fossil vertebrates and invertebrates (Links 1400, 1401, and 1660). There are also broad areas of Quaternary alluvium and volcanics with low or no potential for fossil resources. From the Aubrey Valley westward, the N1W crosses Quaternary alluvium and various other formations with predominantly low or no potential. The potential for fossils in the Permian, Pennsylvanian, and Mississippian formations along Link 1790 is unknown, but in this case, the potential is probably high.

Nevada

At the Colorado River crossing, the older alluvial deposits have an unknown (but probably high) potential for scientifically important fossils (Link 2060). The remaining Nevada portion of N1W crosses nonfossiliferous Tertiary volcanic rocks and Precambrian metamorphic rocks as well as Quaternary alluvial and eolian deposits with low potential (Links 2200 and 2180).

Northern 2 (N2)

Arizona

The Arizona portion of N2 is the same as N1W with the exception of Links 1742, 1800, 1980, and 2020, which are located to the south of the Hualapai Indian Reservation and replace Link 1790 on N1W. Paleontological resources along this segment of N2 are similar to those along Link 1790 on N1W.

Nevada

The Nevada portion of N2 is the same as N1W.

Southern 2 (S2)

Arizona

In Arizona, S2 varies from N2 beginning at the Moenkopi Substation and continuing west through Link 2006. At this point, S2 is then the same as N2 proceeding north and west along Links 2020 and 2060 to the crossing of the Colorado River and the Nevada border. This segment of S2 crosses the Shinarump Member of the Chinle Formation and Kaibab Limestone with a high potential for vertebrate and invertebrate fossils. There are also broad areas of Quaternary alluvium and volcanic rocks with low or no potential for fossil resources. There are four MNA sites in the Kaibab Limestone near Gray Mountain (Link 1420). The central portion of this alternative crosses volcanics with low or no potential and Kaibab Limestone with a high potential for fossil fish and invertebrates. From the Cottonwood Cliffs westward, this alternative crosses Quaternary alluvium and various other formations with low or no potential. The Permian, Pennsylvanian, and Mississippian formations along Links 1720 and 1960 have an unknown, but in this case, probably high potential.

Nevada

The Nevada portion of S2 is the same as N1W and N2.

Western Area Transmission Line Alternatives - Moenkopi to Mead

Northern 3 (N3), Northern 4 (N4), and Southern 4 (S4)

Alternatives N3, N4, and S4 are identical to alternatives N1W, N2, and S2, respectively, with the exception of Links 2040 and 2080, which connect into the Mead Substation rather than the Marketplace Substation (replacing Links 2060, 2200, and 2180). The following description focuses on Links 2040 and 2080.

Arizona and Nevada

At the Colorado River crossing, the older alluvial deposits have an unknown (but probably high) potential for scientifically important fossils (Link 2040). In Nevada, Links 2040 and 2080 cross nonfossiliferous Tertiary volcanic rocks and Precambrian metamorphic rocks, as well as Quaternary alluvial and colian deposits with low potential.

Substation Alternatives

Red Lake Substation Site—This site is located in an area that generally consists of Quaternary basalt overlying Kaibab Limestone. The Quaternary basalt has low or no potential for fossils, while the Kaibab Limestone has a high potential for vertebrate and invertebrate fossil resources.

Marketplace Substation and Mead Substation—Both sites are located in an area of Quaternary alluvium and eolian deposits. The potential for fossil resources is low.

Microwave Communication Facility

There is no potential for fossil resources at this location.

LAND USE

The land use inventory for the alternative routes includes descriptions of (1) linear features; (2) land jurisdiction; (3) existing land uses; (4) future land uses; and (5) parks, preservation, and recreation areas. Land uses were inventoried within a six-mile-wide study corridor (three miles on each side of the alternative route reference centerline) to identify land uses that could be affected both directly and indirectly by project construction and operation. The results of the land use inventory focus on areas within 500 feet of the alternative routes. The overview section below introduces each component of the land use inventory and is followed by descriptions of land uses for each alternative in the eastern and western areas. Appendix E contains tables that supplement the text.

OVERVIEW

Linear Features—A priority for siting NTP was to use opportunities to parallel existing utility corridors, to be more compatible with the existing land uses (Figures 3-3 and 3-4, Table E-2). Utility corridors in the project area contain facilities such as transmission lines, pipelines, and/or fiber optic cables. Sixty to one-hundred percent of each alternative route is parallel to existing transmission lines.

Where existing transmission lines cross Federally administered lands, the NPS, BLM, and Forest Service have designated them as utility corridors, with one exception. The BLM Farmington District reviews proposed linear facilities on a case-by-case basis. Designated utility corridors on Federal lands are listed in Table E-2. Linear features crossed by NTP alternative routes include major roads, transmission lines, and pipelines.

Jurisdictions—The alternative routes pass through three states and seven counties: New Mexico (San Juan County); Arizona (Apache, Navajo, Coconino, Yavapai, and Mohave counties); and Nevada (Clark County). Incorporated communities within the project area include Page and Seligman, Arizona; and Boulder City, Nevada.

Lands along the alternative routes include those privately owned and those administered by Federal, tribal, or state agencies. Federal agencies that administer lands include BLM, Forest Service, NPS, and the Bureau of Reclamation (BOR). Three American Indian reservations are held in trust by the Federal government on behalf of the Navajo Nation, Hopi Tribe, and Hualapai Tribe, respectively. Also, the Navajo own land (fee simple) off the Navajo Reservation (Big Boquillas Ranch area) and the Hualapai own land off the Hualapai Reservation (Crozier Ranch area). Over the last 100 years, the ownership of certain Navajo and Hopi lands has been under dispute. These areas encompass the lands created by the 1934 boundary bill that defined the borders of the Navajo Reservation. The Bennett Freeze is a statutory restriction, or "freeze," on development in an area in the western portion of the 1934 reservation. The Bennett Freeze does not preclude all development; rather it prohibits development of lands without written consent of both tribes. The four alternative routes in the eastern portion of the project area would cross and be affected by the Bennett Freeze and possibly other lands in litigation within the 1934 reservation.

The state of Arizona administers and owns land crossed by NTP alternatives, but no state lands are crossed by the alternative routes in New Mexico and Nevada.

Land jurisdictions within a six-mile-wide corridor for the alternatives are shown on Figures MV-7E and MV-7W, and the amount of each jurisdiction crossed by the alternative routes is shown in Table E-3. The Navajo Nation agencies and chapters are depicted on Figure 3-5, and the amount of each agency and chapter crossed by the alternative routes is provided in Table E-4.

Existing Land Use—Existing land uses include the following major categories—residential, agriculture, timber management, rangeland for grazing, and mining.

Residences (including hogans) are dispersed throughout the project area, but are present in greater concentrations along major transportation routes and where there are reliable sources of water. Mixes of residential, commercial, industrial, and public uses were identified in the communities of Waterflow, Shiprock, and Fruitland in New Mexico; Teec Nos Pos, Red Mesa, Dennehotso, Shonto, The Gap, Lechee, Page, Dinnebito, Lukachukai, Grand Canyon Caverns, Peach Springs, Truxton, Seligman, and Hackberry in Arizona; and Boulder City in Nevada.

The inventory of residences was initially conducted within a six-mile-wide corridor in support of visual resource investigations. Follow-up land use studies were then conducted within a 500-foot-wide corridor for routes adjacent to an existing transmission line, and within a 1,000-foot-wide corridor for new route locations. Figures MV-8E and MV-8W provide a display of residences recorded at the general scale within a six-mile-wide corridor. The 500-foot-wide inventory corridor and the proposed NTP right-of-way provide the basis to determine the potential for both direct and indirect impacts on residences, as discussed in Chapter 4. Inventories are based on the established location for the NTP line, relative to which side of an existing line is paralleled. In general, the alternative routes in the eastern area are adjacent to a far greater number of residences than in the western area. The residences that are adjacent to routes through the Navajo and Hopi reservations are located in proximity to towns and roads as well as along existing transmission lines and access roads available for local travel.

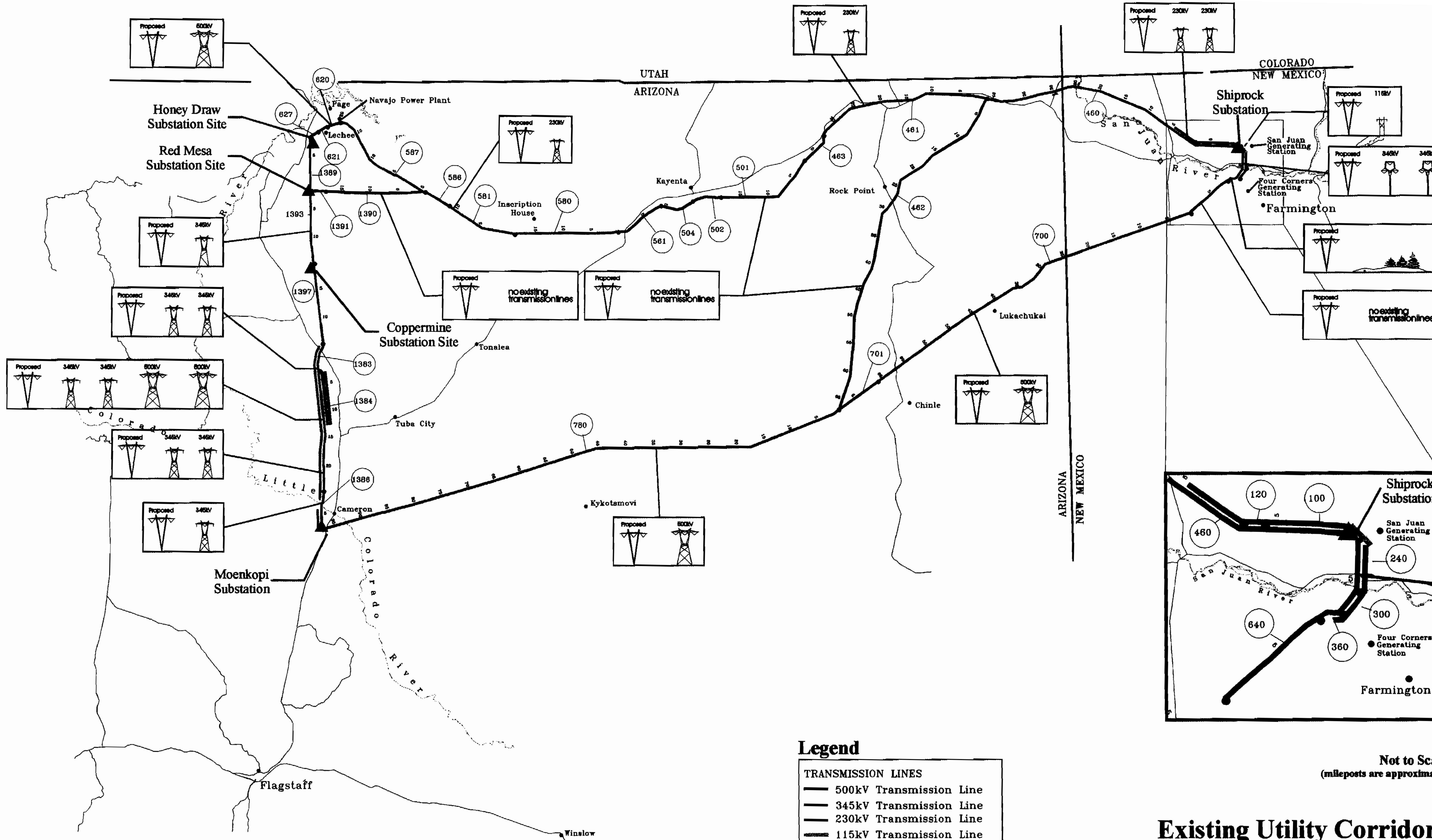
Agricultural crop lands along the alternative routes are typically located in proximity to washes, streams, and rivers. The largest irrigated agricultural area crossed by the alternative routes is in New Mexico near the San Juan River. Another agricultural area is located south of Many Farms in the Chinle Wash. On the Navajo and Hopi lands, settlements and rural residences may have small agricultural fields for personal subsistence. Crops typically grown in the region include alfalfa, corn, and assorted other vegetables. The agricultural inventory along the alternative routes is shown in Figures MV-8E and MV-8W.

Timber management areas for ponderosa pine along the alternative routes are limited to the Chuska Mountains on the Navajo Reservation. Piñon-juniper is managed on the Kaibab National Forest.

Livestock grazing is predominant throughout the project area as shown in Figures MV-8E and MV-8W. Grazing areas and prescribed grazing densities are managed by the BLM, Forest Service, and Arizona State Land Department on their respective lands. Inventories were also conducted for range improvements including fences, water distribution systems, windmills, stock tanks, corrals, and wells. In some areas, sage scrub has been cleared to promote growth of grasses for pasture.

There are a number of large, active mining operations and excavations in the region, primarily in the Arizona portion of the project area (e.g., sand and gravel extraction, large coal mines, and lime mines). All of these active operations would be avoided by the alternative routes. Prior to construction, this inventory would be updated.

Numerous individual, small mining claims are dispersed in areas along the alternative routes but were not researched as a part of the NTP baseline inventory. Prior to construction, BLM would inventory the mining claims along the route to identify and inform the claimants.



Legend

TRANSMISSION LINES
- 500kV Transmission Line
- 345kV Transmission Line
- 230kV Transmission Line
- 115kV Transmission Line

OTHER
- Pipeline
- Fiber Optic Line
- No Existing Utility Lines

Not to Scale
(mileposts are approximate)

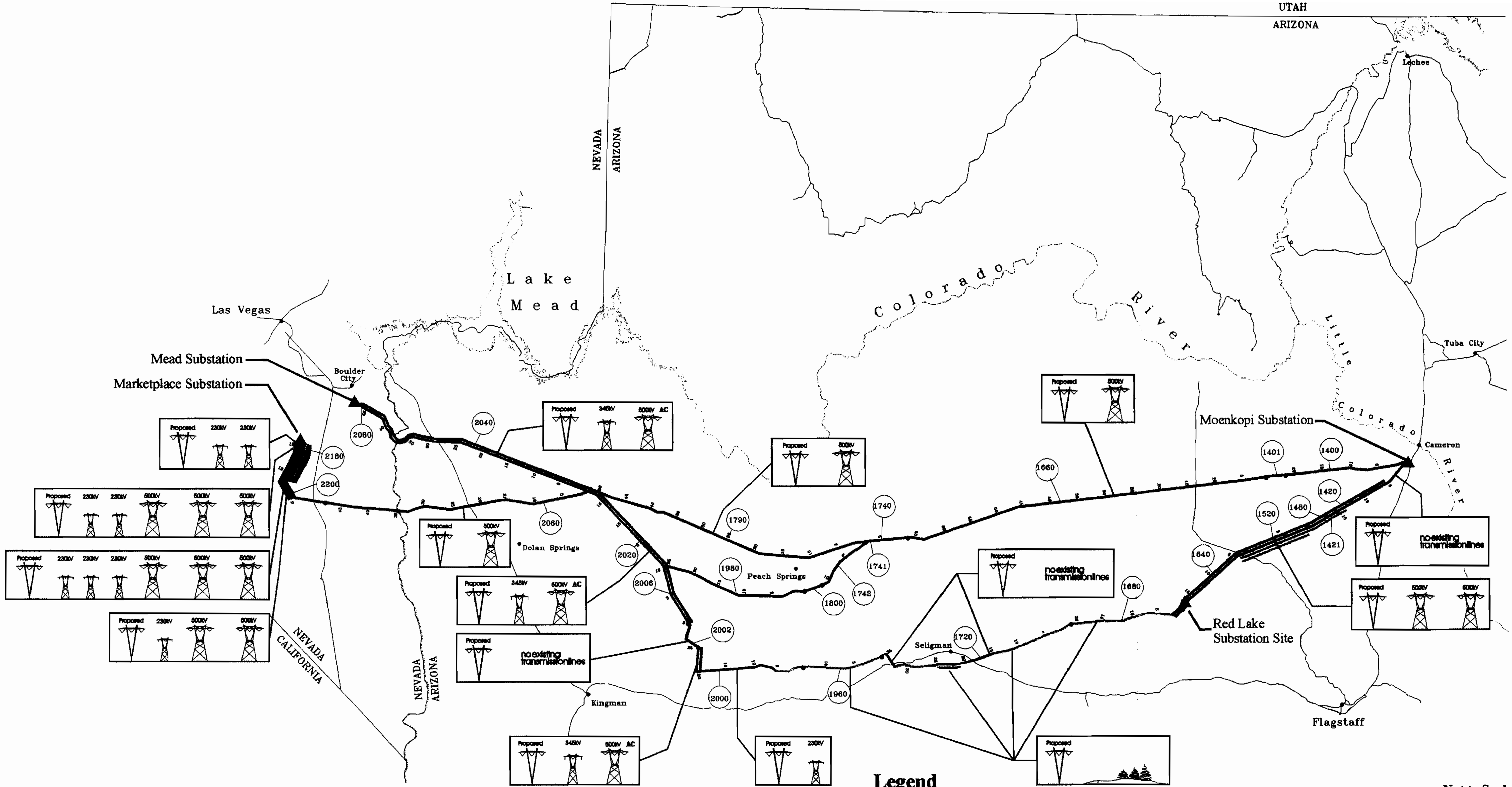
Notes: 1) The figure illustrates only existing utility corridors paralleled by NTP alternative routes.
2) The proposed structure for NTP is V-shaped, guyed, single-pedestal, steel lattice as illustrated in this figure. However, in many locations NTP structures would be constructed to match structures along existing transmission lines to minimize visual impacts.
3) The tower illustrations are schematic and relationships between existing and proposed towers are representative only (particularly in corridors containing multiple lines).

Existing Utility Corridors

Eastern Area

Navajo Transmission Project

Figure 3-3



Legend

TRANSMISSION LINES
- 500kV Transmission Line
- 345kV Transmission Line
- 230kV Transmission Line
- 115kV Transmission Line

OTHER
- Pipeline
- Fiber Optic Line
- No Existing Utility Lines

Not to Scale
(mileposts are approximate)

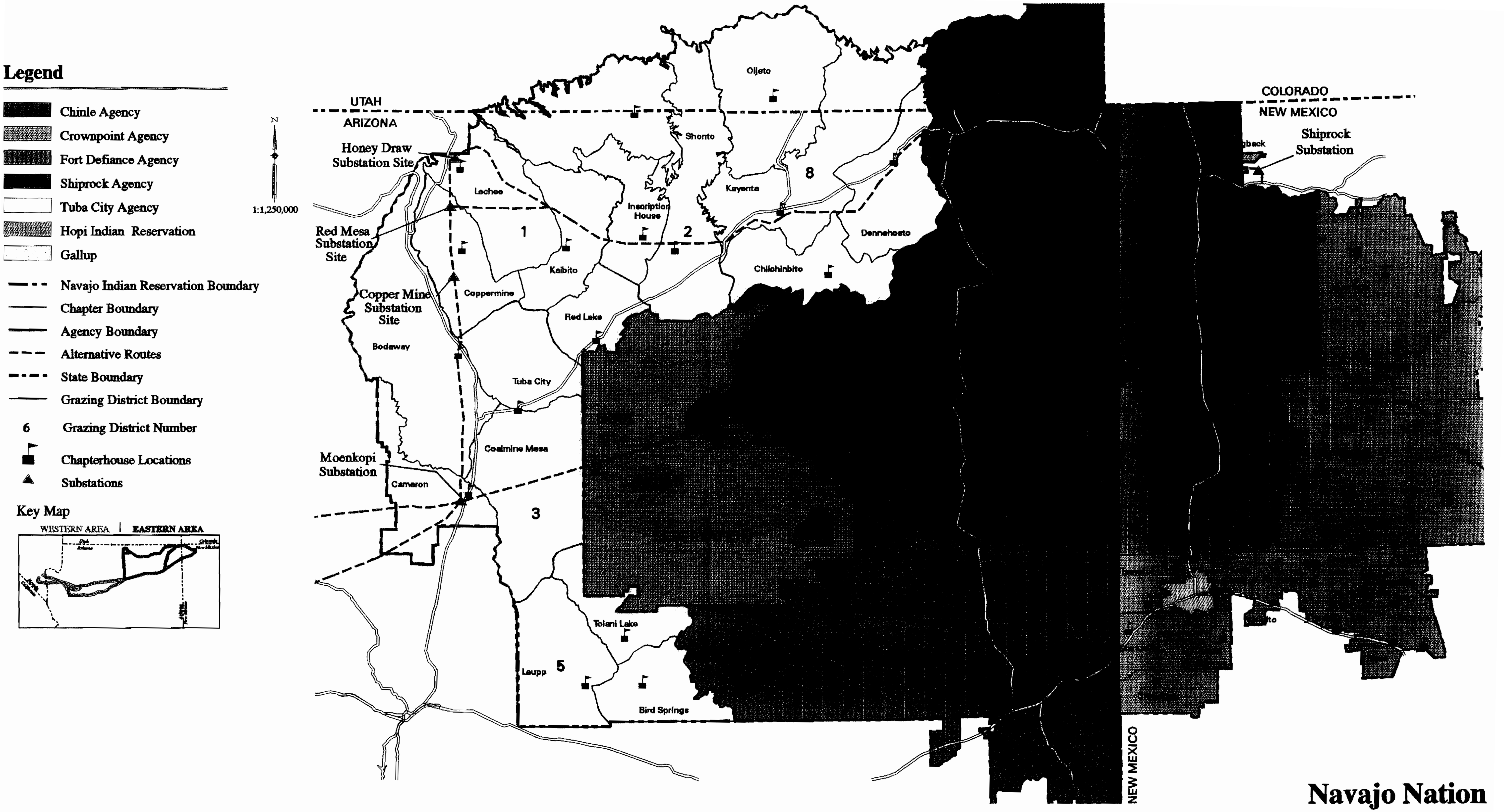
Notes: 1) The figure illustrates only existing utility corridors paralleled by NTP alternative routes.
2) The proposed structure for NTP is V-shaped, guyed, single-pedestal, steel lattice as illustrated in this figure. However, in many locations NTP structures would be constructed to match structures along existing transmission lines to minimize visual impacts.
3) The tower illustrations are schematic and relationships between existing and proposed towers are representative only (particularly in corridors containing multiple lines).

Existing Utility Corridors

Western Area

Navajo Transmission Project

Figure 3-4



Navajo Nation Chapters, Agencies, and Grazing Districts

Navajo Transmission Project
Figure 3-5

Future Land Use—The intent of the future land use component was to inventory planned and proposed land uses and provide a general representation of how future development may occur. Future uses were identified where available from (1) projected uses documented in general and comprehensive plans; (2) recorded, specific development plans; and (3) zoning. Generally, the Federal agency management plans and community plans indicate that the agencies and communities will continue to manage their respective areas primarily for the rural, open space character, allowing for compatible uses.

Parks, Preservation, and Recreation—Recreational uses along the alternative routes include one national recreation area (Lake Mead NRA), two BLM ACECs (The Hogback and Black Mountain), a limited number of developed recreation facilities (e.g., campgrounds, trails, picnic areas), and areas of dispersed recreation (e.g., hiking, off-road vehicle activities), as shown on Figures MV-9E and MV-9W.

ALTERNATIVES

The results of the land use inventory are summarized below for each alternative route, substation, and the communication site. Figures MV-7E through MV-9W illustrate land uses within a six-mile-wide corridor. The tables in Appendix E provide supplemental information.

Eastern Area Transmission Line Alternatives

Glen Canyon 1 (GC1)

New Mexico

Linear Features—GC1 parallels Western's existing Shiprock-to-Glen Canyon 230kV transmission line west from the Shiprock Substation for the entire distance along Links 100, 120, and 460. GC1 crosses two pipelines and one transmission line, as well as two Tribal Routes and U.S. Highway 666.

Land Jurisdiction—BLM land (3.6 miles) and Navajo Nation land (31.3 miles) is crossed by GC1. On the Navajo Nation, GC1 crosses portions of The Hogback, Shiprock, Cudei, Beclahbito, and Teec Nos Pos chapters within the Shiprock Agency.

Existing Land Use—There are no residences within 500 feet of the reference centerline of GC1 in New Mexico, and agricultural lands along the San Juan River near Waterflow are avoided. Grazing is the dominant land use on Navajo lands.

Parks, Preservation, and Recreation—GC1 (Link 100) would cross approximately 3.6 miles of The Hogback ACEC, an area designated to protect and preserve unique and rare plant species.

Arizona

Linear Features—GC1 continues to parallel Western's Shiprock-to-Glen Canyon 230kV line along Links 460, 461, 580, 581, 586, and 587. A new corridor would be established in the Marsh Pass area (Links 463, 501, 502, 504, and 561) in order to avoid Monument Valley Tribal Park. West of the Navajo Generating Station, GC1 parallels Nevada Power Company's 500kV line along Link 620. Links 621 and 627 would require a new corridor across the city of Page and in the Lechee area. The remainder of GC1 parallels Western's two Glen Canyon-to-Pinnacle Peak 345kV lines to the Moenkopi Substation along Links 1389, 1393, 1397, 1383, 1384, and 1386.

Major transportation routes are crossed 16 times (seven U.S. highway crossings, three state highway crossings, and six tribal route crossings). In addition, there are two crossings of pipelines and four crossings of high-voltage transmission lines.

Land Jurisdiction—GC1 crosses the Navajo Nation for 223.8 miles in Arizona, including portions of the Teec Nos Pos, Red Mesa, and Mexican Water chapters within the Shiprock Agency; and the Dennehotso, Kayenta, Chilchinbito, Shonto, Inscription House, Kaibito, Lechee, Copper Mine, Tuba City, Bodaway, and Cameron chapters within the Tuba City Agency. Private and municipally owned lands are located within the Page city limits.

Existing Land Use—There is a dispersed pattern of approximately 21 residences within 500 feet of GC1. Residences in proximity to GC1 are along existing transmission lines (Links 461, 580, 581, 587, 1389, 1393, and 1397); roads, including U.S. 160 (Link 461), Tribal Route 22a and State Route 564 (Link 580), and State Route 98 (Link 587); near towns including Red Mesa and Mexican Water (Link 461), Dennehotso (Link 463), Shonto (Link 580), and The Gap (Link 1383). Other towns that are near GC1 include Teec Nos Pos (south of Link 460), Kayenta (north of Links 502 and 504), Tsegi (north of Link 561), Lechee (south of Link 621), Copper Mine (east of 1393), and Cameron (east of Link 1386).

Future Land Use—The city of Page has lands designated for industrial and open space uses along Links 620 and 621. The Dennehotso Chapter has identified plans for a potential housing development across from the chapter house in Dennehotso, and the Teec Nos Pos Community Planning Area recommends mixed use development in the area of Link 460 where a small commercial tourist-related facility has been proposed.

Parks, Preservation, and Recreation—Commercial recreational sites within approximately 0.5 mile of Link 621 include a shooting range operated by the Page Gun Club within the Page city limits, and a facility for radio-controlled airplanes adjacent to the shooting range. The Great Western Trail, a multiple-use recreational trail proposed to extend from Canada to Mexico, is crossed by Link 1397 north of The Gap. The Shonto rodeo arena, located north of town, is adjacent to GC1 along Link 580.

Kaibito 1 (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1).

Linear Features—A new transmission line corridor would be established along Links 1390 and 1391. In this area, similar to GC1, there is one crossing of State Route 98 and Tribal Route 20, and crossings of three high-voltage transmission lines (Links 1390 and 1391). In contrast to the GC1 route, K1 avoids crossing these high-voltage lines and roads near the city of Page.

Land Jurisdiction—This segment of K1 crosses the Navajo Reservation for the entire length. Navajo agencies and chapters crossed along this alternative are the same as GC1.

Existing Land Use—Few residences are dispersed along Links 1390 and 1391 across the Kaibito Plateau, and none were identified within approximately 500 feet of the reference centerline. The dominant existing land use along Links 1390 and 1391 is grazing.

Parks, Preservation, and Recreation—No parks, preservation, or recreational uses were identified along this segment of K1.

Central 1 (C1)

New Mexico

Linear Features—C1 parallels two TEP 345kV lines along Links 240, 300, and a portion of 360, and an APS 500kV transmission line along Link 700. Two U.S. highways, one tribal route, and five pipelines are crossed.

Land Jurisdiction—Lands surrounding and south of the Shiprock Substation are administered by BLM, where 2.1 miles are crossed by Links 180 and 240. Privately owned lands are located along Link 240 (1.7 miles) north of the San Juan River crossing. The remainder of the alternative in New Mexico is on the Navajo Reservation (36.4 miles). Within the Shiprock Agency, the San Juan, Nenahnezad, Sanostee, Shiprock, Red Valley, and Cove chapters are crossed.

Existing Land Use—Existing land uses include residential, agricultural, and rangeland for grazing. Seven residences are found in an area along Link 240 near the San Juan River, and seven residences are dispersed along Link 700 east of the Chuska Mountains within the 500-foot-wide corridor. Oil wells are also located within the vicinity of the alternative route near The Hogback.

Parks, Preservation, and Recreation—C1 crosses The Hogback ACEC, which is designated to protect unique and rare plant species that are listed as threatened and endangered (Links 180 and 240).

Arizona

Linear Features—C1 parallels an APS 500kV transmission line for the entire length of the alternative along Links 700, 701 and 780 into the Moenkopi Substation. There are a total of 12 crossings of major transportation routes. Link 700 crosses one U.S. highway and two tribal routes. Link 780 crosses one U.S. highway, one state highway, and tribal routes seven times. In addition, Link 780 crosses two pipelines and one high-voltage transmission line.

Land Jurisdiction—The Navajo Nation is crossed along Links 700, 701, and 780 (114.3 miles), and Hopi lands would be crossed along Link 780 (33.1 miles). This alternative would cross the Red Valley and Cove chapters of the Shiprock Agency; the Round Rock, Lukachukai, Many Farms, Chinle, Tselani/Cottonwood, Tachee/Blue Gap, Whippoorwill Spring, Piñon, and Hard Rocks chapters of the Chinle Agency; and the Coalmine Mesa and Cameron chapters of the Tuba City Agency of the Navajo Nation.

Existing Land Use—Land uses include residential, agricultural, timber management, rangeland for grazing, and industrial. The dominant use is livestock grazing. Eighteen residences are located along the alternative. Heavier residential concentrations within the six-mile-wide study corridor are located on the western side of the Chuska Mountains near the community of Lukachukai (Link 700); along U.S. 191 between Many Farms and Chinle (Link 700); in the Burnt Corn Valley (Link 780); along Tribal Route 4 (Link 780); and near Hard Rocks and Dinnebito (Link 780). On American Indian lands, Navajo and Hopi settlements and rural residences typically have small agricultural fields maintained for personal subsistence. Industrial uses include oil production (wells) in and near the Chuska Mountains, and uses associated with agriculture.

Link 700 crosses timber management areas (Navajo Compartments 32 and 33) in the Chuska Mountains for a distance of about seven miles in an existing transmission line corridor. Harvestable ponderosa pine is found for a distance of approximately 2.1 miles along C1 in this area. Although currently inactive, commercial logging has taken place in the Chuska Mountains, and areas have been cleared for development by oil extraction facilities and the existing APS transmission line.

East of Cameron near the crossing of the Little Colorado River (Link 780), there are some excavations that are reported to be reclaimed uranium mines, portions of which may be located within the right-of-way.

Future Land Use—No planned or proposed uses were identified along C1 on the Navajo Nation. The Hopi Comprehensive Development Plan, adopted in 1988, identifies one community development near C1 in the vicinity of Hard Rocks. This development is called the Turquoise Community Development and is under construction outside the right-of-way of C1 (Link 780). The Hopi development plan also indicates that future use along the alternative (Link 780) is designated for livestock grazing and commercial development near Arizona State Route 264.

Parks, Preservation, and Recreation—The Great Western Trail would be crossed by Link 780.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains along Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1.

Linear Features—With the use of Link 462 across Carson Mesa and through the Chinle Valley, a new transmission corridor would be established. Along the Arizona portion of Link 460, C2 parallels Western's Shiprock-to-Glen Canyon 230kV line. Along Links 460 and 462 there are five crossings of major transportation routes (three U.S. highways and two tribal routes).

Land Jurisdiction—The Arizona portion of C2 crosses the Navajo Nation along Links 460 and 462. Link 460 and Link 462 cross the Teec Nos Pos, Sweetwater, and Rock Point chapters of the Shiprock Agency and the Rouch Rock Chapter of the Chinle Agency.

Existing Land Use—Existing land uses include residential and grazing along the western portion of Links 460 and Link 462. One residence was identified along the western portion of Link 460 within 500 feet. A total of 10 residences were identified with 500 feet for the entire C2 route. Grazing is the dominant use.

Future Land Use—The only other planned or proposed land use identified was in the area of Teec Nos Pos. The Teec Nos Pos Community Planning Area recommends mixed use development in the area of Link 460; a small commercial tourist-related facility has been proposed.

Substation Alternatives

Shiprock Substation—The existing Shiprock Substation is owned by Western and is surrounded by land administered by BLM. The use at the substation is industrial, associated with operation and maintenance of the transmission lines. The substation is surrounded by The Hogback ACEC, designated to protect unique and rare plant species. Use in the immediate vicinity of the substation is grazing. No other uses exist or are planned in proximity to the substation.

Honey Draw Substation Site—This site is located on the Navajo Nation, south of Page, within the boundaries of the Lechee Chapter in an area known as Honey Draw. The only existing or planned land use in the area is grazing.

Red Mesa Substation Site—This site is located approximately 10 miles south of Page along Link 1389. The site falls within the boundaries of the Copper Mine Chapter and is approximately six miles northwest of the community of Copper Mine. The predominant land use in the area of the site is grazing. No other existing or planned land uses were identified in the immediate vicinity.

Copper Mine Substation Site—The site is located approximately 25 miles south of Page along Link 1393, just north of the Bennett Freeze area. The site falls within the boundaries of the Copper Mine Chapter. The primary land use in the area is grazing, with scattered residences in the vicinity.

Moenkopi Substation—The site is located near the existing Moenkopi Substation on the Navajo Nation. The use is industrial, associated with the operation and maintenance of transmission lines, and the land use in the area of the site is grazing. No other existing or planned land uses were identified in the immediate vicinity of the substation site.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace

Northern 1 West (N1W)

Arizona

Linear Features—N1W parallels an APS 500kV transmission line along the entire route in Arizona. There are 12 crossings of major transportation routes. Link 1660 crosses one U.S./State highway and one county road (twice). Link 1790 crosses county roads or tribal routes six times. The eastern portion of Link 2060 crosses two county roads and one U.S. highway. In addition, two high-voltage transmission lines are crossed along the eastern portion of Link 2060.

Land Jurisdiction—Along the Arizona portion of N1W, land jurisdictions include Federal, state, Navajo Nation, Hualapai Tribe, and private. West of the Moenkopi Substation area, the Cameron Chapter of the Tuba City Agency of the Navajo Nation is crossed by Link 1400. The Kaibab National Forest is crossed for about 19.1 miles on Links 1400, 1401, and 1660. Mixed state and private land is crossed by Links 1660, 1740, and 1741. Some of the private land is an area known as the Big Boquillas Ranch, much of which is owned by the Navajo Nation, and adjacent state lands are leased to the Navajo Nation. Hualapai lands are crossed by Link 1790 (35.1 miles). West of the Hualapai lands, the majority of land along Link 1790 is administered by BLM. Along Link 2060, jurisdiction includes mixed (checkerboard) BLM and private lands, and lands administered by the NPS at the Lake Mead NRA. The BLM Kingman Resource Area Draft Resource Management Plan (1993) includes a list of lands proposed for disposal northeast of Dolan Springs (Link 2020).

Existing Land Use—N1W parallels an existing transmission line, which is a designated utility corridor across the Federally administered lands. No residential uses were identified within approximately 500 feet of N1W. The only residential concentration near N1W is on the subdivided land south of Link 2060 and northeast of Dolan Springs. The dominant land use is livestock grazing. The land-managing agencies (Forest Service, BLM, and Hualapai Tribe) have divided rangelands in the region into grazing allotments to facilitate the management of the land for livestock grazing. Much of the private land and state trust lands are also open range. An airstrip was identified approximately 0.5 mile south of Link 1790, near Frazier Well Road. Within the Kaibab National Forest, the majority of lands crossed consist of piñon-juniper woodlands, which are not suitable for harvest.

Future Land Use—No planned or proposed land uses were identified in the immediate vicinity of N1W. In Coconino County, lands along N1W are zoned for rural residential or agricultural residential, but no plans for development were identified. In Mohave County, Link 2060 crosses or is adjacent to private subdivided lands (near Dolan Springs, Lake Mohave Ranchos, and Keno Ranches), but there are no specific plans for development.

Parks, Preservation, and Recreation—A number of areas, either preservation or recreation, are crossed by the Arizona portion of N1W in the existing utility corridor. On lands administered by the Forest Service, N1W (Link 1400) crosses areas classified as "semi-primitive non-motorized," areas characterized by predominantly unmodified natural environment with no motorized use allowed. Also, the Arizona Trail is crossed on the Kaibab National Forest by Link 1401. BLM's Black Mountain ACEC, located northwest of Kingman, is crossed by Link 2060 for approximately three miles. BLM is proposing 219,428 acres for the ACEC, which provides habitat for special status wildlife and plants, contains prehistoric and historic cultural resources, and offers recreation activities such as hunting, camping, picnicking, and nature viewing. The Grand Canyon Railroad, carrying tourists from Williams to the Grand Canyon, is crossed by N1W along Link 1660. Link 1790 crosses the proposed Music Mountains Crest Trail. Link 2060 to the west crosses the Lake Mead NRA for about 6.5 miles. The NRA offers land and water recreation activities; however, the most popular recreation uses in the area of N1W are water sports (e.g., boating, fishing, swimming, water skiing).

Nevada

Linear Features—N1W parallels the APS 500kV line along Link 2060 and a portion of Link 2200. As Link 2200 approaches the Marketplace Substation in the Eldorado Valley, two additional 500kV lines and three 230kV lines are paralleled until their termination point at Marketplace. One U.S. highway, three high-voltage transmission lines, and one fiber optic cable is crossed.

Land Jurisdiction—The Nevada portion of N1W crosses primarily three jurisdictions—NPS, BOR, and BLM. Link 2060 crosses NPS-administered Lake Mead NRA for about 4.4 miles, 0.4 mile of which is land that was withdrawn by BOR for purposes of power-facilities development.

Existing Land Use—N1W parallels an existing transmission line, which is in a designated utility corridor. The primary land use is livestock grazing on BLM-administered land. Residences were not identified within approximately 500 feet of the reference centerline of alternative N1W.

Future Land Use—No planned or proposed land uses were identified along N1W.

Parks, Preservation, and Recreation—Link 2200 crosses the Eldorado Valley Transfer Area, which Boulder City plans to use for recreation, open space, a desert tortoise preserve, and a solar-power peaking station. Parks, preservation, and recreation areas in the vicinity of this route include the Lake Mead NRA (Link 2060). The BLM Ireteba Peaks Wilderness Study Area (WSA) is located adjacent to and south of Link 2060 in Clark County.

Northern 2 (N2)

Arizona

The Arizona portion of N2 is the same as N1W with the exception of Links 1742, 1800, 1980, and 2020, which are located to the south of the Hualapai Indian Reservation (and replace Link 1790 on N1W).

Linear Features—Links 1742, 1800, and 1980 are not in an existing utility corridor. Link 2020 parallels existing 345kV and 500kV lines. In this area N2 crosses a total of three major transportation routes—two U.S. highways, and one county road. Links 1742 and 1980 each crosses U.S. Route 66 once. Also, there are two crossings of a fiber optic cable along Link 1980.

Land Jurisdiction—Link 1742 crosses lands of mixed (checkerboard) state and private ownership. Some of the private land along Link 1742 is owned by the Navajo Nation. BLM-administered land is along Links 1980 and 2020. In the area west of the Music Mountains, the land-ownership pattern is mixed (checkerboard) BLM and private. The BLM Kingman Resource Area Draft Resource Management Plan (1993) includes a list of lands proposed for disposal northeast of Dolan Springs (Link 2060). Link 1980 (new corridor) also crosses private land owned by the Hualapai Tribe.

Existing Land Use—One residence is located within approximately 500 feet of Link 1980 near Route 66. The primary existing land use is grazing. The land-managing agencies have divided the rangeland into grazing allotments to facilitate management of grazing.

Future Land Use—Similar to the areas along N1W, areas along N2 are zoned for rural residential or agricultural residential but no development plans were identified. Link 2020 crosses or is adjacent to private subdivided land west of the Music Mountains, but there are no specific plans for development.

Parks, Preservation, and Recreation—Park, preservation, and recreation uses include historic Route 66 crossed by Links 1742 and 1980, historic Beale Wagon Road crossed by Link 1980, and the proposed Music Mountains Crest Trail crossed by Link 1980.

Nevada

The Nevada portion of N2 is the same as N1W.

Southern 2 (S2)

In Arizona, S2 varies from N2 beginning at the Moenkopi Substation and continuing west through Link 2006. At this point, S2 is then the same as N2 proceeding north and west along Links 2020 and 2060 to the crossing of the Colorado River and the Nevada border.

Arizona

Linear Features—S2 parallels two APS 500kV lines along Links 1420, 1480, 1520, 1640, and a small portion of 1680. Along Links 1680, 1720, 1960, and 2000, S2 parallels a variety of fiber optic lines and pipelines. Along a portion of Link 2000, and along Link 2006, S2 parallels a Western 345kV line and a Salt River Project (SRP) 500kV line.

There are 11 crossings of major transportation routes along this portion of S2. Links 1640, 1680, 1720, and 2000 cross one interstate highway (twice), two U.S. highways (three times), one state highway, and five county roads. In addition, Links 1640, 1720, 1960, and 2000 would cross 11 pipelines, 4 fiber optic lines, and 4 high-voltage transmission lines.

Land Jurisdiction—Land jurisdictions along this portion of S2 include Navajo Nation, Forest Service, BLM, state of Arizona, and private. West from the Moenkopi Substation area, S2 crosses the Cameron Chapter of the Tuba City Agency of the Navajo Nation along Links 1420 and 1421. Mixed (checkerboard) state (56.1 miles) and private lands are crossed intermittently along Links 1421, 1480, 1520, 1640, 1680, 1720, 1960, 2000, and 2002. BLM and private lands are crossed by Links 2002 and 2006. The Kaibab National Forest is crossed by portions of Links 1640 and 1680.

Existing Land Use—Existing land uses along S2 include residential, rangeland used for grazing, agricultural, and industrial. Seven residences were identified within approximately 500 feet along Links 1420, 1960, and 2006. Within the six-mile-wide study corridor, heavier residential concentrations are located near Seligman north of Link 1720, Hackberry (Link 2002), and Antares (Link 2006). An airstrip was identified at the base of the Cottonwood Mountains, southeast of Hackberry about 0.5 mile from Link 2000.

Future Land Use—No planned or proposed developments were identified along the Arizona portion of S2. Designated utility corridors exist where S2 parallels existing transmission lines across Federal lands. Private lands in Coconino County are zoned rural residential and agricultural residential, and are expected to remain rural in character with very low density residential use. In Mohave County, Link 2020 crosses or is adjacent to planned subdivisions, but there are no specific plans for development. Portions of Links 1640 and 1680 cross the Red Lake area north of Williams, Arizona. According to the Red Lake Area Plan, developed by the Red Lake Planning Committee, the unsubdivided private land in the project area is primarily zoned "General," 10-acre minimum parcel size, which allows one dwelling per parcel.

Parks, Preservation, and Recreation—A proposed section of the Arizona Trail is crossed by Link 1480, Link 1640 crosses the San Francisco Peaks Scenic Road, and Link 1680 crosses the historic Beale Wagon

Road and the Grand Canyon Railroad. Historic Route 66 is crossed by Link 1720 southeast of Seligman and north of Hackberry on Link 2006.

Link 2002 crosses another segment of the Beale Wagon Road.

Nevada

The Nevada portion of S2 is the same as N1W and N2.

Western Area Transmission Line Alternatives - Moenkopi to Mead

Northern 3 (N3), Northern 4 (N4), Southern 4 (S4)

Alternatives N3, N4, and S4 are identical to alternatives N1W, N2, and S2, respectively, with the exception of Links 2040 and 2080, which connect into the Mead Substation rather than the Marketplace Substation (replacing Links 2060, 2200, and 2180). The following description focuses on Links 2040 and 2080. The following land use discussions focus on descriptions of Links 2040 and 2080.

Arizona

Linear Features—Link 2040 parallels an SRP 500kV line and a Western 345kV line. One U.S. highway and four county roads would be crossed Link 2040. Also, there are two crossings of a coaxial cable.

Land Jurisdiction—Land ownership along Link 2040 is mixed (checkerboard) with BLM, private lands, and a small area of state land in the Detrital Valley. Unincorporated private lands in this area are under the administration of Mohave County. The NPS-administered Lake Mead NRA is crossed by Link 2040 (7.2 miles).

Existing Land Use—Existing land use identified along Link 2040 consists of livestock grazing. No residences were identified within 500 feet along the entire route.

Parks, Preservation, and Recreation—Link 2040 crosses the Lake Mead NRA for 7.1 miles in Arizona. The Willow Beach Marina, National Fish Hatchery, and Willow Beach overlook are located within the land use study corridor, but are not in the immediate vicinity of Link 2040.

Nevada

Linear Features—An SRP 500kV line and a Western 345kV line are paralleled along Link 2040. Several high-voltage transmission lines pass through the area near the Mead Substation terminus, two of which would be crossed by Link 2040.

Land Jurisdiction—Link 2040 crosses NPS-administered Lake Mead NRA for about 9 miles, 2.8 miles of which are in a BOR power withdrawal. Just east of the Mead Substation, Link 2040 crosses BOR-administered land (1.8 miles).

Existing Land Use—Existing land use along Link 2040 in Nevada is limited. Link 2040 parallels two existing transmission lines, which are located in an NPS-designated utility corridor across the Lake Mead NRA, and terminate at the Mead Substation.

Future Land Use—At the western end of Link 2040 near the Mead Substation, the Boulder City Master Plan indicates plans for a new airport, public, quasi public, residential, and commercial uses; however, Link 2040 would not be adjacent to or cross any of these.

Parks, Preservation, and Recreation—Lake Mead NRA proposes the recreational Canyon-Rim Trail along the rim of the Black Canyon, which is crossed by Link 2080. The trail will start at the NPS Visitor Center and terminate about 20 miles south in the area of the Eldorado Canyon Road. Several recreational facilities were identified within alternative study corridors near Boulder City, but none are crossed by or adjacent to Links 2040 and 2080.

Substation Alternatives

Red Lake Substation Site—The site is located on Arizona state trust lands. Existing land uses in the vicinity of the site are limited primarily to livestock grazing. No other uses were identified within one-quarter mile of the site. Future land use in the general area is planned as rural residential. The substation site is located within the Red Lake Planning Area. Unsubdivided private land in the vicinity of the project area is primarily zoned General (e.g., 10-acre minimum parcel size), which allows one dwelling per parcel. No parks, preservation, or recreation uses were identified in the immediate vicinity.

Marketplace Substation—The Marketplace Substation is located within the boundaries of Boulder City. Land use at the substation is industrial, associated with operation and maintenance of the transmission lines. The surrounding area is used for livestock grazing. No planned or proposed land uses, parks, preservation, or recreation uses were identified in the immediate vicinity of the Marketplace Substation.

Mead Substation—The Mead Substation, south of Boulder City, is owned and operated by Western. Lands surrounding the substation are administered by BOR. Use at the substation is industrial, associated with operation and maintenance of transmission lines. The surrounding area is used for livestock grazing. No other uses were identified within one-quarter mile of the substation. No planned or proposed land uses, parks, preservation, or recreation uses were identified in the immediate vicinity of the Mead Substation.

Microwave Communication Facility

The existing Bill Williams Mountain communication site is administered by the Kaibab National Forest and is within the Bill Williams Peak off-road vehicle closure area. The Forest Service classifies the general use of the area as roaded and natural. Recreation activities that take place in the vicinity of this site include hunting, fishing, dispersed camping, sightseeing, cross country skiing, and hiking.

SOCIOECONOMICS

This section presents the social and economic characteristics of the people and communities in the vicinity of NTP's alternative routes and facilities. The following discussion addresses the data inventoried including general data regarding state, county, and American Indian communities; and provides a general overview of the state, county, and American Indian populations socioeconomic conditions.

INVENTORY DATA

State and County (Non-American Indian)

Detailed statistics on demographic, social, and economic characteristics of each county were compiled for the study, including population by sex, race, and age; family income and poverty status; labor force and employment (by industry and by occupation); housing tenure and conditions; and fiscal conditions.

The socioeconomic studies used a wide variety of sources, primarily governments and academic institutions, with emphasis on local area social and economic conditions. The decennial censuses by the Federal government; periodic regional and local economic surveys by Federal, state, and county governments; and studies by academic and private research organizations provided a myriad of time-series data on demographic and economic trends in counties and regions. Institutions contacted and other sources of data on general state, county, and city socioeconomic characteristics are listed in Chapters 5 and 6. Statistical abstracts from each state as well as comprehensive annual financial reports for each county and the two cities (Page and Boulder City) in the project area were obtained. Baseline economic data sets for each county were provided from the Minnesota IMPLAN Group. Summaries of the information are included in the overview of the project area.

American Indian Communities

Alternative routes cross the Navajo, Hopi, and Hualapai reservations and lands occupied by the San Juan Southern Paiute tribe. Specific communities were selected for the inventory based on their distance from the alternative routes and availability of socioeconomic data. All of the selected communities fall within 20 miles of the alternative routes, and are located at an average distance of five miles from alternative routes.

Data collection consisted of a review of public documents and other sources. Most of the material was obtained from the Government Documents library at Arizona State University and the University of New Mexico. Tribal planning agencies were contacted for specific data on tribes. The Navajo recommended the following three publications:

- *1990 Census, Population and Housing Characteristics of the Navajo Nation (Division of Community Development, Navajo Nation 1993)*

- *Chapter Images: 1992 Edition (Division of Community Development, Navajo Nation 1993)*

- *Navajo Nation FAX (Division of Economic Development, Navajo Nation 1994)*

A listing of all agencies and other knowledgeable persons that were contacted is provided in the summary of agencies consulted (Table 5-2 in Chapter 5).

OVERVIEW

States and Counties

The seven counties in which alternative routes could be located had an aggregate population of 1.27 million at the time of the 1990 census and, according to state and Federal projections, would reach 1.57 million in 1995 and 1.78 million by the year 2000. This projected growth represents an average growth rate of 3.4 percent per year for the project region; in fact, this growth is skewed by the higher rates projected for the western counties of Mohave, Arizona, and Clark, Nevada (at 4.2 and 3.5 percent per year, respectively), offsetting slower population growth rates in the other more rural counties that make up the eastern and central portions of the region (San Juan—1.3 percent per year; Apache—1.6 percent; Navajo—1.4 percent; Coconino—2.1 percent; Yavapai—2.7 percent) (Statistical Abstracts for Arizona, Nevada, and New Mexico 1993/1994 and Bureau of the Census 1994).

A review of comparative demographic, social, and economic data for the seven counties reinforces the picture of a lower income, rural socioeconomic setting dominating the eastern half of the project area, while the western half shows greater economic vitality and diversity. Data for the counties were compiled that compare such indicators as population, occupation, housing tenure and facilities, per capita expenditures, tax revenues, and such measures of income as household and per capita income, percent of persons and families below the poverty level, and level of unemployment. The counties of San Juan, Apache, Navajo, and, to a lesser extent, Coconino have the highest proportions of American Indian residents and the highest incidences of economic dependency and distress in the project area.

The primary indicators of the socioeconomic health of a community are income, employment, dependency (numbers of below- and above-working age residents), and household size. Virtually all of San Juan County's indicators are lower than the statewide New Mexico averages, as is the case with the two most easterly Arizona counties (Apache and Navajo) relative to Arizona statewide averages. To a lesser extent, Coconino County's indicators fall below the Arizona statewide average, but are uniformly higher than its eastern neighbors. Arizona's Yavapai and Mohave counties show the impact of high percentages of retirement age residents: somewhat lower per capita incomes relative to the statewide average, but significantly lower poverty percentages and higher home values and educational attainments than their eastern neighbors. Finally, Clark County reflects the southern Nevada boom in gaming, tourism, and industrial development in its levels of income, employment, housing value, and educational attainment.

American Indian Populations

This section describes the socioeconomic environment of the Navajo, Hopi, Hualapai, and San Juan Southern Paiute populations in the vicinity of the project alternatives, and Navajo chapter services. Table 3-4 presents an overview of the various tribes present in the area.

Hopi

The Hopi Reservation is located in north-central Arizona, and covers 1,561,213 acres. Nearly 80 percent of the reservation is in Navajo County, with only Moenkopi, Coal Mine Mesa, and Sand Springs located in Coconino County.

Between 1970 and 1990, the population on the Hopi Reservation expanded from 4,966 to 9,199 residents (an 8.5 percent increase overall). This increase may be related to increased job opportunities in neighboring communities such as Flagstaff. In 1989, 61 percent of the Hopi labor force was unemployed. The median household income was $14,325, with 52.5 percent based on a mix of social security, public assistance, and retirement benefits. Per capita income on the reservation was $4,953 in 1989, with 48.2 percent of the people living below the poverty level. Housing statistics showed an average of 3.3 persons per household in 1990. Data on kitchen facilities and plumbing for these households were not available, and data on electricity were available only for Coconino County. Ten percent of Hopi houses in Coconino County had electric power in 1990, and 77 percent of the houses on the Hopi Reservation used wood or gas for fuel.

The economic base of the Hopi rests on subsistence agriculture, some manufacturing (e.g., artisan industry), tourism, and government. Education, health services, government administration, and livestock grazing provide most of the jobs on the reservation.

Data on the public finances (sources and uses of public funds) of the Hopi were not available.

Hualapai

The Hualapai Reservation is located in northwestern Arizona and covers 992,463 acres predominantly in Mohave and Coconino counties, with a very small portion in northwestern Yavapai County. The number of residents on the reservation is relatively small—682 in 1970, rising to 1,498 by 1990.

In 1990, 54.7 percent of the Hualapai labor force was unemployed. Median household income was $11,071 in 1989 while per capita income was $3,711. Fifty-five percent of the population was below the poverty level, while 52.5 percent of the households were receiving supplemental income from Social Security, public assistance, or retirement benefits. Housing statistics indicate an average of 3.8 persons per household. Data on kitchen facilities and plumbing for these houses were not available. The available data indicate that 7.2 percent of the houses on the reservation had electricity in 1990, while wood and gas were used in 77 percent of Hualapai households.

TABLE 3-4
DISTRIBUTION OF AMERICAN INDIAN TRIBES IN THE PROJECT AREA

	Navajo	Hopi	Hualapai	San Juan Southern Paiute
State	Arizona, New Mexico	Arizona	Arizona	Arizona
County	San Juan, New Mexico; Apache, Navajo, Coconino, Arizona[1]	Navajo, Coconino, Arizona	Mohave, Coconino, Yavapai; Arizona	Coconino
Principal Communities in the Reservations	Shiprock, New Mexico; Window Rock, Fort Defiance, Lukachukai, Chinle, Rock Point, Kayenta, Lechee, Tonalea, Tuba City	Moenkopi, Kykotsmovi, Oraibi, Bacavi, Shungopavi, Shipalovi, Mishongovi, Polacca, Walpi, Sichomovi, Hano, Lower Moenkopi	Peach Springs	Tuba City
Acreage, 1991[2]	14,775,066 in Arizona; 2,329,600 in New Mexico	1,561,213 (Arizona)	992,463 (Arizona)	NA
Population Trends[3]				
1970	95,104	4,966	682	NA
1980	140,984	8,253	988	NA
1990	155,276	9,199	1,498	NA
1996	not available	9,607	2,033	250
Primary Economic Base	livestock, mining, manufacturing, tourism	livestock, mining, manufacturing, tourism	livestock, tourism	NA

(1) McKinley (New Mexico) and San Juan (Utah) counties included in Navajo Reservation lands outside NTP area.
(2) Source: Arizona Commission on Indian Affairs, in Arizona Statistical Abstract (University of Arizona 1993).
(3) Sources: Navajo - 1970—U.S. Census from Navajo Nation FAX statistical abstract (Navajo Nation Division of Economic Development 1994), New Mexico Trust Lands population excluded until 1980 Census; 1980 and 1990—Census of total population in Chapter Images: 1992 Edition (Navajo Nation 1993). Hopi and Hualapai—Arizona Commission on Indian Affairs, from Arizona Statistical Abstract (University of Arizona 1993). 1996 data from BIA Phoenix Agency Office.
NA The San Juan Southern Paiutes were formally recognized by the Federal government as a tribe in 1990. Reservation lands have not been assigned.

The Hualapai's economic base rests on livestock grazing, tourism, and government. These activities, along with education, transportation, and health services provide most employment.

Data on the public finances (sources and uses of public funds) of the Hualapai were not available.

San Juan Southern Paiute

The San Juan Southern Paiutes were formally recognized by the Federal government as a tribe in 1990, but were not assigned reservation lands. The lands they claim are in the region of the project but would not be crossed by any of the NTP alternative routes. At present the San Juan Southern Paiute reside mainly in Coconino County, Arizona, and in 1996, 250 members were documented by BIA as living in the area. Census data for 1990 are not available for the San Juan Southern Paiute, so it is not possible to provide detailed demographic statistics. However, since the San Juan Southern Paiute Tribe is located in Coconino County, it probably experiences economic conditions similar to those of the Navajo living in the area.

Navajo

The Navajo Reservation extends from northwestern New Mexico to north-central Arizona, spanning four counties including San Juan County in New Mexico, and Apache, Navajo, and Coconino counties in Arizona. In 1991, the Navajo Reservation covered approximately 2,329,600 acres in New Mexico and 14,775,068 acres in Arizona. The Navajo Reservation is subdivided into 110 local jurisdictions referred to as chapters. Although the socioeconomic characteristics of the Nation vary across the study area, basic trends are clear.

From 1970 to 1990, population trends for the reservation and trust lands indicated a substantial but slowing rate of increase, rising from 95,104 in 1970 to 140,984 in 1980, and to 155,276 by 1990. While the median age of Navajo residents is low (22.3 years), a decreasing birth rate and out-migration of young people searching for jobs and education are factors that have contributed to a lower rate of population growth.

In 1990, 27.9 percent of the Navajo Nation's labor force was unemployed. The mean annual household income was $10,433. Income from social security, public assistance, and retirement benefits contributed to the economy, with 58.8 percent of the households in 1990 receiving funds from at least one of these sources. The Navajo Nation's per capita income level in 1990 was $4,106, with 56.1 percent of the population living below the poverty level. Housing statistics indicate an average of 4.07 persons per household in 1990. Fifty percent of the houses on the reservation lacked complete plumbing and 77.5 percent lacked complete kitchen facilities and telephones. Wood and gas were the principal fuels in 81 percent of the homes.

The economic base of the Navajo Nation rests on coal mining, some manufacturing (e.g., artisan industry), tourism, and government. Livestock grazing, mining, retail trade, construction, health, and education provide most of the jobs on the reservation.

Data on the public finances (sources and uses of public funds) of the Navajo Nation were not available.

Navajo Chapter Services—The manuscript *Chapter Images* was reviewed to identify the locations of health and safety services in the project area that could be used by construction personnel. Due to the number and range of health and safety services offered by individual chapters, comprehensive tables of police, fire, and hospital services that serve each chapter within the Navajo Reservation were compiled. To provide an overview of the range of services available and the primary locations of police, hospital, and fire protection services within the Navajo Reservation, the data are summarized below for the Western Navajo, Eastern Navajo, Fort Defiance, Chinle, and Shiprock agencies.

Ten police service districts and substations serve the entire Navajo Reservation, covering 110 chapters. The Crownpoint district (serving 32 chapters), Shiprock (19), Tuba City (10), Window Rock (16), and Chinle (15) districts serve 84 percent (92) of the chapters in the Navajo Reservation. The remaining districts, Kayenta (8), Dilkon (5), Ganado (3), Piñon (1), and the Toyei Substation (1) serve the remaining 18 chapters. Table 3-5 summarizes the information. A total of 272 police officers were identified with the police service districts, distributed as follows among the Navajo agencies: Western Navajo—77; Eastern Navajo—67; Fort Defiance—41; Chinle—47; Shiprock—40.

TABLE 3-5
NUMBER OF CHAPTERS SERVED BY POLICE SERVICES
(by agency)

Police Service District	Western Navajo	Eastern Navajo	Fort Defiance	Chinle	Shiprock	Totals
Tuba City District	10					10
Kayenta District	7				1	8
Toyei Substation	1					1
Window Rock		1	15			16
Crownpoint		29	3			32
Ganado			3			3
Dilkon			5			5
Chinle			1	13	1	15
Shiprock			1		18	19
Piñon				1		1
Totals	18	30	28	14	20	110

Twenty-two hospitals serve the entire Navajo Reservation, collectively covering 186 chapters. On average, each hospital serves 8.5 chapters. The Steamboat Chapter in the Fort Defiance Agency is served by the greatest number of hospitals (a total of four), while 32 chapters are served by only one hospital facility. Table 3-6 presents a summary of the data. The Gallup Indian Health Center serves the largest number of chapters within the Navajo Nation (36 chapters), and is followed by the Shiprock Indian Health Center (serving 23 chapters). The Crownpoint Indian Health Facility and Chinle Indian Hospital each serve 20 chapters while the Fort Defiance Indian Health Center and the Tuba City Indian Medical Center serve 19 and 18 chapters, respectively. The San Juan Regional Medical Center and the Keams Canyon Indian Hospital serve 11 and 10 chapters, respectively. The Winslow Health Center serves six chapters, Sage Memorial Hospital and Rehoboth McKinley Christian Center each serve four, Monument Valley Health Facility serves three, Albuquerque and Flagstaff Indian Hospitals each serve two chapters, while Blackrock, Ganado, Kayenta, Laguna-Acoma, Page, Presbyterian, Socorro and Zuni medical facilities each serve one chapter.

Information on fire protection and prevention services for each chapter was obtained from the manuscript *Chapter Images*, but this data consisted of agency maps showing fire trucks within chapters that provide this service. It is uncertain whether these services are available to adjoining chapters, but given the isolation of many chapters from large cities, it is assumed that the chapters with fire services provide protection in adjoining chapters. The Fort Defiance Agency contains the most chapters with fire protection services (seven), followed by the Chinle Agency (five), the Western Navajo and Shiprock agencies (four each), and, finally, the Eastern Navajo Agency with four chapters served.

VISUAL RESOURCES

The visual resource inventory includes the evaluation of scenic quality, existing visual conditions, visual sensitivity, and agency management objectives. A six-mile-wide study corridor, three 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, impacts were studied beyond three miles.

The visual resource inventory is summarized in two major sections below. First, a project area overview describes applicable regulations and introduces each component of the visual resource inventory, and second, the results of the inventory are summarized by alternative route. Maps illustrating these descriptions include Figures 3-3 and 3-4 and Figures MV-10E through MV-13W.

OVERVIEW

Scenic Quality—The elements of scenic quality include the character and diversity of landform, vegetation, water, color, and cultural or man-made features. Landscapes with greater diversity of features are typically considered to have higher scenic quality.

TABLE 3-6 NUMBER OF CHAPTERS SERVED BY HOSPITAL SERVICES (by agency)						
Service District	**Western Navajo**	**Eastern Navajo**	**Fort Defiance**	**Chinle**	**Shiprock**	**Totals**
Albuquerque Indian Hospital		2				2
Blackrock		1				1
Chinle	1		4	14	1	20
Crownpoint		18	2			20
Flagstaff	2					2
Fort Defiance		2	17			19
Gallup		17	13	1	5	36
Ganado				1		1
Kayenta					1	1
Keams Canyon	1		7	2		10
Laguna-Acoma		1				1
Monument Valley	2			1		3
Page	1					1
Presbyterian Medical Service		1				1
Rehoboth McKinley Christian Hospital		3	1			4
Sage				4		4
San Juan		2			9	11
Shiprock		3			20	23
Socorro		1				1
Tuba City	16			2		18
Winslow	3		3			6
Zuni		1				1
Totals	26	52	47	25	36	186

The project area includes a diverse range of largely undeveloped vistas and open landscapes interspersed with small communities and rural towns. The landscapes are dominated by the distinctive features and landforms of the Colorado Plateau and Basin and Range physiographic provinces.

A majority of the project area in New Mexico and Arizona is located on the Colorado Plateau. Major distinguishing landforms of the Colorado Plateau are formed from horizontal strata including mesas, canyons, and landmarks such as Shiprock. Vegetation is generally sparse with densely forested areas limited primarily to the Chuska Mountains. Water features are isolated and limited to the San Juan and Colorado rivers, as well as other ephemeral creeks. The region is otherwise arid. The exposed strata in the landforms provide a wide range of colors such as those that occur in the Monument Valley Navajo Tribal Park, Painted Desert, Chuska Mountains, Black Mesa, and portions of the Grand Canyon.

The Basin and Range area in Nevada is distinguished by isolated, roughly parallel, north-south trending mountain ranges separated by closed (undrained) desert basins. There is limited diversity in the basin areas; however, the surrounding ranges provide visual interest and diversity in landforms, vegetation, and color.

For purposes of the visual resource studies, areas are assigned one of the following scenic quality classifications:

Class A—lands of outstanding or distinctive diversity or interest
Class B—lands of common or average diversity or interest
Class C—lands of minimal diversity or interest

Eight percent of the lands crossed by NTP alternatives are Class A lands. These are represented by unique landscapes including high relief mountains, escarpments, highly dissected canyons, monumental landforms, and riverways. Forty-six percent of the lands crossed by NTP alternatives are Class B lands. Class B scenic quality areas consist primarily of rolling vegetated hills and valleys, mesas, and buttes. The remaining 46 percent of lands crossed by NTP alternatives are Class C scenic quality areas. These are represented primarily by high desert plateaus and desert basin areas.

Landscape character types and scenic quality levels are shown in Figures MV-10E and MV-10W.

Existing Visual Conditions—Cultural or man-made features are dispersed throughout the lands along the alternative routes and include communities, rural residences, agricultural lands and ranches, mines, energy and communication facilities (e.g., transmission lines, pipelines, fiber optic cables), highways, and roads. Most of the land crossed by the alternatives exhibits visual conditions that have been locally modified primarily due to the presence of existing transmission lines paralleled by the alternative routes as shown in Figures 3-3 and 3-4.

Visual Sensitivity—Visual sensitivity reflects the degree of public concern for change in the scenic quality of the landscape from key viewing areas. Both the type of viewpoint and the distance from viewers are considered. Visual sensitivity levels (high, moderate, or low) reflect the type of viewpoint and viewer concern for change, volume of use, public and agency concerns, influence of adjacent land use, and viewing duration. Distance from the viewer is defined as foreground (0 to 0.5 mile), middleground (0.5

mile to 3 to 5 miles), background (beyond 3 to 5 miles), or seldom seen areas (beyond 15 miles). Viewers are primarily dispersed with larger concentrations in small scattered communities and at recreational sites throughout the project area. Key viewpoints within the project area include residences, communities, park and recreation areas, travel routes, and historic trails or sites. Numerous parks, national monuments, and recreational areas in the region are considered to be of national significance including the Grand Canyon, Monument Valley, Canyon de Chelly, and the Glen Canyon and Lake Mead NRAs. Many of the travel routes within the project area, including historic U.S. Route 66, serve as access to these destinations. Generally, views from these locations are considered to be of high sensitivity because of the level of viewer and agency concern and use volumes.

The landscape setting of the project area allows for views that are often vast, expansive, and unobstructed for several miles. Areas limited to foreground and middleground views are primarily associated with either mountainous terrain, river valleys, streams, or canyons.

Views from high sensitivity residential viewpoints are shown in Figures MV-11E and MV-11W. Views from sensitive parks, recreation areas, roads, and cultural sites are shown in Figures MV-12E and MV-12W.

Agency Management Objectives—There are no formal guidelines for managing visual resources on state, county, city, private, American Indian, or NPS lands within the project area. Visual resources on lands administered by BLM and Forest Service are managed through the Farmington, Phoenix, and Las Vegas districts (BLM), and the Coconino and Kaibab national forests.

Visual management objectives define the acceptable degree of visual change in the natural landscape on public lands. These objectives are classified differently by the Forest Service than by BLM. Forest Service classifications are called Visual Quality Objectives (VQOs), and BLM classifications are called Visual Resource Management Classes (VRM classes). The five VQO classifications are as follows: preservation, retention, partial retention, modification, and maximum modification.

Preservation areas are afforded the highest level of protection and maximum modification areas the lowest. There are four VRM classes (I, II, III, and IV). Class I areas are afforded the highest level of protection and Class IV areas the lowest.

Both the BLM and Forest Service derive visual management objectives by considering scenic quality (BLM) or variety class (Forest Service), visual sensitivity, and visibility from sensitive viewpoints. A majority of the BLM and Forest Service lands associated with alternative routes are managed to allow for modifications or development that may be evident (BLM Class III or Forest Service Partial Retention), or even dominant (BLM Class IV or Forest Service Modification) in the landscape (Figures MV-13E and MV-13W). Class II areas on BLM lands are located primarily in the vicinity of the Highland Range, Eldorado Mountains, Grand Wash Cliffs, and Music Mountains; and Forest Service retention areas are generally associated with U.S. Highway 180 and Red Horse Wash area. Both Class II and Retention areas are managed to allow for change that should not be evident in the landscape. No Class I or Preservation areas would be traversed by any of the alternative routes.

ALTERNATIVES

The results of the visual resources inventory are summarized below for each alternative route, substation, and the communication site. Discussions include scenic quality, existing visual conditions, visual sensitivity, and agency management objectives. Figures MV-10E through MV-13W illustrate visual resources within a six-mile-wide corridor.

Eastern Area Transmission Line Alternatives

Glen Canyon 1 (GC1)

New Mexico

Scenic Quality and Existing Visual Conditions—The majority of lands crossed by GC1 in New Mexico are Class C, consisting of dissected desert plains. Class B landscapes are associated with the eroded terraces of the San Juan River Valley (Link 460), and The Hogback area (Link 100). Class A areas are limited to the crossing of the San Juan River on Link 460. The existing visual conditions have been modified by the 230kV transmission line that GC1 parallels along its entire length.

Visual Sensitivity—High sensitivity viewpoints along GC1 are from dispersed rural residences in the San Juan River Valley and from U.S. Highway 64. Residential viewers are primarily concentrated along the river immediately north of the town of Shiprock. Views from these residences are open to partially screened, and range from foreground to middleground and background views along Link 460. Views from U.S. Highway 64 are limited and in the background from the river valley setting (Link 460). U.S. Highway 666 (moderate sensitivity) is crossed by GC1. Views from this highway are open in the foreground, middleground, and background areas (Link 460).

Agency Management Objectives—GC1 crosses lands within the Farmington District of the BLM, west of the Shiprock Substation on Link 100. This area has been designated as VRM Class IV. There would be no Forest Service lands crossed by GC1.

Arizona

Scenic Quality—The majority of lands crossed by GC1 are designated Class C and Class B landscapes. Class C areas include dissected, sandstone, and grassland plains characteristic of Links 461, 501, and 586. Class B landscapes are associated with the dissected plateau and buttes north of the Carrizo Mountains near Teec Nos Pos (Link 460); drainage crossings at Chinle, Walker, and Laguna Creeks (Link 461); the piñon-juniper covered hills on the Shonto Plateau (Link 580); outcroppings and the piñon-juniper grasslands on the Kaibito Plateau south of Page (Links 1389, 1393, and 1397); and the badlands and eroded terraces west of Tuba City and in the vicinity of The Gap and Cameron (Links 1384, 1397, 1383, and 1386). Class A areas occur along the Red Point Mesa cliffs (Link 501), the northern escarpment of Black Mesa (Links 504 and 561), across the red sandstone formations and canyonlands east of Kaibito

(Links 580 and 561), at the crossing of Choal Canyon (Links 1390, 586, and 587); and along the Echo Cliffs near The Gap (Link 1383).

Existing Visual Conditions—Existing 230kV, 345kV, and 500kV transmission lines are paralleled with the exception of Link 463 near Dennehotso, Links 501 and 502 southeast of Kayenta, Links 504 and 561 on the northern edge of Black Mesa, and Links 621 and 627 immediately south of the city of Page (3.0 miles). Along portions of Links 1389, 1383, 1384, and 1386, GC1 would be located within a corridor that may contain as many as two to four additional transmission lines (345kV or 500kV).

Visual Sensitivity—High sensitivity residential viewpoints are located within and on the fringe of several communities in proximity to GC1 including Red Mesa, Mexican Water, Tes Nez Iah, Dennehotso (Links 461 and 463), Kayenta (Link 502), Tsegi (Link 561), Shonto (Link 580), Page and Lechee (Links 621, 627, and 1389), The Gap (Link 1383), and Cameron (Link 1386). Other areas with dispersed rural residential views are concentrated along U.S. Highway 160 in the Four Corners area extending west to Black Mesa (Links 460, 461, 463, 501, 502, 504, and 561), northwest of White Mesa (Links 581, 586, and 587), on the Kaibito Plateau west of Copper Mine (Links 1389, 1393, and 1397), and north of Cameron (Link 1384). Most of these residences have open to partially screened foreground to middleground and background views in these areas.

High sensitivity travel routes include U.S. Highway 89 and 64 and Arizona State Routes 98, 564, and 64. U.S. Highway 89 provides primary access to major recreation destinations including Grand Canyon National Park and Glen Canyon NRA. GC1 parallels and crosses this highway, with views primarily ranging from middleground to background areas (Links 627, 1384, and 1389). Viewing conditions from this highway are often partially or fully screened based on local topography; however, there are open foreground views from the highway crossing at The Gap (Link 1383). GC1 parallels and crosses State Route 98 in an open foreground setting east of Page and are open to screened in views from this road between Kaibito and Shonto (Links 580, 581, 587, and 620). Views from State Route 564 are partially to fully screened due to foreground vegetation and terrain (Links 561 and 580), and State Route 64 have foreground to background views in an open setting (Link 1386). Views from the proposed Great Western Trail, a high sensitivity historic travel route, are open in a panoramic setting (Links 1386, 1389, and 1397) and views from Cameron Bridge (National Register site), located in Cameron, are open (Link 1386).

Moderate sensitivity travel routes that are crossed by GC1 include U.S. Highway 160, and Tribal Route 59. U.S. 160, a proposed state scenic route, provides primary east-west access to Navajo lands from the Four Corners area and is paralleled and crossed six times by GC1. Foreground views from this highway are primarily open from Four Corners to Kayenta (Links 460, 461, 463, and 502), and become more restricted in the Long House Valley area (Link 561). Views from Tribal Route 59 are partially screened by local terrain. Other important views include those from a rest area located on U.S. 160 near Mexican Water that are screened by foreground terrain (Link 461). Views from U.S. Highway 163, a proposed state scenic route that provides primary access to Monument Valley, are open and panoramic in a flat, open valley; however, development in the community of Kayenta partially screens some views from this highway (Links 502 and 504). Foreground and middleground views from U.S. Highway 191 near Mexican Water (Link 461) are open to partially screened due to the terrain.

Agency Management Objectives—GC1 does not cross any lands administered by BLM or Forest Service.

Kaibito 1 (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1).

Scenic Quality and Existing Visual Conditions—This portion of K1 is characterized primarily by Class C scenery consisting of plateau grasslands and high desert plateau. A small portion of Class B scenery also is crossed, including piñon-juniper covered grasslands (Link 1391) and Circular White Ridge (Links 1390 and 1391). Existing visual conditions in this area are primarily natural, with dispersed rural residences. Link 1390 crosses the Black Mesa and Lake Powell Railroad. In this area, this segment of K1 would be a new transmission line corridor.

Visual Sensitivity—High sensitivity viewpoints consist of limited, dispersed rural residences that have predominantly open views ranging from foreground to background. K1 crosses State Highway 98 in a setting that provides partial screening in the middleground and background areas in the vicinity of Horse Thief Mesa (Link 1390). Also, there are very limited background views from the proposed Great Western Trail (Link 1391) where this alternative intersects Link 1393 in an existing transmission line corridor.

Agency Management Objectives—No lands administered by BLM or Forest Service are crossed by K1 in this area.

Central 1 (C1)

New Mexico

Scenic Quality—The majority of lands crossed by C1 are Class C, consisting of dissected desert plains. Class B landscapes crossed include the San Juan River Valley west of Fruitland (Link 240), Chaco Wash and The Hogback ridge (Links 360 and 640), and Rock Ridge (Link 700). Other prominent Class B features within the immediate vicinity include Table Mesa and Cathedral Cliff. Class A areas are limited to the crossing of the San Juan River (Link 240), and portions of the eastern slope of the Chuska Mountains immediately south of the reference centerline (Link 700).

Existing Visual Conditions—Existing transmission lines or pipelines are paralleled over its entire length except 10.4 miles on Links 360 and 640 through The Hogback area. Conditions have been substantially affected in the vicinity of Links 180, 240, and 300, where C1 parallels a combination of 115kV and 345kV transmission lines. In addition, Link 700 parallels an existing 500kV transmission line.

Visual Sensitivity—High sensitivity viewpoints include rural residences, U.S. Highway 64, and selective cultural sites. Residential viewers are primarily concentrated along the San Juan River in the Fruitland and Waterflow areas (Link 240) with additional dispersed residences adjacent to U.S. Highway 666 south of Shiprock, and within the foothills of the Chuska Mountains north of Sanostee (Link 700). Views from these residences are typically open to partially screened and range from foreground to background.

U.S. Highways 64 and 666 are crossed by C1 in an existing transmission line corridor. Views from U.S. 64 are open to partially screened by vegetation and terrain (Link 240), and views from U.S. 666 (moderate sensitivity) are in an open and panoramic setting (Link 700). Cultural sites considered to be highly sensitive with potential background views include the Pictured Cliffs area (Links 180 and 240) and Mitten Rock (Link 700).

Agency Management Objectives—VRM Class II and IV areas are crossed by C1 along the San Juan River (Links 180 and 240). No lands administered by Forest Service are crossed by C1.

Arizona

Scenic Quality—Class C landscapes are predominant along C1, including dissected upland plains north and west of Lukachukai (Link 700); on the southern edge of Black Mesa (Links 701 and 780); and across the grasslands of First, Second, and Third mesas and the Moenkopi Plateau (Link 780). Class B areas are primarily associated with major drainages and areas of diverse landform or color including Tsedatoh Canyon, Agua Sal Creek, Yellowstone Canyon, and Chinle Wash (Link 700); the Cottonwood Wash area (Link 701); and the Chaaghaztial area, Polacca Wash, Burnt Corn Valley, Oraibi Wash, Dinnebito Wash, Howell Mesa, and portions of the lower Moenkopi Plateau and the Painted Desert (Link 700). Class A areas are located at the crossing of the Chuska Mountains northeast of Lukachukai (Link 700); and Lohali Mesa, Toadindaaska Mesa, Coal Mine Mesa and the Adeii Eechii Cliffs (Link 780).

Existing Visual Conditions—C1 parallels a 500kV transmission line that has modified existing visual conditions along its entire length. These modifications are particularly evident in localized areas where tree clearing for right-of-way and access roads has accentuated the change to the natural character of the landscape, such as the Chuska Mountains (Link 700).

Visual Sensitivity—Open views from residences on the fringe of rural communities in the foreground and middleground are found near Lukachukai (Link 700); Dinnebito, Hard Rocks, and Cameron (Link 780). Dispersed residences with open views are scattered along C1, with higher concentrations in the areas north of Chinle along U.S. Highway 191 (Link 700), and in the Cottonwood and Piñon areas (Link 780). C1 crosses high sensitivity roads including Tribal Route 12 west of Lukachukai (Link 700) and U.S. Highway 89 west of Cameron (Link 780), both with open foreground and middleground views. Moderate sensitivity travel routes crossed by C1 include U.S. Highway 191 north of Chinle with panoramic views (Link 700) and State Route 264 near Coal Mine Mesa with open views (Link 780). C1 also crosses the proposed Great Western Trail along the Little Colorado River with open and extended views. Cultural sites considered to be high sensitivity viewpoints include Taawa Tribal Park with partially screened middleground views, and Cameron Bridge with open background views (Link 780).

Agency Management Objectives—C1 does not cross any lands administered by BLM or Forest Service.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains along Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1.

Scenic Quality—The western portion of Link 460 in Arizona and Link 462 primarily cross a mixture of Class B and Class C scenery. Class C areas are located in the dissected plains near Tsitah Wash along U.S. Highway 160 (Links 460 and 462), and in the Sandstone Plains south of Sweetwater and the grasslands associated with the Carson Mesa area (Link 462). Class B areas are crossed on the buttes north of the Carrizo Mountains (Link 460); and on the dissected plateau between Toh Atin and Cheznindeza Mesas, the Dibe Chaa Valley, and Black Mountain Wash (Link 462). No Class A areas are crossed by C2 on Links 461 and 462 in Arizona; however, distinctive features within the general vicinity include Walker Butte, Dancing Rocks, and Lohali Mesa.

Existing Visual Conditions—This portion of C2 includes the introduction of a new transmission line corridor on Link 462 across Carson Mesa and through the Chinle Valley (65.7 miles). The existing visual conditions in this area include only minor modifications associated with small communities (e.g., Sweetwater, Emmanuel Mission, and Rock Point), or scattered and dispersed rural residences.

Visual Sensitivity—The majority of residences with views to C2 are located near the communities of Teec Nos Pos (Link 460); and Sweetwater, Emmanuel Mission, and Rock Point (Link 462). Other dispersed residences are scattered throughout the Chinle Valley in the vicinity of Many Farms and Rough Rock and along the eastern slopes of Black Mesa. Views from these residential areas vary from foreground to background zones, primarily in open settings.

Three moderate sensitivity travel routes are crossed in this area by C2, including U.S. 160 north and west of Teec Nos Pos (Link 460), U.S. Highway 191 near Rock Point, and Tribal Roue 59 west of Many

Farms (Link 462). All of these roads have open to partially screened views extending from foreground to background.

Agency Management Objectives—No lands administered by BLM or Forest Service are crossed along this portion of C2.

Substation Alternatives

Shiprock Substation—The existing substation is located on an open plateau, which is generally characterized by Class B Scenery, with substantial modifications including existing transmission lines. Background views are screened from U.S. Highway 64, a high sensitivity road near Waterflow. BLM-administered lands in the vicinity are designated as VRM Class IV.

Honey Draw Substation Site—This is an undeveloped site in an area of Class B scenery; however, the site is adjacent to an existing 345kV transmission line, which has modified the setting. Background views from Page would be predominantly screened by terrain, and residences on the western edge of Lechee would have open to partially screened middleground views to the site. Views from two travel routes including U.S. Highway 89 (high sensitivity) and State Route 98 (moderate sensitivity) are screened by terrain.

Red Mesa Substation Site—This site is adjacent to an existing 345kV transmission line and characterized by Class B scenery consisting of sparsely scattered piñon-juniper grasslands. Residences in the vicinity of Circular White Ridge have partially screened background views of the site.

Copper Mine Substation Site—This site is situated between two existing 345kV transmission lines and is characterized by Class B scenery consisting of grasslands with a moderate to dense cover of piñon-juniper and scattered rock outcrops. Dispersed residences in the area have partially to fully screened middleground views to the site.

Moenkopi Substation—Located adjacent to the existing Moenkopi Substation on an eroded terrace above the Little Colorado River, the area is generally characterized as Class B scenery with substantial modifications including existing transmission lines. Residences and high sensitivity travel routes, including U.S. Highway 89 and Arizona State Route 64, have open to partially screened middleground and background views of the substation site area.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace

Northern 1 - West (N1W)

Arizona

Scenic Quality—The majority of lands crossed by N1W are a combination of Class C and Class B scenery. Class C areas are predominant on the rolling grasslands west of Cameron (Link 1400); on the plateau grasslands of the Coconino Plateau (Link 1660); in the basin grasslands of the Aubrey Valley (Link 1740, 1741, and portions of 1790) and the Hualapai Valley (Link 1790); and in the Detrital Valley (Link 2060). Class B landscapes are found in the Tappan Wash Canyon area and piñon-juniper woodlands on the Kaibab National Forest (Links 1400 and 1401); at Red Horse Wash, Cataract Canyon, Farm Dam Draw, and the eastern slopes of the Aubrey Cliffs (Link 1660); at the crossing of Blue Mountain, the foothills and canyon washes of the Peach Springs area, and the Music Mountains on Hualapai Indian Reservation (Link 1790); and in the White Hills and the Black Mountains (Link 2060). Areas of Class A scenery occur on the Coconino Rim (Link 1400); along the western side of the Aubrey Cliffs (Link 1660); in the upper reaches of Peach Springs and Milkweed canyons, and at the crossing of the western escarpment of the Grand Wash Cliffs (Link 1790); and at the eastern edge of the Colorado River crossing (Link 2060).

Existing Visual Conditions—N1W parallels a 500kV transmission line that has modified existing visual conditions along its entire length. These modifications are particularly evident in localized areas where the clearing of piñon-juniper for right-of-way and access roads has accentuated the changes to the natural character of the landscape. These modifications are most noticeable on portions of the Kaibab National Forest (Links 1400, 1401, and 1660), and in the Music Mountains and north of Peach Springs on Hualapai Indian lands (Link 1790).

Visual Sensitivity—Residential viewpoints are extremely limited and primarily located in the vicinity of Cameron (Links 1400 and 1401); in the Aubrey Valley (Links 1740 and 1741); in the vicinity of Peach Springs (Link 1790); and north of Dolan Springs (Link 2060). Views from most of these locations vary from middleground to background in settings that are open or partially screened due to local terrain and vegetation.

Several high sensitivity travel routes have views to this area. This alternative crosses U.S. Highway 180 and the Grand Canyon Railroad (Link 1660), Tribal Route 18 (Links 1740, 1741, and 1790), Buck and Doe Road, and the Diamond Creek Road (Link 1790), all of which serve as access routes to the Grand Canyon. Foreground views from U.S. 180, the Grand Canyon Railroad, and Diamond Creek Road are in open settings while views from Tribal Route 18 and Buck and Doe Road vary from open to partially and fully screened by terrain and vegetation. Historic Route 66 has views ranging from middleground to background areas in settings that are open to partially screened (Links 1740, 1741, and 1790). U.S. Highway 93 and the Dolan Springs Road, which serve as to access Lake Mead, also are crossed in an open setting.

High sensitivity recreational viewpoints include the Arizona Trail and Moqui Stage Station on the Kaibab National Forest. Views from these locations are open to partially screened by vegetation (Links 1401 and 1660).

The proposed Music Mountains Crest Trail is a moderate sensitivity recreation viewpoint located along the Grand Wash cliffs (Link 1790). Views from this trail are primarily open to partially screened in the foreground and middleground, based on terrain and vegetation.

Agency Management Objectives—VRM Class II areas are located in the Music Mountains and Grand Wash Cliffs area (Link 1790) and Class IV areas are crossed in the Aubrey Valley (Links 1660, 1740, and 1741) and north and east of Dolan Springs (Links 1790 and 2060). Portions of the Kaibab National Forest crossed by N1W are predominantly designated as Partial Retention in the Red Horse Wash and Tappan Wash Canyon areas (Links 1400, 1401, and 1660) or Modification in the Tappan Wash (Link 1400). A small area of Retention is crossed in the vicinity of Russell Wash (Link 1401). Link 2060 crosses Lake Mead NRA within a designated utility corridor.

Nevada

Scenic Quality—N1W crosses Class C areas in the desert basin scrub of the Eldorado Valley (Links 2200 and 2180) and Class B landscapes on the Bajada east of the Eldorado Mountains (Link 2060). Class A areas crossed by N1W include the Colorado River, Eldorado Mountains (Link 2060), and northern slopes of the Highland Range (Link 2200).

Existing Visual Conditions—The existing visual conditions along N1W are modified for its entire length. Existing high-voltage transmission lines, ranging from 230kV to 500kV, are paralleled throughout the length of this route. These conditions have been substantially modified in the vicinity of Links 2200 and 2180 in the Eldorado Valley, where N1W parallels a combination of as many as three 230kV and three 500kV transmission lines as it approaches the Marketplace Substation.

Visual Sensitivity—Residential viewpoints are extremely limited and dispersed within the Eldorado Mountains and Eldorado Valley where middleground and background views of N1W would be fully or partially screened by terrain. N1W crosses U.S. Highway 95 (a moderate sensitivity road), and a high sensitivity travel route leading into the Lake Mead NRA. Views from these roads are open to partially screened in the foreground to middleground areas (Link 2060).

Management Objectives—Class II areas are crossed in the Eldorado Mountains (Link 2060). Class III areas are crossed throughout the Eldorado Valley (Links 2060, 2200, and 2180). Portions of Link 2060 also cross Lake Mead NRA within a designated utility corridor.

Northern 2 (N2)

Arizona

The Arizona portion of N2 is the same as N1W with the exception of Links 1742, 1800, 1980, and 2020, which are located to the south of the Hualapai Indian Reservation (and replace Link 1790 on N1W).

Scenic Quality—This portion of N2 is characterized by Class C scenery in the grasslands of the Aubrey Valley (Link 1742), Truxton Plains (Link 1980), and Hualapai Valley (Link 2020). Areas of Class B scenery are associated with Blue Mountain and Nelson Canyon (Link 1742), Blue Canyon (Links 1800 and 1980), and the southern foothills of the Music Mountains (Link 1980). Class A areas are crossed on Link 1980 at the Grand Wash Cliffs and Music Mountains.

Existing Visual Conditions—This portion of N2 includes the introduction of a new transmission line corridor on Links 1742, 1800, and 1980 in the Aubrey Valley and Truxton Plain (41.5 miles). The existing visual conditions in this area have been slightly modified by changes associated with the small communities of Truxton and Nelson, the Atchison Topeka and Santa Fe Railroad, and Nelson mine. Link 2020 parallels an existing 345kV and 500kV transmission line on the eastern edge of the Hualapai Valley.

Visual Sensitivity—Residential viewpoints in this area are primarily associated with the small communities of Nelson (Link 1742) and Truxton (Link 1980). Views from these towns, or residences in their outlying areas, are open to partially screened and primarily in middleground and background settings. Other dispersed residences north of Antares also are open to partially screened background views. High sensitivity travel routes include State Historic Route 66, which is crossed twice by N2, including views that range from foreground to background in open and partially screened settings (Links 1742 and 1980). In addition, the Beale Wagon Road, a historic travel route, and the proposed Music Mountain Trail are crossed south and west of Truxton (Link 1980) in an area with open to partially screened views.

Agency Management Objectives—This portion of N2 is south of the Hualapai Reservation and crosses portions of the BLM Kingman Resource Area. Areas administered by the BLM have been designated as VRM Class II in the Music Mountains and Grand Wash Cliffs (Link 1980); and VRM Class IV in the Aubrey Valley (Link 1742); Blue Canyon Area (Links 1980, 1800); Truxton Plains (Link 1980); and the Hualapai Valley (Link 2020).

Nevada

The Nevada portion of N2 is the same as N1W.

Southern 2 (S2)

Arizona

In Arizona, S2 varies from N2 beginning at the Moenkopi Substation and continuing west through Link 2006. At this point, S2 is then the same as N2 proceeding north and west along Links 2020 and 2060 to the crossing of the Colorado River and the Nevada border.

Scenic Quality—Class B scenery is predominant and located on the western edge of the Painted Desert and along Lava Wash (Link 1420); in the Cinder Cones juniper woodlands north and west of Mesa Butte (Links 1421, 1480, and 1520); the piñon-juniper woodlands and grasslands near Spring Valley Wash and Howard Mesa (Link 1640); at Cataract Canyon and the foothills near Paradise Ridge (Link 1680); Eight Mile Wash, Pineveta Creek, the Juniper Mountains, and east of Seligman (Link 1720); the crossing of the Seventyfour Plains (Link 1960); and the crossing of the Cottonwood Mountains and eastern slopes of the Peacock Mountains near Hackberry (Links 2000, 2002, and 2006). Class C areas primarily consist of grasslands found along portions of Links 1420, 1680, 1720, 2000, and 2006. This portion of S2 does not cross Class A scenery.

Existing Visual Conditions—Conditions along S2 vary substantially from N2, including areas of new corridor on Links 1720 and 2002 (24.8 miles); areas where pipeline and fiber optic cables are paralleled along Links 1680, 1720, and 1960 (89.4 miles); and an existing transmission line corridor on all or portions of Links 1420, 1421, 1480, 1520, 1640, 1680, 2000, and 2006. Areas of greatest existing modification are associated with existing transmission line corridors, while pipeline and fiber optic corridors are most apparent in areas where tree clearing has been required for rights-of-way.

Visual Sensitivity—Residences are sparse and primarily concentrated in the outlying areas of small communities in the vicinity of S2. In general, these residences have open to partially screened views in areas west of the town of Gray Mountain (Links 1420 and 1421), north of Red Lake (Link 1640), near Seligman (Link 1720), and in the vicinity of Hackberry (Links 2002 and 2006).

Several high sensitivity travel routes and recreation areas also have views of S2. Historic Route 66 is crossed twice—east of Seligman (Link 1720) and in the vicinity of Hackberry (Link 2006) in open to partially screened settings. The Grand Canyon Railroad and Arizona State Route 64 are crossed north of Red Lake in open to partially screened settings (Link 1680). U.S. Highway 180 also is crossed in a partially screened area east of Valle (Link 1640).

S2 crosses the Arizona Trail in an open setting (Link 1480), and crosses the Beale Wagon Road in three locations with views ranging from open (Links 1680 and 1720) to partially screened (Link 2006).

Moderate sensitivity travel routes include Interstate 40, which S2 crosses twice in open settings with extended views (Link 1720).

Agency Management Objectives—BLM-administered lands crossed by S2 have been designated as VRM Class IV. Those areas crossed on the Kaibab National Forest are generally characterized as Partial Retention, interspersed with Modification (Links 1640, 1680, and 1720), and Retention areas associated with U.S. Highway 180.

<u>Nevada</u>

The Nevada portion of S2 is the same as N1W and N2.

<u>Western Area Transmission Line Alternatives - Moenkopi to Mead</u>

Northern 3 (N3), Northern 4 (N4), Southern 4 (S4)

Alternatives N3, N4, and S4 are identical to alternatives N1W, N2, and S2, respectively, with the exception of Links 2040 and 2080, which connect into the Mead Substation rather than the Marketplace Substation (replacing Links 2060, 2200, and 2180). The following description focuses on Links 2040 and 2080.

Arizona

Scenic Quality—Link 2040 is characterized by a mixture of A, B, and C Class Scenery in Arizona. Class C scenery is characteristic of the basin grassland areas within the Detrital Valley and areas of Class B Scenery are associated with the crossing of the White Hills and Black Mountains. Link 2060 crosses the Colorado River in a distinctive mountainous and canyon setting designated as Class A Scenery.

Existing Visual Conditions —Conditions along Link 2040 have been modified by the 345kV and 500kV transmission lines that are paralleled. Modifications to the setting are particularly evident in the Black Mountain area due to the recent upgrade of existing roads and construction of new access roads for the 500kV line in areas of steep terrain.

Visual Sensitivity—Sensitive viewpoints consist primarily of travel routes and recreation sites, and a smaller number of residences with foreground-to-background views of this alternative. Four high sensitivity roads with open views are crossed by Link 2040 including U.S. Highway 93 and three local travel routes accessing Lake Mead NRA. Recreation viewpoints in Arizona are concentrated along the Colorado River, including Willow Beach Landing and Willow Beach Overlook, where views are partially or fully screened because of intervening terrain.

Agency Management Objectives—Link 2040 in Arizona is located on lands administered by the BLM Kingman Resource Area and designated as VRM Class IV. Portions of Link 2040 also are within a designated utility corridor. No lands administered by Forest Service are crossed by Link 2040.

Nevada

Scenic Quality—In Nevada, Link 2040 is characterized primarily by Class A Scenery associated with the crossing of the Colorado River Canyon and Eldorado Mountains immediately west of the river. Small portions of Link 2040 and Link 2080 are located in areas of Class C Scenery in the Eldorado Valley near the Mead Substation.

Existing Visual Conditions—Conditions along Links 2040 and 2080 in Nevada have been substantially modified by the presence of numerous transmission lines and electrical facilities near the Mead Substation in the Eldorado Valley. Links 2040 and 2080 parallel 345kV and 500kV transmission lines in this area. Modifications to the setting also are particularly evident in the Eldorado Mountains because of the recent upgrade of existing roads and construction of new access roads for the 500kV line in areas of steep terrain.

Visual Sensitivity—In Nevada, residences south of Boulder City have middleground-to-background views into the Mead Substation area.

Agency Management Objectives—Link 2040 crosses areas under the jurisdiction of the NPS at Lake Mead NRA that are within a designated utility corridor. Lands administered by the BLM Stateline Resource Area along Links 2040 and 2080 have been characterized as an interim VRM Class III.

Substation Alternatives

Red Lake Substation Site—The site is located north of Red Lake and adjacent to State Route 64 near Howard Mesa. The site is located in an area designated as Class B and C scenery. Existing visual conditions in this area have been modified based on the presence of two existing 500kV transmission lines. Foreground and middleground views of the site from Arizona Route 64 (a proposed state scenic route), Grand Canyon Railroad, and Beale Wagon Road are generally screened by foreground vegetation. Residential middleground views also are partially screened by vegetation.

Mead and Marketplace Substations—This general area has been characterized as Class C Scenery, with extensive modifications because of the existing substation and numerous transmission lines in the vicinity. There are no sensitive viewpoints located near this substation, and BLM has characterized this general area as an interim VRM Class III.

Microwave Communication Facility

The general area is characterized as Class B Scenery; however, the proposed facility, a parabolic dish, would be attached to an existing structure. Sensitive viewers include recreational users and viewers on Interstate 40. Views to the site area primarily range from middleground to background. The Forest Service has characterized the general area as a Partial Retention VQO; however, the proposed parabolic dish would be located in an area designated by the Forest Service as a communication site.

CULTURAL RESOURCES

Cultural resources are used to encompass physical manifestations of the region's heritage that are resources worthy of inventory and evaluation for listing on the National Register, counterpart state registers, or are deemed potentially significant by traditional cultural groups. Anthropologists define "culture" as those learned behaviors that human societies pass on from generation to generation. In this sense, culture is a broad concept encompassing our customs and traditions, including languages, social structures, religions, economies, and styles of shelter and clothing. The National Historic Preservation Act (NHPA) provides a regulatory definition of "historic properties" as including prehistoric and historic sites, buildings, structures, districts, and objects included in or eligible for inclusion in the National Register of Historic Places, as well as artifacts, records, and remains related to such properties. Traditional cultural places rooted in a community's history also may be eligible for inclusion in the National Register because of their association with cultural practices or beliefs that are important in maintaining the cultural identity of that community (*National Register Bulletin* 38).

The results of the inventory are summarized in an overview which describes a cultural history of the area and introduces each component addressed: (1) archaeological and historical sites, (2) special status cultural resources, and (3) traditional cultural places.

OVERVIEW

Cultural History—The project area, as much of North America, has been occupied by human societies, at least intermittently, since about 10,000 BC and perhaps even earlier. From about 10,000 BC to 7,000 or 5,000 BC, highly mobile Paleo-Indian groups lived by hunting game and gathering natural plant foods. Their hunting strategy focused on large Pleistocene game animals, many of which became extinct as the last Ice Age waned. In general, Paleo-Indian sites are rare throughout the project area.

During approximately the next five to six millennia of the Archaic era, local groups hunted and gathered a diversity of animal and plant foods. During the later part of the Archaic period, some groups in some parts of the project area began growing domesticated crops, especially maize. However, this new subsistence strategy initially had only minor impacts on settlement strategies, which continued to emphasize seasonal movements of relatively small groups to hunt game and gather natural foods. The local Archaic cultures are identified by a number of spatial and temporal phase labels reflecting increasing cultural diversity within the project area. Archaeological sites representing the Archaic era are more common than Paleo-Indian sites, but still constitute a small percentage of the regional archaeological record.

More intensive use of crops, evidence of more substantial residential architecture in the form of pit houses followed by masonry pueblos, and the making and using of ceramic jars and bowls mark the advent of the Formative era, which dates from about AD 100 or 500 to about AD 1300 or 1400 in various parts of the project area. Although Formative groups continued to hunt game and gather natural plant foods, they increasingly relied on farming and adopted a more sedentary life. The population of the region increased substantially during the Formative era, and sites reflecting this time period dominate the archaeological record of the project area.

The local Formative cultures within the project area are identified by several labels including Anasazi (also called Hisatsinom, or Basketmaker/Pueblo), Sinagua, Virgin Anasazi, and Patayan. More specific spatial and temporal phases have been defined, reflecting substantial differentiation among local populations as evidenced by variation in types of ceramics, architecture, and other cultural traits. At the beginning of the sequence, settlements tended to be small clusters of a few pit houses. Subsequently, larger villages were built, and social and economic systems became quite complex. These are especially evidenced in the eastern part of the project area by the Chaco Canyon people, who constructed scores of large, distinctive pueblos across their territory, built miles of roads to connect many of these places, and traded for exotic goods as far as Mexico.

By about AD 1350 to 1450, the sedentary farming societies no longer existed in most of the region. When the first Spanish explorers arrived in the area during the sixteenth century, they documented sedentary puebloan peoples residing primarily in the Rio Grande Valley of New Mexico, with a few scattered clusters to the west, including approximately half a dozen pueblos each at Zuni and Hopi. Farming societies that spoke Yuman languages lived along the lower Colorado River when the first Europeans arrived in that region.

Athabaskan speakers, who migrated from their original homelands in Canada, arrived in the region about the same time as the Spanish, or perhaps a few centuries earlier, and eventually differentiated into the

Navajo and various Apache groups. The Navajos and Apaches, along with other groups who relied more on hunting and gathering and less on farming, including the Southern Utes, Southern Paiutes, Hualapais, Havasupais, and Yavapais, occupied the regions beyond the more settled groups.

The Spanish arrived in the sixteenth century, but never occupied the project area intensively. However, their arrival greatly affected aboriginal economies through introduction of domesticated animals, new crops, and new crafts, and decimated native populations through the introduction of European diseases. The era of Mexican rule during the second quarter of the 1800s resulted in little change, but after the area became part of the United States during the mid 1800s, the pace of white settlement quickened dramatically. Aboriginal peoples who militarily resisted the newcomers soon were defeated and forced to accept treaties relegating themselves to reservations. Other more cooperative groups such as the Hopi were not forced to sign treaties, but their access to parts of their traditional territories was reduced by imposition of reservations.

Ranching, logging, and mining were major themes of the historic aboriginal and white occupation of the last century and a half. Construction of railroads in the 1880s stimulated integration with national and global economies and increased the pace of settlement. Despite the dominating influence of the U.S. government, many aboriginal cultures remain in the region today. These groups vigorously maintain aspects of their traditional heritage while continuing to adapt their lifeways to the dominant society.

Archaeological and Historical Sites—Archaeological and historical sites are abundant throughout the project area, but little of the project area has been intensively inventoried. Many of the alternative routes are adjacent to previously constructed transmission lines or other utilities such as pipelines. More than a dozen cultural resource surveys were conducted in conjunction with the planning of some of these facilities, but most were undertaken some 10 to 40 years ago and do not reflect current field survey and documentation standards. The two surveys of existing linear facilities that do meet current standards for survey parallel approximately 12 percent of the length of all the NTP alternative routes.

Agency records were reviewed to compile information about prior inventories and previously recorded archaeological and historical sites. Numerous prior surveys were identified as encompassing portions of 0.5-mile-wide study corridors along all of the alternative routes. Many of these prior surveys are not well documented, but they constitute approximately a 3 to 4 percent sample of the study corridors in New Mexico and Arizona, and about 16 percent of the corridors in Nevada. About 280 previously recorded archaeological and historical sites were identified within the 0.5-mile-wide corridors along all the alternative routes (Figures MV-14E and MV-14W). About 15 percent of these are in New Mexico, 81 percent in Arizona, and 4 percent in Nevada.

Criteria were developed for characterizing the recorded archaeological and historical sites as having low, moderate, or high sensitivities. *Low sensitivity* was assigned to sites consisting of artifact scatters with little potential for buried archaeological deposits and features. *Moderate sensitivity* was assigned to archaeological sites representing small to moderate prehistoric or historic habitations, temporary camps, and work stations. *High sensitivity* was assigned to major prehistoric and historic locales, including large habitation sites and sites where burials have been specifically documented.

Characterization of archaeological and historical sensitivity for the alternative routes is based on the compiled information and the results of selected prior surveys within each of the physiographic/ environmental zones crossed by each route. Areas where the available data suggest an average of one or more sites expected per linear mile of right-of-way, with many of these sites being large and complex, are characterized as high sensitivity zones. Sensitivity is classified as moderate where an average of one site can be expected within approximately every two to four linear miles of right-of-way, with some sites being large and complex. Regions where an average of one archaeological or historical site can be expected for about every five or more linear miles of right-of-way, and relatively few are expected to be complex, are characterized as low sensitivity zones.

Projected sensitivities are typically high in the east and decrease to the west. About 80 percent of the total miles of alternative corridors in the New Mexico section of the project area are characterized as being highly sensitive, with the others classed as low sensitivity zones. Approximately 10 percent of the alternative corridors in Arizona are classified as highly sensitive, about 50 percent as moderately sensitive, and the remaining 40 percent as low sensitivity zones. All of the alternative routes in Nevada are characterized as having low sensitivity.

Special Status Cultural Resources—These were defined to focus consideration on resources having particular designations reflecting agency priorities for in-place preservation or public interpretation. Three levels of high sensitivity were defined for special status resources. *High-moderate sensitivity* resources include properties listed on state registers, resources designated by the BLM as ACECs, or other resources provided special protection or public interpretation by other agencies such as the Forest Service. *High sensitivity* resources include properties listed on the National Register of Historic Places, candidates for designation as Chaco protection sites, and tribal cultural parks. *Very high sensitivity* resources include national monuments and national historic sites managed by the NPS, designated national historic landmarks, national historic roads, and major archaeological sites that have been designated as Chaco protection sites in association with the Chaco Culture National Historic Park.

The values of special status resources could be affected by visual intrusions, and the analysis was coordinated with the visual resource studies. Accordingly, special status resources were evaluated within a six-mile-wide study corridor centered along each alternative transmission line route.

A total of 10 special status cultural resources were identified within the six-mile-wide corridors that were inventoried. Two of these are in New Mexico, seven in Arizona, and one is on the border between Arizona and Nevada.

Traditional Cultural Places—Many American Indian communities reside within or in the vicinity of the project area and heritage resources related to their traditional lifeways are common. Consideration of traditional cultural places as an aspect of environmental impact analysis and historic preservation studies is a new emphasis of regulatory review. Because such considerations are a recent development, no extensive repositories of inventory information have been developed, and often information about traditional places, particularly those related to ritual and ceremonial uses, is considered confidential and therefore is not readily available.

In conjunction with preparation of this DEIS, three separate studies were undertaken to address traditional cultural places valued by the three tribes that were formally designated as cooperating agencies for the DEIS studies, and whose reservation lands might be directly affected by the project. These tribes include the Navajo, Hopi, and Hualapai. Tribal members of each group participated in these studies, which were tailored to address the specific concerns of each tribe.

The Navajo study focused on places named in major ceremonial stories. The Hopi study primarily relied on land use information that had been previously compiled for land claims cases. The Hualapai study emphasized places named in traditional histories of the various social bands of the Hualapai, particularly resource collection, habitation, and burial areas. Although data collection strategies were tailored for each study, all focused on six-mile-wide study corridors centered on each link of the alternative routes.

The three studies identified many places having high sensitivity for traditional Navajos, Hopis, and Hualapais. In general, sensitivities for each group are high in many places within the core of their own traditional territory and decline with distance. The high sensitivity areas of the Navajos and Hopis overlap considerably in the eastern part of the project area and decrease to the west, where sensitivities become high for the Hualapais. Inventoried information within the six-mile-wide corridors served as the basis to establish sensitivity levels that are shown within a one-mile-wide corridor for all of the alternative routes.

Because traditional resources are so broadly distributed, no route can avoid crossing zones characterized as having high traditional cultural sensitivity. More detailed inventories of traditional cultural places and site specific impact analyses will be compiled for the selected route in conjunction with similar follow-up surveys for archaeological and historical sites. Measures to avoid or mitigate direct impacts will be explored in accordance with the programmatic agreement negotiated in compliance with Section 106 of the NHPA.

ALTERNATIVES

Eastern Area Transmission Line Alternatives

The characteristics of the cultural resources along the eastern area alternative routes are summarized in Table 3-7 and on Figures MV-14E, MV-15E, MV-16E, and MV-18E.

Glen Canyon 1 (GC1)

New Mexico

Archaeological and Historical Sites—This section of GC1, which is approximately 35 miles long, crosses the Chuska Valley. This route across the valley is generally rated as having high sensitivity for archaeological and historical sites, except for a 15-mile segment of Link 460 across badlands of Mancos shale, which is rated as having low sensitivity.

TABLE 3-7
SUMMARY OF CULTURAL RESOURCES ALONG THE EASTERN ALTERNATIVE ROUTES

Resource Type	New Mexico	Arizona	Total
Glen Canyon 1 (GC1)			
Archaeological and Historical Sites	20 miles high sensitivity 15 miles low sensitivity	56 miles high sensitivity 113 miles moderate sensitivity 57 miles low sensitivity	76 miles high 113 miles moderate 72 miles low
Special Status Cultural Resources		Cameron Bridge (high sensitivity)	Cameron Bridge (high sensitivity)
Traditional Navajo Cultural Places	25 miles high sensitivity 10 miles moderate sensitivity	29 miles high sensitivity 197 miles moderate sensitivity	54 miles high 207 miles moderate
Traditional Hopi Cultural Places	28 miles low sensitivity (reflects lack of data, not necessarily lack of resources)	114 miles high sensitivity 15 miles moderate sensitivity 97 miles low sensitivity (48 ritual places; 12 nonritual places)	48 ritual places 12 nonritual places
Kaibito 1 (K1)			
Archaeological and Historical Sites	20 miles high sensitivity 15 miles low sensitivity	56 miles high sensitivity 97 miles moderate sensitivity 57 miles low sensitivity	76 miles high 97 miles moderate 72 miles low
Special Status Cultural Resources		Cameron Bridge (high sensitivity)	Cameron Bridge (high sensitivity)
Traditional Navajo Cultural Places	25 miles high sensitivity 10 miles moderate sensitivity	29 miles high sensitivity 181 miles moderate sensitivity	54 miles high 191 miles moderate
Traditional Hopi Cultural Places	28 miles low sensitivity (reflects lack of data, not necessarily lack of resources)	99 miles high sensitivity 16 miles moderate sensitivity 95 miles low sensitivity (44 ritual places; 11 nonritual places)	44 ritual places 13 nonritual places
Central 1 (C1)			
Archaeological and Historical Sites	40 miles high sensitivity	37 miles high sensitivity 104 miles moderate sensitivity 6 miles low sensitivity	77 miles high 104 miles moderate 6 miles low

TABLE 3-7 SUMMARY OF CULTURAL RESOURCES ALONG THE EASTERN ALTERNATIVE ROUTES			
Resource Type	**New Mexico**	**Arizona**	**Total**
Special Status Cultural Resources	Pictured Cliffs Site Mitten Rock District (high-moderate sensitivity)	Taawa Hopi Tribal Park Cameron Bridge (high sensitivity)	Pictured Cliffs Mitten Rock District Taawa Tribal Park Cameron Bridge
Traditional Navajo Cultural Places	21 miles high sensitivity 19 miles moderate sensitivity	70 miles high sensitivity 77 miles moderate sensitivity	91 miles high 96 miles moderate
Traditional Hopi Cultural Places	24 miles high sensitivity (reflects lack of data, not necessarily lack of resources)	147 miles high sensitivity (64 ritual places) (5 nonritual places)	64 ritual places 5 nonritual places
Central 2 (C2)			
Archaeological and Historical Sites	20 miles high sensitivity 15 miles low sensitivity	7 miles high sensitivity 154 miles moderate sensitivity 15 miles low sensitivity	27 miles high 154 miles moderate 30 miles low
Special Status Cultural Resources		Hopi Taawa Tribal Park Cameron Bridge (high sensitivity)	Hopi Taawa Park Cameron Bridge
Traditional Navajo Cultural Places	25 miles high sensitivity 10 miles moderate sensitivity	63 miles high sensitivity 113 miles moderate sensitivity	88 miles high 123 miles moderate
Traditional Hopi Cultural Places	28 miles high sensitivity (reflects lack of data, not necessarily lack of resources)	162 miles high sensitivity 14 miles low sensitivity (66 ritual places) (4 nonritual places)	66 ritual places 4 nonritual places
NOTE: Distances have been rounded to nearest mile.			

Special Status Cultural Resources—There are no special status cultural resources along the New Mexico segment of GC1.

Traditional Cultural Places—Traditional Navajo cultural places along GC1 are rated as having high sensitivity for about 25 miles, and moderate sensitivity for about 10 miles. About 28 miles of Link 460 are in New Mexico. This unit is rated as having low sensitivity for traditional Hopi cultural places, although no specific resources have been identified. This rating reflects lack of available data, not necessarily a lack of resources or Hopi interest in the area.

Arizona

Archaeological and Historical Sites—Environmental subregions crossed by the east-west portion of GC1 are identified as the Gothic Mesas, Chinle Valley, the border area between the north end of Black Mesa and the southern edge of the Tsegi Mesas, Shonto Plateau, and the Kaibito Plateau. These subregions are characterized as a mixture of primarily moderate to high sensitivity zones for archaeological and historical sites. The north-south portion of GC1 crosses the Kaibito Plateau and the Painted Desert subregions, which are characterized primarily as having moderate and low sensitivities for archaeological and historical sites. The GC1 alternative has approximately 56 miles rated as having high sensitivity, 113 as moderate, and 57 as low.

Special Status Cultural Resources—Only one special status cultural resource is located along GC1—a bridge over the Little Colorado River at Cameron (Link 1386). This bridge is listed on the National Register of Historic Places, and is rated as having high sensitivity.

Traditional Cultural Places—Approximately 29 miles are rated as highly sensitive for traditional Navajo cultural places, and the other 197 miles are rated as moderately sensitive. The highest sensitivities are in the Marsh Pass area on the northern end of Black Mesa. Links totaling about 114 miles are rated as having high sensitivity for Hopi traditional places, about 15 miles as moderate sensitivity, and 97 miles as low sensitivity. This reflects a total of 48 known traditional Hopi places associated with rituals within a six-mile-wide corridor, and another 12 nonritual traditional use areas. The highest sensitivity areas are scattered along the east-west portion of GC1.

Kaibito 1 (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1).

Archaeological and Historical Sites—K1 crosses approximately 20 miles of moderate sensitivity zones.

Special Status Cultural Resources—No special status cultural resources are located along K1.

Traditional Cultural Places—K1 crosses about 20 miles of moderate sensitivity zones for traditional Navajo cultural places. Approximately two miles of the corridor are characterized as having moderate sensitivity for traditional Hopi cultural places, and the remainder is rated as a low sensitivity zone. One known Hopi nonritual traditional use area was identified.

Central 1 (C1)

<u>New Mexico</u>

Archaeological and Historical Sites—This section of C1 stretches approximately 40 miles across the Chuska Valley, which is rated as having high sensitivity for archaeological and historical sites.

Special Status Cultural Resources—Two special status cultural resources located along C1 are the Pictured Cliffs site, a petroglyph (rock art) locality, and the Mitten Rock Archaeological District. Both are listed on the New Mexico Register of Cultural Properties. [The Hogback Chaco protection site also is about three miles from the C1 reference centerline, but is screened by The Hogback.]

Traditional Cultural Places—Traditional Navajo cultural places along C1 are rated as having high sensitivity for 21 miles and moderate sensitivity for 19 miles. No known traditional Hopi places were identified in New Mexico, but Link 700, extending about 24 miles into New Mexico, is rated as having high sensitivity. This reflects lack of available data and not necessarily a lack of resources or Hopi interest in the area.

<u>Arizona</u>

Archaeological and Historical Sites—C1 crosses the Colorado Plateau and environmental subregions identified as the Chuska Mountains, Defiance Plateau, Chinle Valley, Black Mesa, Tusayan Washes, Moenkopi Plateau and the Painted Desert. The eastern subregions are characterized as high sensitivity zones, the central subregions as moderate sensitivity zones, and the western Painted Desert subregion as a low sensitivity zone, except for the crossing of the Little Colorado River, which is rated as high. A total of 37 miles are rated as highly sensitive, 104 miles as moderately sensitive, and 6 miles as a low sensitivity zone for archaeological and historical sites.

Special Status Cultural Resources—Two special status cultural resources are located along C1 (Link 780). They are the Hopi Taawa tribal park, which has been defined to protect a group of petroglyphs northwest of Third Mesa, and the Cameron Bridge, which is listed on the National Register of Historic Places.

Traditional Cultural Places—Traditional Navajo cultural places along the route are rated as highly sensitive for approximately 70 miles and as moderately sensitive for 77 miles, with the highest sensitivities in the Chuska Mountains and on Black Mesa. The entire length of the Arizona segment of C1 is rated as a high sensitivity zone for traditional Hopi places. This reflects a total of 64 known traditional Hopi ritual places and five nonritual traditional use areas within a six-mile-wide study corridor.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains along Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1.

Archaeological and Historical Sites—All of Link 462 is characterized as a moderate sensitivity zone.

Special Status Cultural Resources—No special status cultural resources are located along Link 462.

Traditional Cultural Places—Link 462 is rated as a moderate sensitivity zone for traditional Navajo cultural places, and as a high sensitivity zone for traditional Hopi cultural places. Eight known Hopi ritual places are located along Link 462.

Substation Alternatives

Shiprock Substation—Only one prior cultural resource survey along a linear transect is documented within the immediate vicinity, and no archaeological or historical sites were found. However, several sites have been recorded in the general vicinity and the existing substation is situated within an area characterized as having high sensitivity for archaeological and historical sites. Several archaeological or historical sites could be expected within the expansion area. Pictured Cliffs, a petroglyph site listed on the New Mexico Register of Cultural Properties, is the closest special status cultural resource, but it is located about three miles to the southeast. The region is characterized as having low to moderate sensitivity for traditional Navajo cultural places. No traditional Hopi cultural sensitivity is projected, but this reflects lack of available data and not necessarily a lack of resources or Hopi interest.

Honey Draw, Red Mesa, and Copper Mine Substation Sites—The site is situated on the Kaibito Plateau, which is generally characterized as having moderate sensitivity for archaeological and historical sites. No cultural resource surveys have been conducted within the area. Archaeological or historical sites could be present, but are unlikely to be very large or complex. There are no special status cultural resources in the vicinity of the site. The region is characterized as having moderate sensitivity for traditional Navajo cultural places, and generally high sensitivity for traditional Hopi cultural places.

Moenkopi Substation—Four archaeological sites were recorded in the vicinity of the Moenkopi Substation prior to the original construction of the facility, and excavations were conducted at two of the sites. Four hearth features were found at one of the excavated scatters of lithic artifacts; the other site yielded no subsurface features or deposits. In general, the substation is situated within an area characterized as having low to moderate sensitivity for archaeological and historical sites. A few archaeological or historical sites could be present, but are unlikely to be very large or complex. The Cameron Bridge, which is listed on the National Register of Historic Places, is the closest special status cultural resource, but it is located about four miles to the northeast. The region is characterized as having moderate sensitivity for traditional Navajo and high sensitivity for traditional Hopi cultural places.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace

The characteristics of the cultural resources along the western area alternative routes are summarized in Table 3-8 and on Figures MV-14W through MV-18W, and described in the following sections.

TABLE 3-8
SUMMARY OF CULTURAL RESOURCES ALONG THE WESTERN ALTERNATIVE ROUTES

Resource Type	Arizona	Nevada	Total
Northern 1 West (N1W) (Moenkopi to Marketplace)			
Archaeological and Historical Sites	90 miles moderate sensitivity 97 miles low sensitivity	30 miles low sensitivity	90 miles moderate 127 miles low
Special Status Cultural Resources	Moqui Stage Station		Moqui Stage Station
Traditional Navajo Cultural Places	16 miles high sensitivity 68 miles moderate sensitivity 7 miles low sensitivity		16 miles high 68 miles moderate 7 miles low
Traditional Hopi Cultural Places	24 miles high sensitivity 67 miles moderate sensitivity 96 miles low sensitivity (1 ritual place) (1 nonritual trail)	13 miles low sensitivity	1 ritual place 1 nonritual trail
Traditional Hualapai Cultural Places	60 miles high sensitivity 103 miles moderate sensitivity	13 miles moderate sensitivity	60 miles high 116 miles moderate
Northern 2 (N2) (Moenkopi to Marketplace)			
Archaeological and Historical Sites	37 miles moderate sensitivity 158 miles low sensitivity	30 miles low sensitivity	37 miles moderate 188 miles low
Special Status Cultural Resources	Route 66 (2 locations) Beale Road Moqui Stage Station Wright Canyon ACEC		Route 66 (2 locations) Beale Road Moqui Stage Station Wright Canyon ACEC
Traditional Navajo Cultural Places	16 miles high sensitivity 68 miles moderate sensitivity 7 miles low sensitivity		16 miles high sensitivity 68 miles moderate sensitivity 7 miles low sensitivity

TABLE 3-8 SUMMARY OF CULTURAL RESOURCES ALONG THE WESTERN ALTERNATIVE ROUTES			
Resource Type	Arizona	Nevada	Total
Traditional Hopi Cultural Places	24 miles high sensitivity 67 miles moderate sensitivity 104 miles low sensitivity (1 ritual place) (1 nonritual trail)	13 miles low sensitivity	1 ritual place 1 nonritual trail
Traditional Hualapai Cultural Places	50 miles high sensitivity 121 miles moderate sensitivity	13 miles moderate sensitivity	50 miles high sensitivity 134 miles moderate sensitivity
Southern 2 (S2) (Moenkopi to Marketplace)			
Archaeological and Historical Sites	60 miles moderate sensitivity 158 miles low sensitivity	30 miles low sensitivity	60 miles moderate 188 miles low
Special Status Cultural Resources	Wupatki National Monument Route 66 (2 locations) Beale Wagon Road (3 locations) Wright Canyon ACEC		Route 66 (2 locations) Beale Wagon Road (3 locations) Wright Canyon ACEC
Traditional Navajo Cultural Places	20 miles high sensitivity 28 miles moderate sensitivity		20 miles high 28 miles moderate
Traditional Hopi Cultural Places	19 miles high sensitivity 13 moderate sensitivity 187 low sensitivity (2 ritual places) (1 nonritual trail)	13 miles low sensitivity	2 ritual places 1 nonritual trail
Traditional Hualapai Cultural Places	82 miles high sensitivity 66 miles moderate sensitivity	13 miles moderate sensitivity	82 miles high 79 miles moderate
Northern 3 (N3) (Moenkopi to Mead)			
Archaeological and Historical Sites	90 miles moderate sensitivity 99 miles low sensitivity	11 miles low sensitivity	90 miles moderate sensitivity 110 miles low sensitivity
Special Status Cultural Resources	Moqui Stage Station Willow Beach Gauging Station		Moqui Stage Station Willow Beach Gauging Station
Traditional Navajo Cultural Places	16 miles high sensitivity 68 miles moderate sensitivity 7 miles low sensitivity		16 miles high sensitivity 68 miles moderate sensitivity 7 miles low sensitivity

TABLE 3-8
SUMMARY OF CULTURAL RESOURCES ALONG THE WESTERN ALTERNATIVE ROUTES

Resource Type	Arizona	Nevada	Total
Traditional Hopi Cultural Places	24 miles high sensitivity 67 miles moderate sensitivity 97 miles low sensitivity (1 ritual place) (1 nonritual trail)	11 miles low sensitivity	1 ritual place 1 nonritual trail
Traditional Hualapai Cultural Places	60 miles high sensitivity 104 miles moderate sensitivity	11 miles moderate sensitivity	60 miles high 114 miles moderate
Northern 4 (N4) (Moenkopi to Mead)			
Archaeological and Historical Sites	37 miles moderate sensitivity 159 miles low sensitivity	11 miles low sensitivity	37 moderate 170 miles low
Special Status Cultural Resources	Moqui Stage Station Route 66 (2 locations) Beale Wagon Road Willow Beach Gauging Station Wright Canyon ACEC		Moqui Stage Station Route 66 (2 locations) Beale Wagon Road Willow Beach Gauging Station Wright Canyon ACEC
Traditional Navajo Cultural Places	16 miles high sensitivity 68 miles moderate sensitivity 7 miles low sensitivity		16 miles high sensitivity 68 miles moderate sensitivity 7 miles low sensitivity
Traditional Hopi Cultural Places	24 miles low sensitivity 67 moderate sensitivity 105 low sensitivity (1 ritual place) (1 nonritual trail)	11 miles low sensitivity	1 ritual place 1 nonritual trail
Traditional Hualapai Cultural Places	50 miles high sensitivity 123 miles moderate sensitivity	11 miles moderate sensitivity	50 miles high 133 miles moderate
Southern 4 (S4) (Moenkopi to Mead)			
Archaeological and Historical Sites	60 miles moderate sensitivity 159 miles low sensitivity	11 miles low sensitivity	60 miles moderate 170 miles low
Special Status Cultural Resources	Wupatki National Monument Route 66 (2 locations) Beale Wagon Road (3 locations) Willow Beach Gauging Station Wright Canyon ACEC		Route 66 (2 locations) Beale Wagon Road (3 locations) Willow Beach Gauging Station Wright Canyon ACEC

TABLE 3-8 SUMMARY OF CULTURAL RESOURCES ALONG THE WESTERN ALTERNATIVE ROUTES			
Resource Type	Arizona	Nevada	Total
Traditional Navajo Cultural Places	20 miles high sensitivity 28 miles moderate sensitivity		20 miles high 28 miles moderate
Traditional Hopi Cultural Places	19 miles high sensitivity 13 miles moderate sensitivity 188 miles low sensitivity (2 ritual places) (1 nonritual trail)	11 miles low sensitivity	2 ritual places 1 nonritual trail
Traditional Hualapai Cultural Places	82 miles high sensitivity 67 miles moderate sensitivity	11 miles moderate sensitivity	82 miles high 78 miles moderate
NOTE: Distances have been rounded to nearest mile.			

Northern 1 West (N1W)

Arizona

Archaeological and Historical Sites—N1W crosses environmental subregions identified as the Painted Desert, Coconino Plateau, Transition Zone, and the Basin and Range Province. The eastern subregions are generally characterized as moderate sensitivity zones for archaeological and historical sites, along with the section across the plateau at the southern end of the Hualapai Reservation. Sensitivities decline to low levels to the west. A total of 90 miles are rated moderately sensitive, and 97 miles are rated as low sensitivity zones for archaeological and historical sites.

Special Status Cultural Resources—The only special status cultural resource located along N1W is the Moqui Stage Station site. Interpretative signs have been installed by the Kaibab National Forest in conjunction with development of the Arizona Trail.

Traditional Cultural Places—Traditional Hualapai cultural places are rated as highly sensitive for 60 miles, and moderately sensitive for 103 miles of the Arizona section. Traditional Navajo cultural places along the route are rated as highly sensitive for 16 miles, moderate for 68 miles, and low for 7 miles. Traditional Hopi places are rated as having high sensitivity for 24 miles, moderate for 67 miles, and low for 96 miles. This reflects a single known traditional Hopi ritual place and one traditional trail within a six-mile-wide study corridor.

Nevada

Archaeological and Historical Sites—N1W is confined to the environmental subregion identified as the Basin and Range Province. The specific physiographic features crossed by N1W are the Eldorado

Mountains and the Eldorado Valley, which are characterized as low sensitivity zones for archaeological and historical sites.

Special Status Cultural Resources—No special status cultural resources are located along this portion of N1W.

Traditional Cultural Places—Thirteen miles of Link 2060 are characterized as having moderate sensitivity for traditional Hualapai cultural places, and low sensitivity for traditional Hopi cultural places.

Northern 2 (N2)

Arizona

The Arizona portion of N2 is the same as N1W with the exception of Links 1742, 1800, 1980, and 2020, which are located to the south of the Hualapai Reservation and replace Link 1790 on N1W.

Archaeological and Historical Sites—The section of N2 that diverges from N1W and descends from the Hualapai Plateau down onto the Truxton Plain crosses about 60 miles rated as having low sensitivity for archaeological and historical sites.

Special Status Cultural Resources—This section of N2 includes the Beale Wagon Road, U.S. Route 66 at two locations, and the Wright Canyon ACEC. The Beale Wagon Road was surveyed and constructed in 1857-1859 and was a popular immigrant trail during the 1860s and 1870s prior to the construction of railroads. Land-managing agencies have identified and developed parts of this route as a historic recreational trail. U.S. Route 66 has been designated as a historic road, and NPS has studied the highway for possible incorporation or affiliation with the National Park system. The Wright Canyon ACEC is designated primarily for riparian steam values, but has associated archaeological sites.

Traditional Cultural Places—About 42 miles of the Truxton Plain section of N2 are characterized as high sensitivity zones for traditional Hualapai cultural places and about 19 miles are rated as moderately sensitive. Sensitivities for traditional Hopi cultural places are rated as low for this entire section.

Nevada

The Nevada portion of N2 is the same as N1W.

Southern 2 (S2)

Arizona

In Arizona, S2 varies from N2 beginning at the Moenkopi Substation and continuing through Link 2006. At this point, S2 is then the same as N2 proceeding north and west along Links 2020 and 2060 to the crossing of the Colorado River and the Nevada border.

Archaeological and Historical Sites—This section of S2 crosses about 60 miles rated as having moderate sensitivity and 103 miles as low sensitivity.

Special Status Cultural Resources—The Beale Wagon Road is crossed in three locations, U.S. Route 66 is crossed in two locations, and the Wright Canyon ACEC is passed by S2 (all in different locations than N2). In addition, S2 is likely to be visible from portions of Wupatki National Monument, although the line would be about 10 miles or more from the monument boundary.

Traditional Cultural Places—About 82 miles of the eastern section of S2 that varies from N2 are characterized as high sensitivity zones for traditional Hualapai cultural places and about 12 miles are rated as moderately sensitive. Sensitivities for traditional Navajo cultural places are rated as high for about 20 miles and moderate for about 28 miles. Sensitivities for traditional Hopi cultural places are rated as high for about 19 miles, moderate for about 13 miles, and low for about 132 miles. Two known Hopi traditional ritual places and a trail are located along this section of S2.

Nevada

The Nevada portion of the S2 route is the same as N1W and N2 routes.

Western Area Transmission Line Alternatives - Moenkopi to Mead

Northern 3 (N3), Northern 4 (N4), and Southern 4 (S4)

Alternatives N3, N4, and S4 are identical to alternatives N1W, N2, and S2, respectively, with the exception of Links 2040 and 2080, which connect into the Mead Substation rather than the Marketplace Substation (replacing Links 2060, 2200, and 2180). The following description focuses on Links 2040 and 2080.

Arizona and Nevada

Archaeological and Historical Sites, Special Status Cultural Resources, and Traditional Cultural Places—In general, the cultural resource sensitivities are very similar to the N1W, N2, S2 western segment into Marketplace.

This segment crosses areas rated as low sensitivity zones for archaeological and historical sites. The Willow Beach Gauging Station, which is listed on the National Register of Historic Places, is located within the six-mile-wide study corridor along this segment. This historic facility was used to measure the flows of the Colorado River.

Sensitivities for traditional Hualapai cultural places are rated as moderate along portions of the alternative route. This segment crosses about 48 miles of these moderate sensitivity zones. There are no traditional Navajo cultural places and Hopi sensitivities are rated only as low.

Substation Alternatives

Red Lake Substation Site—Two previous linear surveys have been conducted near the site, but neither recorded any archaeological resources in the vicinity of the site. The site is within a portion of a mountain environmental zone that is projected to have moderate sensitivity for archaeological and historical sites. This suggests that a few such sites might be present within the substation area, but they are unlikely to be very large or complex.

The closest special status resource is the Beale Wagon Road, which is located on the opposite side of State Route 64 about one mile to the west of the substation site. The road is not well preserved in this section. Laws Spring, a National Register listed camp site along the Beale Wagon Road, is located almost six miles to the southeast.

The alternative route that connects with the substation site is rated as having medium and high sensitivities for traditional Navajo cultural places. Traditional Hopi cultural place sensitivities are rated as low, and no traditional Hualapai cultural place sensitivities are identified.

Marketplace Substation—A cultural resource survey conducted for development of the Marketplace Substation (then referred to as McCullough II) resulted in the discovery of only four isolated finds and one small lithic scatter, all of which were determined to be insignificant. No special status cultural resources are present in the vicinity of the substation, and no traditional cultural places have been identified in the area.

Mead Substation—Prior cultural resource surveys along transmission lines connecting to the existing substation have recorded only a single isolated artifact in the vicinity of the substation. The general area is characterized as having low sensitivity for archaeological and historical sites. No special status cultural resources are present in the vicinity of the substation, and no traditional cultural places have been identified in the immediate area.

Microwave Communication Facility

No archaeological and historical sites or special status cultural places have been identified in the vicinity of the existing facility. Bill Williams Peak is named in Navajo ceremonial stories, and traditional Hopi places are located on the mountain, but not within the existing communications site.

CHAPTER 4 - ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

The purpose of this chapter is to describe the potential consequences, or impacts, on the environment that could result from the construction, operation, and maintenance of the proposed 500kV transmission line.

Impacts are defined as modifications to the existing condition of the environment that would be brought about by a proposed action. Impacts can be beneficial (positive) or adverse (negative), and can result from the project action directly or indirectly. Impacts can be permanent, long lasting (long term) or temporary (short term). Long-term impacts are defined as those that would substantially remain for the life of the project or beyond. In the case of NTP, the life of the project is estimated to be about 50 years. Short-term impacts are defined as those changes to the environment during construction that generally would revert to preconstruction condition at or within a few years of the end of construction. Impacts can vary in significance from no change or only slightly discernible change, to a full modification of the environment.

Using the information about the existing condition of the environment (Chapter 3) and the description of the proposed action (Chapter 2), the types and magnitude of impacts were identified and quantified to the extent practical at this stage of the project. If the decision is made to construct the transmission line, the final route selected would be investigated further to refine environmental data in preparation for the COMP (e.g., biological and cultural resources).

The sections that follow this introduction address the potential impacts on each resource. Most of the sections contain an overview including brief explanations of the types of impacts anticipated, impact levels (high [H], moderate [M], low [L]), and descriptions of measures to mitigate the impacts, followed by descriptions of the potential impacts or residual impacts (impacts remaining after mitigation is applied) for each project alternative. Air, socioeconomics, noise, and EMF are addressed regionally rather than for each alternative. The last sections in the chapter include a summary of significant unavoidable adverse impacts, cumulative effects, irreversible and irretrievable commitment of resources, and short-term versus long-term productivity.

Because of the large volume of data, it is necessary to summarize the results to the extent appropriate for each resource. The descriptions of potential impacts focus on those resources that could be affected substantially or those identified by the public and/or agencies as issues regardless of the impact (e.g., biology, land use, visual, and cultural resources). Potential impacts on those resources that would not be affected substantially, or that were not identified as major issues (e.g., air, water, earth, paleontology), are presented in a general summary. Impacts on these resources would be minimal (low to moderate) with only slight differences between alternatives.

The descriptions of impacts for each alternative should be reviewed in conjunction with the resource maps provided in the map volume accompanying this DEIS. Also, a fold-out map illustrating the alternatives is provided for reference in the index at the end of this DEIS.

Several of the alternative routes are similar—many share common links with one another. Rather than repeating information, in most cases the descriptions of alternative routes have been abbreviated as appropriate to focus on the segment that is unique to each alternative. *To facilitate review of the alternatives, diagrams that illustrate each alternative route and highlight the segment being described are shown on the fold-out reference key in the index at the end of the DEIS.* A summary explaining the key is provided in the introduction of Chapter 3.

Resource data supporting this DEIS are on file at Western. Also, a description of the impact assessment and mitigation planning process is provided in Appendix A and in the *Navajo Transmission Project Mitigation Plan* (September 1996).

AIR QUALITY

If the project were not implemented (no action), the environment would remain as it presently exists. If the project were implemented, impacts on air quality would be short in duration (during construction) and localized to the general area of activity. This is true regardless of which action alternative would be selected.

During construction, sources of air emissions would include particulate emissions (fugitive dust) from construction operations and tailpipe emissions (nitrogen oxides, carbon monoxide, sulfur oxides, and hydrocarbons) from vehicles and gasoline- or diesel-powered construction equipment. Emissions from construction activities would be confined to the daytime hours and would exist only during active construction periods.

Sources of particulate matter would include grading and earth moving associated with developing access roads and work pad areas, digging, drilling, and, where required, blasting to prepare for the tower foundations, and vehicular traffic. Disturbed surface areas could be a passive source of windblown dust during periods of high wind. Another source of particulate emissions could be temporary concrete batch plants. These would be necessary only when concrete for the tower footings could not be supplied by commercial ready-mix concrete sources, and this would occur only if a tower footing was being built too far from a commercial source.

The identified emission sources are generally fugitive and temporary. These sources would not need Federal prevention of significant deterioration (PSD) permits. State or local air quality permits usually are not required for temporary construction activity sources, but a notice of intent would be filed with each jurisdiction to be certain the project would be in compliance with all permit requirements. The temporary concrete batch plants would require an air quality permit. State and local jurisdictions have specific rules for permitting this type of temporary mobile source that may require the batch plant to have a general permit already in place rather than one specific to this project, or a permit that would apply to more than one individual project site.

Principal air quality impacts associated with the operational phase of the transmission system would include windblown dust from disturbed ground surfaces, road dust, and vehicle exhaust during periodic maintenance checks or emergency repair activities.

Mitigation measures would be used to limit particulate emissions during both the construction and operational phases. The need for specific measures would, to some extent, be dictated by the nature of the local ground surface, vegetative cover, and meteorological conditions. Snow-covered or heavily vegetated surfaces, for example, may need little dust control, while very dry silty surfaces may require considerable dust control. Control of dust includes minimizing the amount of ground surface disturbed to leave natural vegetation and soil surface conditions intact. Where ground must be disturbed and is subject to active vehicle or equipment traffic, dry surfaces would be watered. An effective watering program should obtain at least a 50 percent reduction in dust emissions.

Upon completion of construction, the area would be returned to its natural contour and vegetative cover as appropriate.

WATER RESOURCES

Overall, impacts on surface water resources would be low since there would be limited or no ground disturbance in the vicinity of water resources, resulting in indiscernible-to-minor effects. There would be low or no impacts on ground water since construction activities generally would not reach ground water depths.

Perennial Streams and Springs—Ground disturbing activities in the vicinity of surface water features could result in increased sedimentation, which could affect the aquatic ecology, the quality of domestic water supplies and irrigation systems, and the aesthetic quality of the stream or river. Accidents involving construction equipment adjacent or proximal to a surface water feature could result in spillage of petroleum products or construction materials that could contaminate nearby water. Construction activities could disrupt the natural flow and/or quality of springs. However, mitigation which precluded limiting the construction of new access roads in the vicinity of streams would protect the integrity of the riparian areas, streambanks, and streambeds, and avoid turbidity and sedimentation. In addition, structures and roads would be placed to avoid sensitive features including springs, streams and other drainages. Therefore, impacts on perennial streams and springs would be low.

100-year Floodplains—A 100-year floodplain could be susceptible to increased sedimentation and bank erosion due to inundation from rainfall or snowmelt. By avoiding placement of a tower in a designated 100-year floodplain or major wash, effects on erosion and deposition, tower stability, and modified flow patterns can be reduced. Impacts on 100-year floodplains are anticipated to be low.

EFFECTS OF EACH ALTERNATIVE

No-action Alternative

Under this alternative, the environment would remain as it presently exists.

All Other Alternatives

Because residual impacts on water resources would be low, a description specific to each alternative is not provided.

EARTH RESOURCES

The primary concern of the earth resources investigation was the potential for accelerated soil erosion. Overall, the majority of impacts on soils would be low resulting from the limited extent of ground disturbance causing indiscernible-to-minor increases in erosion rates. Moderate impacts would result in minor-to-substantial increases in erosion rates and occur only in a very localized areas where there are soils with severe/high erosion potential in steep terrain (e.g., along Links 504 and 561 in the Marsh Pass area). No high impacts (substantial-to-extensive increases in erosion rates) are expected.

Soil Erosion—Erosion potential is the result of several factors including slope, vegetation cover, climate, and the physical and chemical characteristics of the soil, and is an indication of how susceptible soils are to increased erosion if disturbed. Increased soil erosion may occur when vegetation is removed during construction or in areas where the surface is disturbed by heavy equipment. Increased water erosion often occurs during high-intensity or long-duration rain storms and may reduce the productivity of the soil as well as affect the water quality of streams by accelerating sediment loading. Construction activities could also cause loss of productivity of agricultural and grazing land (as discussed in land use) because of soil compaction and/or increased erosion. Wind is also an erosion factor throughout northwestern New Mexico and northeastern Arizona.

Impacts can occur during operation. The surface of access roads could be exposed to water and wind actions potentially resulting in soil erosion.

Accelerated soil erosion would be reduced by not widening or otherwise upgrading existing access roads and aligning new or cross-country access with landform contours.

Unique Geologic Features and Mineral Resources—No unique geologic features were identified in proximity of the alternatives; therefore, there would be no impacts on these resources. Impacts on mineral resources are not anticipated.

EFFECTS OF EACH ALTERNATIVE

No-action Alternative

Under this alternative, the environment would remain as it presently exists.

Eastern Area Transmission Line Alternatives

Because the majority of impacts on soils would be low, a description for each alternative is not provided. A summary of impacts on soils is shown in Table 4-1 and illustrated on Figure MV-2E (map volume).

TABLE 4-1
SUMMARY OF POTENTIAL IMPACTS ON SOILS - EASTERN AREA ALTERNATIVES

Alternative Route	Impact	Miles of Residual Impacts		Total
		NM	AZ	
GC1	M	—	15.0	15.0
K1	M	—	16.8	16.8
C1	M	2.5	—	2.5
C2	M	—	3.0	3.0

Substation Alternatives

Impacts on soils at the Shiprock, Honey Draw, Red Mesa, and Moenkopi substation sites would be low. No impacts on soils at the Copper Mine Substation site are expected.

Western Area Transmission Line Alternatives

Because the majority of impacts on soils would be low, a description for each alternative is not provided. A summary of impacts is shown in Table 4-2 and illustrated on Figure MV-2W.

TABLE 4-2
SUMMARY OF POTENTIAL IMPACTS ON SOILS - WESTERN AREA ALTERNATIVES

Route	Impact	Miles of Residual Impacts		
		AZ	NV	Total
Moenkopi to Marketplace				
N1W	M	2.1	0.6	2.7
N2	M	3.0	0.6	3.6
S2	M	1.2	0.6	1.8
Moenkopi to Mead				
N3	M	0.9	0.0	0.9
N4	M	1.8	0.0	1.8

Substation Alternatives

Impacts on soils at the Red Lake, Marketplace, and Mead substation sites would be low.

Microwave Communication Facility

There would be no impacts on soils.

BIOLOGICAL RESOURCES

Overall, impacts on biological resources would be low with a minimal amount of moderate impacts in two very localized areas (e.g., in Marsh Pass and The Hogback).

Impacts on biological resources are based predominantly on resource sensitivity and estimated ground disturbance. Resource sensitivity is based on several criteria including vulnerability of the resource to increased human access, level of agency concern, legal protection, and rarity of the resource within the project area. Estimates of ground disturbance are based on the amount of upgrading or new access road needed in context with the terrain (e.g., slope) (see Table 2-4). The majority of the alternative routes would parallel existing linear facilities (e.g., transmission lines) thereby minimizing the need for new access roads and thus reducing most impacts on biological resources.

A low impact would result when the proposed action is expected to affect vegetation, wildlife, special status species, or unique habitat only slightly. For example, vegetation types considered to be low sensitivity (e.g., Great Basin desertscrub) or moderate sensitivity (e.g., piñon-juniper woodlands) in areas where there is existing access and disturbance would be minimal were assigned low impacts. Similarly, big game and special status species considered to be low sensitivity in areas where there is existing access and disturbance would be minimal were assigned low impacts.

A moderate impact would result when the proposed action is expected to substantially affect vegetation, special status species, or unique habitat (e.g., biological resources of moderate or high sensitivity in areas where disturbance from construction would be greater). For example in The Hogback (Link 640), Mancos milkvetch, Federally listed as endangered, could be present in an area of steep terrain where new access would be needed (0.1 mile).

A high impact would result when the proposed action is expected to significantly affect special status species, unique habitat, vegetation, or wildlife considered to be highly sensitive. These could include areas where mitigation may be only partially effective, resulting in long-term or permanent loss of important habitat or substantial disturbance to a resource (e.g., during critical period in the life cycle of wildlife species). For this project, mitigation would reduce all initially high impacts to lower levels.

OVERVIEW

Vegetation—In the immediate vicinity of construction areas, vegetation could be trampled and soils compacted. The rate and success of revegetation in these areas would depend on the vegetation type, soils, climatic conditions, and extent of damage. A small amount of vegetation would be removed permanently in areas where towers would be placed or where new or upgraded access roads would be required for construction and maintenance for the transmission line. Tree removal would be required in selected areas to comply with NESC requirements for ensuring human safety and line reliability.

Mitigation measures effective in minimizing impacts on vegetation are those designed primarily to limit ground disturbance. In areas where vegetation is considered highly sensitive, existing roads would not be widened and, where practical, new roads would not be constructed. To minimize ground disturbance and reduce erosion, new access roads would follow landform contours and access would be restricted after construction if not needed for maintenance of the line. Towers would be carefully placed to avoid sensitive features (e.g., riparian areas, special status plant species) to span the features. Right-of-way clearing would be minimized to reduce loss of biomass in densely vegetated areas (e.g., Chuska Mountains). Following construction, affected areas would be rehabilitated as appropriate.

Because of the low sensitivity of habitats throughout much of the project area coupled with the relatively small amount of vegetation loss, the majority of residual impacts on vegetation are anticipated to be low. Since the majority of the alternative routes would parallel existing linear facilities, land needed for new access roads would be minimized. Impacts on sensitive areas, such as riparian woodlands and wetlands, would be minimized by careful placement of towers or selective clearing of right-of-way.

Big Game—Big game species could be affected by disruption of habitat, vegetation removal, disturbance from construction activities, or presence of humans. Clearing trees from the right-of-way (e.g., Chuska Mountains) would disrupt habitat; however, the cleared area would be open and meadow-like, and with the appropriate seed mix for revegetation, could be attractive to certain species for grazing. Direct mortality could also occur along travel routes. Impact on big game species would depend on their mobility, size and extent of range, habitat selectivity, and the duration and timing (e.g., season of life cycle) of construction activities. Indirect impacts could occur where increased access to wildlife habitat could allow use of the area by humans increasing the potential for harassment and legal take of big game.

Mitigation measures effective in minimizing impacts on big game species are those designed to limit disturbance and reduce human accessibility. In sensitive areas where access roads are not needed, travel could be overland. In sensitive areas (e.g., bighorn sheep habitat) where roads are needed, access would be restricted after construction. Certain areas of unique or important habitats (e.g., riparian areas) would be spanned by the transmission line to avoid direct loss or damage. To reduce impacts on wildlife during critical seasons in their life cycle, construction would be curtailed during such times. Right-of-way clearing would be minimized to reduce loss of biomass in densely vegetated areas (e.g., Chuska Mountains).

Residual impacts on big game are anticipated to be low along all of the alternative routes. Although some modification of habitat would result from the proposed project, it would affect a small percentage of the habitat and the overall long-term impact on local big game populations would be minimal. Ground disturbance and habitat loss would be minimized since the majority of alternative routes would parallel existing transmission lines. Impacts resulting from direct mortality along travel routes are anticipated to be low; however, this depends on the construction period, density of wildlife populations, and the overall incidence of travel on the access roads. Big game species are mobile enough to move away from disturbance during construction, although there is some possibility that such movement could be from areas of high quality habitat to areas of lesser quality.

Other Wildlife—There is a possibility of waterfowl or other birds colliding with transmission line conductors or, more likely, the ground wires above the conductors, particularly along rivers that serve as migration corridors. At the river crossings for the proposed alternatives one or more transmission line(s) presently exist. A new line or the proposed project would not significantly increase the potential for collisions. The design of high-voltage electrical transmission lines (e.g., spacing of the conductors) reduces the possibility of electrocution of raptors to minimal levels.

Increased noise and activity levels associated with construction could disturb raptors during breeding and nesting, affecting reproductive success or resulting in nest abandonment. Curtailing construction during such critical seasons of their life cycle would reduce those potential impacts.

Increased predation on herptofauna (e.g., lizards and young tortoises) and small mammals could result as transmission line towers provide new perches for raptors and ravens. Increased human access into areas could result in more opportunities for poaching or direct mortality of tortoises, lizards, and snakes. The indirect effect of increased predation and greater public access would be minimal since the majority of the alternative routes parallel existing transmission lines.

Effects on fish and their aquatic habitat would be avoided by placing towers so that the transmission line spans rivers, perennial streams, and sensitive riparian areas.

Special Status Species—Ground-disturbing activities could result in impacts on special status plant species and their habitats, as well as some special status wildlife species (e.g., Mojave desert tortoise). Some plant species are subject to collecting for horticultural or medicinal purposes, while several wildlife species are valued by collectors. Indirect impacts from increased access in areas where such species occur could result in loss of these species from collecting or degradation of habitat (e.g., trampling and compaction from increased use). Impacts on wildlife species could include disturbance during critical periods in their life cycle, displacement of such species into other areas, or direct mortality of individuals because of increased vehicular activity.

Residual impacts on habitats suitable for special status plant and wildlife species would be low except for 0.1 mile of potential moderate impact in The Hogback (Link 640). The project proponents would be required to adhere to mitigation set forth in a FWS Biological Opinion (Section 7 of the Endangered Species Act) for species listed as threatened or endangered. Also, the project proponents would coordinate with land-managing agencies to develop measures for species of concern that are not Federally listed.

Habitat suitable to support numerous special status plant and wildlife species exists along the alternative routes. Because of the lack of inventoried data, it was possible only to predict initial impacts at this stage of the project. Mitigation would be implemented in accordance with legal mandates and agency policy if such resources are located during preconstruction biological resources surveys. These surveys would be conducted wherever suitable habitat for protected species is present and biological information is needed to develop effective mitigation measures. It is likely that residual impacts would be low in such cases.

EFFECTS OF EACH ALTERNATIVE

The following descriptions of impacts focuses primarily on biological resources assigned a high sensitivity, areas where moderate impacts could occur along the alternative routes, and/or resources or areas of particular concern to agencies.

Tables summarizing impacts are presented in Appendix D for vegetation (Table D-5), known habitat of special status plants (Table D-6), potential habitat for special status plants (Table D-7), special status wildlife (Table D-8), and big game (Table D-9).

No-action Alternative

Under this alternative, the environment would remain as it presently exists.

Eastern Area Transmission Line Alternatives

Impacts on biological resources are illustrated on Figures MV-4E, MV-5E, and MV-6E.

Glen Canyon 1 (GC1)

New Mexico

Vegetation—Impacts on vegetation would be low. GC1 would cross riparian vegetation along the San Juan River (Link 460); however, impacts would be low because the transmission line would span the river and riparian vegetation.

Big Game—Impacts on big game species along this segment of GC1 would be low.

Special Status Species—Impacts on special status plant species, which include Mesa Verde cactus and Mancos milkvetch on The Hogback (Links 100 and 120) would be low if individual plants were first identified during preconstruction surveys and then protected from construction activities. Suitable habitat for such species could occur at tower sites and along spur roads. Preconstruction surveys to identify plants and on-site monitoring during construction would be required in such areas to avoid loss of individual plants. Because there is existing access along the majority of GC1, public use is not anticipated to increase appreciably. Therefore, associated indirect impacts on special status species would be low.

Spanning the San Juan River and implementing effective erosion-control measures to reduce or prevent sedimentation would minimize or eliminate impacts on special status fish species, including razorback sucker and Colorado squawfish. Because of existing lines in the immediate vicinity of the proposed crossing, an additional line would not significantly increase the potential for collisions by birds. Moreover, because of the size and visibility of 500kV conductor bundles, collisions by birds are rare.

Arizona

Vegetation—Residual impacts on vegetation along the Arizona segment of GC1 would be low, except 0.3 mile of moderate impact in the Marsh Pass area where vegetation of moderate sensitivity could be affected in an area of very steep terrain.

Big Game—Impacts on big game along GC1 would be low. The majority of this route parallels existing transmission lines, and access in the area would increase minimally.

Special Status Species—Impacts are anticipated to be low. Habitat on Black Mesa and/or other cliffs in the area is known to support several species of raptors, although no specific nest sites have been identified. Impacts on nesting raptors would be reduced by restricting construction activities in proximity to active nest sites. There is habitat suitable for Navajo sedge (Links 501 and 581), a Federally listed threatened species associated with springs along Navajo Sandstone cliffs. Minimal impacts are anticipated.

Kaibito 1 (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1).

Vegetation—Impacts on vegetation would be low due to the low sensitivity of vegetation types across the Kaibito Plateau.

Big Game—Impacts on big game would be low. New roads in this area would result in indirect impacts because of increased accessibility, and therefore a potential for increased disturbance to big game. These impacts would be mitigated by using overland routes to the extent practicable and minimizing the construction of new access roads.

Special Status Species—No special status species or associated habitat were identified in the Kaibito Plateau area. Habitat suitable for Navajo sedge is present along this segment of K1 resulting in minimal impact.

Central 1 (C1)

Impacts along C1 are anticipated to be low; however, unique habitats including The Hogback, San Juan River, and Chuska Mountains would be traversed. The most biologically diverse area within the project area is the Chuska Mountains. The Navajo Fish and Wildlife Department and Natural Heritage Program consider the Chuska Mountains particularly important because the Chuska Mountains area is a unique habitat and natural feature within the boundaries of the Navajo Reservation. C1 would parallel an existing transmission line with the exception of a short distance (10.4 miles) along Links 360 and 640.

New Mexico

Vegetation—Impacts along the New Mexico portion of C1 would be low. The alternative route would cross riparian habitat associated with the San Juan River (Link 240); however, the river and associated riparian habitat would be spanned by the transmission line.

Big Game—Impacts on big game along the New Mexico portion of C1 would be low.

Special Status Species—Numerous Mesa Verde cactus plants were identified along Links 180 and 240 (approximately 1,000 individuals) during surveys conducted along the alternative route in The Hogback ACEC in spring 1995. The Mancos milkvetch also is found on The Hogback along Link 640. Impacts on these plants are anticipated to be low for the following reasons. Because the alternative route would parallel an existing line, new access road would not have to be constructed in much of this area. Surveys to identify exact locations of the plants would be undertaken prior to construction, and a biologist would be on site to monitor just before and during construction. Placement of towers would be coordinated to minimize impacts on the plants. Also, temporary fencing or flagging of plants would be used to minimize trampling or crushing, and construction workers would be educated regarding the laws protecting this species. If avoidance were not possible, individual plants would be transplanted to adjacent habitat and a monitoring program would be implemented to determine the success of the transplant. Additionally, during the winter months Mesa Verde cactus that are no larger than one inch in diameter contract into the soil and could withstand some surface activity.

Impacts on riparian habitat along the San Juan River, which supports bald eagles and possibly southwestern willow flycatcher, would be low. Although a transmission line across a river may pose a collision hazard to migratory birds, increased hazard is not expected because of existing transmission lines in the immediate vicinity.

Habitat suitable for Mesa Verde cactus exists along the route between The Hogback and the foothills of the Chuska Mountains (Links 380, 640, and 700). Preconstruction surveys would be conducted to identify populations of these species, which would be avoided if possible, or transplanted to minimize loss.

Arizona

Vegetation—Impacts on vegetation would be low. The Arizona portion of C1 crosses the Chuska Mountains, which support the only ponderosa pine forests in the project area. This alternative parallels an existing line and use existing access road wherever possible in this area; thereby reducing the amount of right-of-way clearing needed. Trees in the new right-of-way would be cleared selectively and only as needed to ensure safety standards of clearance between transmission line conductors and vegetation. The effect of tree removal would be long term. The area cleared of trees within the right-of-way would become open and meadow-like—attractive to certain species of big game. A native seed mix would be selected if requested by the land-managing agency for revegetation that would enhance the area as habitat.

Big Game—Potential impacts on big game would be low. Increasing the width of the right-of-way would not result in habitat fragmentation or create a barrier to big game movement. Furthermore, big game may use the cleared area for grazing after revegetation. Impacts would be reduced by overlapping with the existing right-of-way, limiting cutting and removal of trees, selectively removing trees (e.g., "feathering" the edge of the right-of-way), and revegetating with a native seed mix that would enhance the habitat.

Special Status Species—Impacts are anticipated to be low. The Chuska Mountains have been designated as critical habitat for Mexican spotted owls (Link 700). Golden eagles nest in the buttes and mesas across the grasslands (Link 780). If C1 were selected for construction, surveys for active nesting sites would be completed prior to construction. Surveys and subsequent mitigative action would be coordinated with FWS and the Navajo Fish and Wildlife Department.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains on Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1.

Vegetation—This segment of C2 (Link 462) does not parallel any existing linear facilities. Although there would be some loss of vegetation (primarily Great Basin desertscrub) along this link, impacts would be low.

Big Game—Impacts on wildlife along Link 462 would be low.

Special Status Species—Impacts would be low on raptors such as golden eagle and ferruginous hawk that are known to nest in the area. Increased access into nesting habitat for golden eagles (e.g., mesas adjacent to Link 462) would result in indirect impacts. These impacts would be mitigated by minimizing construction of new access roads to the extent practical and restricting use of them when construction is complete.

There is habitat suitable for Navajo sedge in the vicinity of springs and ephemeral drainages. Preconstruction biological resources surveys would identify locations of individual plants and the need for mitigation resulting in low impacts. Impacts on habitat suitable to support Candidate Category 2 species (e.g., Tusayan rabbitbrush [Link 462]) would be low.

Substation Alternatives

Impacts on biological resources at the Shiprock, Honey Draw, Red Mesa, and Copper Mine would be low. Coconino Arizona pocket mouse exists in the area of the Moenkopi Substation; however, impacts are anticipated to be low.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace

Impacts on biological resources are illustrated on Figures MV-4W, MV-5W, and MV-6W.

Northern 1 West (N1W)

Arizona

Vegetation—Although the entire length of the Arizona portion of N1W parallels an existing transmission line, there are portions of the existing right-of-way through the Black Mountains that are inaccessible by wheeled vehicles. There would be some loss of vegetation where access would have to be upgraded or constructed; however, impacts would be low. Riparian habitat exists in isolated patches along the Colorado River (Link 2060), but would be avoided by spanning the river and associated riparian areas.

Big Game—Since N1W parallels an existing transmission line and the need for additional access would be minimal along most of the alternative route, impacts on big game (elk, antelope, and mule deer) would be low. No crucial seasonal habitat or birthing areas for these species have been identified along the alternative route. Displacement of wildlife into marginal habitat is unlikely. These animals may avoid areas of construction activities, but would likely return once construction activities are complete. The transmission line would not create a barrier to wildlife movement, nor would the associated access roads increase habitat fragmentation. Access roads would be required along portions of the line in bighorn sheep habitat in the Black Mountains (Link 2060). Roads would be closed following construction. No impacts on lambing grounds located north of Link 2060 would occur due to the distance between the lambing grounds and Link 2060.

Special Status Species—Impacts on special status species along N1W would be low with the exception of 0.2 mile of moderate impacts on desert tortoise (Sonoran population), which inhabits Mohave desertscrub (Link 2060). Impacts on desert tortoise would include minimal loss of habitat and the potential for direct mortality of tortoises from increased vehicular activity in the area during construction. Mitigation would include educating construction workers about acceptable protocol when tortoises are encountered and on-site monitoring by a qualified biologist during construction.

The black-footed ferret management area in the Aubrey Valley is crossed (Links 1740, 1741, and 1790). Ground-disturbing activities and increased vehicular traffic would affect black-footed ferrets and prairie dogs, their main prey base, but impacts would be low.

Populations of Tusayan rabbitbrush (Link 1660) and Tusayan flameflower (Link 1400) are known to be present; however, these could be avoided by judicious placement of towers. Loss of habitat for these species would be minimal and impacts would be low. The Colorado River supports species such as the wintering bald eagle and numerous fish species. Impacts on these species would be low. There is low potential for direct or indirect impact on riparian or aquatic habitat, provided structures avoid (span) these areas and adequate erosion and sedimentation controls are implemented.

Impacts on special status raptor species would be low. Special status raptors include Swainson's and ferruginous hawks, peregrine falcons, and wintering bald eagles. Construction activities would be limited in the vicinity of active nest sites during the breeding and nesting seasons.

Hualapai Mexican vole could be present along N1W (Link 1790), but impacts are anticipated to be low. Impacts on habitat of the Arizona toad (Milkweed Canyon, Link 1790), which could be spanned, would be low.

Nevada

Vegetation—Along the Nevada portion of N1W, impacts on vegetation would be low (Links 2060, 2200, and 2180). Riparian and aquatic habitat associated with the Colorado River would be spanned.

Big Game—The Nevada segment of N1W parallels an existing transmission line requiring limited additional access. Impacts on big game, including mule deer and bighorn sheep, would be low. No crucial habitat exists along the alternative route and displacement into marginal habitat is unlikely. These animals may avoid construction areas, but would likely return once construction was completed. Some new access would be required in bighorn sheep habitat; however, upon completion of construction access should be restricted where it does not currently exist.

Special Status Species—Impacts would be low on the Mojave population of desert tortoise (Federally listed threatened species), which is present along N1W in desertscrub vegetation designated as critical habitat for the tortoise. Preconstruction surveys to identify locations and on-site monitoring during construction would result in minimizing potential loss of individuals. Potential loss of burrows and feeding areas would be limited to tower sites and along access and spur roads. Ravens feed on juvenile tortoise and perch on transmission line towers. Because Links 2060 and 2180 would parallel an existing transmission line, increased perching of ravens on towers and subsequent loss of juvenile tortoise would be insignificant.

There may be some loss of potential habitat for rosy and twotone beardtongues (Federal Candidate C2 species), which may be present along gravelly washes. However, washes could be spanned to avoid these species. Impacts would be low.

Northern 2 (N2)

<u>Arizona</u>

The Arizona portion of N2 is the same as N1W with the exception of Links 1742, 1800, 1980, and 2020, which are located to the south of the Hualapai Indian Reservation (and replace Link 1790 on N1W).

Vegetation—Impacts on vegetation, which consists primarily of Great Basin conifer woodland, Great Basin/Plains grassland, and Mohave desertscrub, are anticipated to be low.

Big Game—Effects on big game (including antelope, mule deer, elk, and bighorn sheep) would be low. Populations of antelope inhabit this area and use a movement corridor in the Truxton Plain. These species would likely avoid the area during construction, but return after construction. No crucial habitat for these species would be lost or degraded and the transmission line would not create a barrier to movement or increase habitat fragmentation. Increased accessibility along Links 1800, 1980, and 2020 could result in increased human presence and associated indirect effects on wildlife. However, limiting access after construction would reduce indirect impacts on wildlife species to low, particularly in sensitive areas. Roads exist in much of the area already.

Special Status Species—No listed threatened or endangered plant species are known to occur along this portion of alternative route N2.

Swainson's and ferruginous hawks are known to nest in the Hualapai Valley (Link 2020), and peregrine falcons are known to nest in the Grand Wash Cliffs (Link 1980), although no nest sites have been identified along the alternative route. Impacts on these species would be minimized by restricting activities in the vicinity of active nest sites during the breeding and nesting season. Link 1742 would cross the black-footed ferret management area in the Aubrey Valley; however, impacts would be low.

Habitat suitable for the Roaring Springs prickly poppy is present along Link 1980. Preconstruction surveys would identify locations where mitigation would be required to reduce impacts to low.

Nevada

The Nevada portion of N2 is the same as N1W.

Southern 2 (S2)

Arizona

In Arizona, S2 varies from N2 beginning at the Moenkopi Substation and continuing west through Link 2006. At this point, S2 is then the same as N2 proceeding north and west along Links 2020 and 2060 to the crossing of the Colorado River and the Nevada border.

Vegetation—Impacts along the Arizona portion of S2 would be low.

Big Game—Increased accessibility would not result in greater use of the area by the public, because roads exist in much of the area crossed by this portion of S2. The access roads associated with the transmission lines would not result in habitat fragmentation or create a barrier to wildlife movement.

Special Status Species—The Coconino Arizona pocket mouse is known to inhabit areas along Link 1420. Tusayan rabbitbrush may be present along Links 1640 and 1680. There may be a loss of habitat for several special status raptor species including Swainson's hawks (Hualapai Valley), and peregrine falcon (Cottonwood Cliffs, Link 2000). However, existing nest sites could be avoided and impacts on these species would be low by restricting activities in the vicinity of active nest sites during the breeding and nesting season.

There could be some loss of potential habitat for several candidate plant species on S2. Impacts on these species in a regional perspective, however, are expected to be low.

Nevada

The Nevada portion of S2 is the same as N1W and N2.

Western Area Transmission Line Alternatives - Moenkopi to Mead

Northern 3 (N3), Northern 4 (N4), and Southern 4 (S4)

Alternatives N3, N4, and S4 are identical to alternatives N1W, N2, and S2, respectively, with the exception of Links 2040 and 2080, which connect into Mead Substation instead of Marketplace Substation (replacing Links 2060, 2200, and 2180). The following discussions focus on Links 2040 and 2080.

Arizona and Nevada

Vegetation—Potential impacts on vegetation would be low. Along the Colorado River and associated drainages (Link 2040), riparian habitat exists in isolated patches but would be avoided by spanning.

Big Game—Since Links 2040 and 2080 parallel two existing transmission lines and the roads associated with access to these lines, impacts on big game species including antelope, mule deer, and bighorn sheep would be low. Most big game species would avoid areas of construction activities, but would likely return once construction has been completed. Bighorn sheep lambing grounds exist in the Black Mountains (Link 2040). Curtailing construction during critical season and restricting access following completion of construction would effectively reduce impacts on bighorn sheep.

Special Status Species—The Mojave population of the desert tortoise is present along the Nevada portion of Link 2040 and along all of Link 2080. In Nevada, the links traverse designated critical habitat for the desert tortoise (Mojave population). The Sonoran population of desert tortoises exists along the Arizona portion of Link 2040. Populations here are reported to be denser than those along Link 2060 to the south. Direct effects on tortoises would include loss of burrows along access roads and at tower sites, and mortality of individuals due to increased traffic during construction. Mitigation of impact would include preconstruction surveys to identify sensitive areas and on-site monitoring during construction, as well as programs to educate construction workers about the laws and protocol designed to protect the desert tortoise. Ravens feed on juvenile tortoises and perch on transmission line towers. Because Links 2040 and 2080 parallel existing transmission lines, increased perching of ravens on towers and subsequent loss of juvenile tortoise would be insignificant.

Rosy and yellow twotone beardtongues could be present on gravelly washes along Link 2040. Because loss of habitat for these species is expected to be minimal, and locations of the plants could be spanned, impacts on these species would be low.

Substation Alternatives

Impacts on biological resources at the Red Lake, Marketplace, and Mead substation sites would be low.

Microwave Communication Facility

Impacts on biological resources would be low.

PALEONTOLOGICAL RESOURCES

Overall, impacts on paleontological resources would be low to nonexistent. The primary concern regarding impacts on paleontological resources is that direct damage or destruction of these fossils would result in the loss of important scientific information. It is possible that ground disturbance, such as grading and cutting of access roads, auguring or blasting for tower footings and/or anchors, or preparing batch plant sites and staging areas could encounter important fossil resources. Also, adverse impacts indirectly associated with construction are a concern. For example, fossils could be subject to damage or destruction by erosion that is accelerated by construction disturbance. Improved access and increased visibility as a result of construction could cause fossils to be damaged, destroyed, or collected as a result of unauthorized collection or vandalism. Not all impacts of construction are adverse to paleontology. Excavation can and often does reveal significant fossils that would otherwise remain buried and unavailable for scientific study. In this manner, excavation can result in beneficial impacts. Such fossils can be collected properly and catalogued into the collection of a museum repository so that they can be available for scientific study.

To mitigate potential impacts, a more detailed inventory will be completed of those portions of the selected route that warrant further investigation (e.g., high potential for scientifically important fossils and areas directly affected by construction), and to develop plans to avoid or mitigate impacts once more information is available. Areas of potential scientifically significant paleontological resources would be reviewed in coordination with the land-managing agency to identify the need for surveys. Following the surveys, a plan would be developed addressing the treatment of specific areas. Mitigation of ground-disturbing impacts could involve (1) minor design modifications such as shifting the location of a tower or access road in order to avoid direct effects, or (2) recovering important information from paleontological sites by conducting research prior to construction. Also, the plan would generally address treatment of paleontological resources that may be discovered during construction. The rating of low impacts therefore assumes that important information would be adequately recovered from significant sites if they could not be avoided by the selected route.

In New Mexico and Arizona, impacts would be low. In New Mexico, the potential for fossils is high or unknown and ground disturbance from construction would be greater. These areas are located primarily near The Hogback and Chuska Mountains. In Arizona, these areas are located along portions of alternatives in the Chinle Valley and near Sweetwater, northern Black Mesa, south of Lechee, west of Cameron, and in areas near the Cottonwood Mountains, along the Colorado River, in areas near the Coconino Plateau, and on the Kaibito Plateau. Typically these areas are less than 0.1 mile long. In Nevada, geologic units crossed have low or unknown potential for yielding paleontological resources.

EFFECTS OF EACH ALTERNATIVE

<u>No-action Alternative</u>

Under this alternative, the environment would remain as it presently exists. This option would forego the opportunity to develop paleontological resource inventories along the route selected for construction and any recovery of paleontological data that might be undertaken to mitigate project impacts.

<u>Eastern Area Transmission Line Alternatives</u>

Because potential impacts on paleontological resources would be low, a description for each alternative route is not provided. Impacts are illustrated on Figure MV-6E.

Substation Alternatives

Impacts on the paleontological resources at the Shiprock, Honey Draw, Red Mesa, Copper Mine, and Moenkopi substation sites would be low.

Western Area Transmission Line Alternatives

Impacts on paleontological resources are illustrated on Figure MV-6W.

Substation Alternatives

Impacts on paleontological resources at the Red Lake, Marketplace, and Mead substation sites would be low.

Microwave Communication Facility

Impacts on paleontological resources would be low.

LAND USE

Impacts on land uses along the alternative routes, at the alternative substation sites, and at the communication facility would range from low to moderate. The level of impact would vary depending on the type of land use affected, the extent to which impacts would be direct or indirect, and whether they would be short or long term. With the exception of grazing, agricultural, and timber resources, direct impacts on land use would be confined to the 250-foot right-of-way.

Assessment of impacts on each category of land use is based on the relationship between the sensitivity of each use to the disturbance caused by the proposed project (e.g., requirement of project construction, operation, and maintenance).

Impacts from construction disturbance associated with right-of-way clearing, access roads, and tower installation have the potential to impact agriculture, grazing, and timber management. Construction-related impacts on agriculture primarily would result from construction vehicles and heavy equipment compacting soils at tower sites and along the right-of-way. Soil restoration practices would provide effective mitigation to re-establish agricultural productivity. Impacts on grazing were assessed on the basis of acres removed, and the number of AUMs potentially displaced, where data are available. Criteria for assessing impacts on timber management are based on requirements for conductor clearance from trees. (Minimum clearance above trees in forested areas is approximately 24 feet).

Because of operation restrictions, occupied residences are not a compatible use within the proposed 250-foot-wide right-of-way. Where the proposed line would parallel an existing transmission line, residences on the same side proposed for location of NTP would not be a compatible use within a 275-foot distance from the existing transmission centerline. This is based on an assumed 150-foot separation between the centerlines of each facility, as shown on Figure 4-1. This separation criterion was established by Western for the purposes of this assessment and is based on the recently completed Mead-to-Phoenix 500kV transmission line, which was located 150 feet from the parallel Mead-to-Liberty 345kV transmission line.

Indirect impacts on residential uses could also occur after construction of the transmission line. For example, construction of new buildings or additions to existing structures could be precluded within the right-of-way to avoid conflicts with maintenance activities and ensure safety.

The assessment is the result of a series of studies that used a combination of aerial photography and limited field reviews. While these investigations have helped to refine the residential land use information and enhance the evaluation of potential impacts for purposes of the DEIS, it is assumed that if the project progresses, further refinement and evaluation could be needed as part of detailed design and engineering studies and right-of-way acquisition.

Through the process of selecting alternative routes, other potentially incompatible uses such as airports, mines, or other industrial uses have been avoided. Agriculture and grazing uses are compatible within the right-of-way.

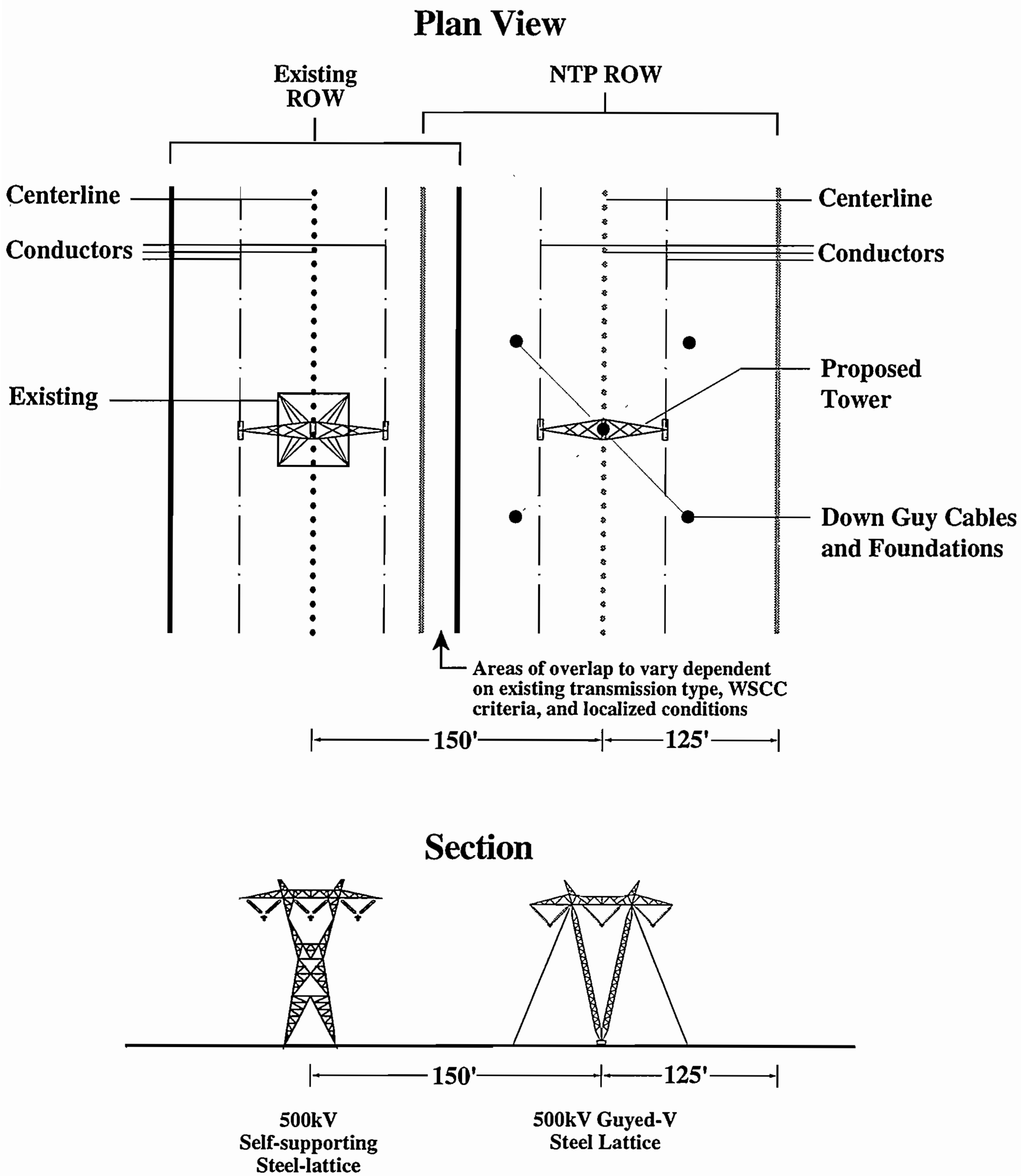
EXISTING LAND USES

Existing land uses that were evaluated include residential, agricultural, timber management, range management, and grazing.

Residential—Direct or high impacts on existing residences could result from the incompatibility with or removal of occupied dwellings and related structures from the NTP right-of-way. This is an issue that has received considerable attention, in response to the level of concern expressed by residents within the project area.

While the alternative routes are adjacent to several towns and dispersed rural residences, initial data show the number of residences in proximity (500 feet) to the reference centerlines of each alternative route is less than 40. Refinement of the data revealed a high potential to avoid residences within the NTP right-of-way.

Where the proposed route would be adjacent to existing transmission lines, there are three types of mitigation opportunities, where feasible, that may be applied to avoid residences within the right-of-way: (1) shifting the NTP centerline to the opposite side of the existing line, (2) narrowing the right-of-way, and (3) locally rerouting the alignment for a segment of the alternative. Figure 4-2 illustrates the relationship of the NTP alternative routes to existing transmission lines. These refinements clarified the residential land use information and enhanced the evaluation of potential impacts for purposes of the DEIS.



Note: 1) Proposed structure type may vary in order to match existing structures.
2) Distances shown are assumed for purpose of the EIS studies.

Example Centerline-to-Centerline Separation

Navajo Transmission Project

Figure 4-1

Agriculture—In general, the types of impacts related to agriculture that could result during construction include those that would reduce the crop value or pose a potential safety hazard to the requirements of crop production. Short-term impacts could include disruption to farming practices and seasonal loss of crops during construction. Long-term impacts could include (1) removal of cropland from production at tower sites; (2) reduction in crop yields around towers because of soil compaction during construction and increased difficulties with weed and pest control; (3) increased time required for farming operations; (4) disruption of agricultural aircraft operations; (5) removal of irrigation systems; and (6) economic losses. Impacts on agriculture would be very localized (e.g., Link 240 near the San Juan River in New Mexico) because of the limited amount of cultivated lands in the project area, and are expected to be low. Where cropland would be crossed, impacts would be minimized through careful tower placement or spanning cultivated fields.

Timber Management—Impacts on timber resources could result from the clearing of marketable timber at tower sites and within the right-of-way. Additional impacts could also be associated with the construction of access road and substations where tree clearing would be required. In most areas, selective clearing of trees would be limited to the right-of-way and to those trees that pose a hazard to the transmission line. Impacts on timber would be long term; however, impacts are anticipated to be generally low, with areas of moderate impact limited to clearing ponderosa pine in a timber management area in the Chuska Mountains that is managed by the Navajo Nation Department of Forestry. Clearing in the Chuska Mountains would be reduced to 50.9 acres of ponderosa pine by paralleling a previously disturbed area (an existing transmission line corridor). Further mitigation would result from minimizing the extent of clearing by selectively removing trees along the edges of the right-of-way, or "feathering" so that the minimum amount of forest would be cleared.

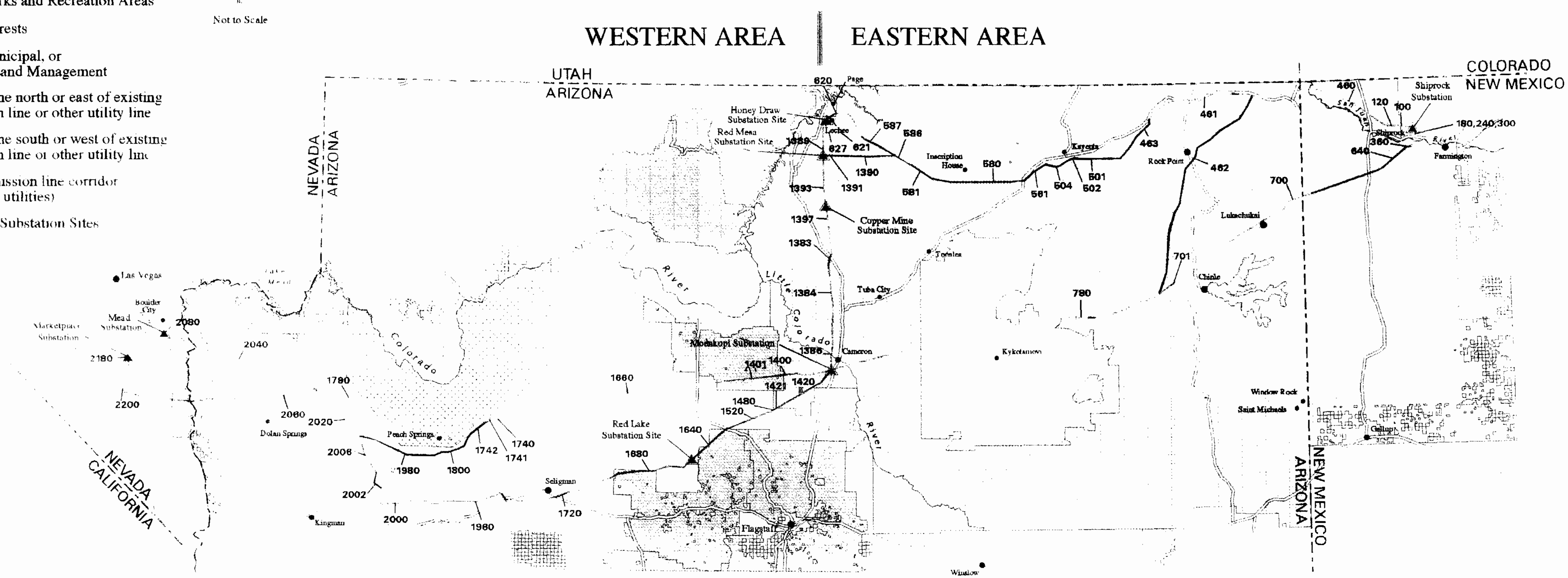
Grazing—Short-term impacts on grazing could result from construction disturbance at tower sites (including laydown areas), substation sites, staging areas, and in areas where new temporary access is required. Long-term impacts could result from those areas permanently displaced by project facilities and roads. Long-term impacts on grazing would be low because of the minimal extent of disturbance (refer to Table 2-4) on rangelands as a result of project construction and operation. The area disturbed by construction may be minimal, and following the rehabilitation, the only areas removed from use for the life of the project would be the small areas at the tower footings and/or guy anchors (approximately .006 acre per mile) and new access roads that would remain permanently. The remainder of the rangeland within the right-of-way would be available for grazing. Any damaged range improvements would be repaired or replaced.

The percent of long-term disturbance of rangeland within the right-of-way is between approximately 2.5 and 4 percent of the total right-of-way for each alternative route. In the western area, long-term displacement of AUMs ranges from one to five percent of the animal unit months (AUMs) within the right-of-way. This is based on the relationship of the total AUMs for each western area alternative route and the long-term AUM displacement. In the eastern area, no data or AUMs were available. In order to estimate impacts for alternatives in this area, data on rangeland suitability from the Natural Resources Conservation Service (formerly Soil Conservation Service) were reviewed in conjunction with Forest Service and BLM grazing management data. Results from this analysis showed that impacts on grazing would be low based on the level of disturbance associated with NTP and the existing condition of soils and vegetation in this area.

Legend

- Navajo Indian Reservation
- Hopi Indian Reservation
- Hualapai Indian Reservation
- National Parks and Recreation Areas
- National Forests
- Private, Municipal, or Bureau of Land Management
- Parallel to the north or east of existing transmission line or other utility line
- Parallel to the south or west of existing transmission line or other utility line
- New transmission line corridor (no existing utilities)
- ▲ Alternative Substation Sites

Not to Scale



Alternative Routes-
Relation to Existing Lines

Navajo Transmission Project

Figure 4-2

Note: Locations of these referenced centerlines were established for study purposes, refined based on study results, and may be modified based on further investigations and project design.

FUTURE LAND USE

Impacts on future land uses could occur in those areas where construction, operation, and maintenance would preclude or impair future development activities. Impacts on future land uses would be generally low to moderate, based on the future plans along the alternative routes, and the use of existing utility corridors. Potential moderate impacts would be limited to a small area planned as open space and industrial land in the city of Page. Development plans in the Turquoise Development District on the Hopi Reservation would not be affected by NTP; however, additional approval for right-of-way would be required by the Hopi Tribal Council.

PARKS, PRESERVATION, AND RECREATION AREAS

Impacts on parks, preservation, and recreation areas could result from the removal of existing recreational facilities or potential conflicts with recreational and interpretive activities. Potential impacts on preservation areas are addressed accordingly in the biological or cultural resources sections of this DEIS. Aesthetic impacts on views from parks and recreation areas are described in the visual resources section. Impacts on parks, preservation, and recreation areas along the alternative routes would be low. These areas have been avoided largely as a result of the siting process, and where parks, preservation, and recreation areas would be crossed, the use of designated existing corridors was optimized. A designated utility corridor would be used for NTP through the Lake Mead NRA.

Long-term impacts on dispersed recreation uses, such as hunting and hiking, would be minimal because the proposed project would not interfere with these activities.

EFFECTS OF EACH ALTERNATIVE

No-action Alternative

Under this alternative, the environment would remain as it presently exists.

Eastern Area Transmission Line Alternatives

The only high residual impacts identified within the eastern area would be associated with direct impacts on residences within the NTP right-of-way, as described below for each route.

Glen Canyon 1 (GC1)

New Mexico

Direct impacts on residences would be avoided along GC1 in New Mexico.

Arizona

Residences located within the NTP right-of-way along GC1 on the Navajo Reservation could be avoided by either shifting the NTP alignment to the opposite side of an existing line, or by locally rerouting the alignment of NTP. The first residence, located near Red Mesa at Milepost 4 on Link 461, was avoided by shifting the NTP alignment to the opposite side of the existing line. Other residences within the NTP right-of-way near Shonto (Link 580) were also avoided by shifting the line. In addition, on Link 581 there are two residences that would be within the right-of-way at Milepost 38 south of Page. These are small mobile homes that could be moved beyond the right-of-way.

Kaibito 1 (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1). There would be no direct impacts on residences along this segment.

Central 1 (C1)

New Mexico

Three residences were identified on the Navajo Reservation within the NTP right-of-way where C1 parallels the south side of the existing APS transmission line in New Mexico. All three were avoided by shifting the NTP alignment to the north or opposite side of the existing APS transmission line. Two residences are located along Link 700 at Milepost 10.3, east of Rock Ridge. A third residence is located along Link 700 between Mileposts 17.3 and 17.4, south of Mitten Rock.

Arizona

Two residences were identified within the NTP right-of-way where C1 parallels the south side of the existing APS transmission line through the Burnt Corn Valley at Milepost 20.8 (Link 780). These residences were avoided by shifting the alignment to the northern or opposite side of the APS line.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains along Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1. There would be no direct impacts on residences along this segment of C2.

Substation Alternatives

No impacts on land use were identified at the Shiprock Substation. Impacts on land use (grazing) would be low at Honey Draw, Red Mesa, Copper Mine, and Moenkopi substation sites.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace/Mead

All alternative routes in the western area would avoid direct impacts on residences.

Substation Alternatives

Impacts on land use (grazing) at the Red Lake Substation site would be low. No impacts on land use were identified at Marketplace or Mead substations.

Microwave Communication Facility

There would be no impacts on land use.

SOCIOECONOMICS

OVERVIEW

The potential impacts of NTP on local communities was based on comparing inventory of the project needs and economic input of the project with the capability of the communities to accommodate or assimilate those needs. It is difficult to determine precisely how much the construction of NTP would benefit or harm communities in the vicinity of the transmission line. A community's ability to deal with change is reflected primarily in the culture of the people and the existing economic strength of the community. Communities may react differently to events that cause changes in their normal activities.

The local economic effects of a project like the NTP are generated by the spending activities of people and institutions associated with the project. "Direct economic effects" are those caused by the contractors' work at the construction site and are measured by the value of the project personnel's wages and salaries, materials and equipment inputs, proprietors' earnings and entrepreneurial profits, and indirect business taxes. "Indirect economic effects" arise from the payrolls and procurements of the suppliers of goods and services to fill orders placed by the project, and are measured by the portion of the project's purchases going to local vendors. "Induced economic effects" are those created when the people working directly or indirectly at jobs related to the project purchase goods and services from merchants and businesses in communities near the project. The total economic effects of the project then are the sum of the direct, indirect, and induced effects, and generally are a multiple of the original direct effect. In general, the more work there is in building the transmission line, the more indirect and induced effects there are on the local communities, resulting in an economic expansion of the local economy during the construction period.

Sources of increased local indirect business taxes from NTP would include sales and use taxes on materials and equipment purchased locally for the project (e.g., fuels, concrete, engineering and environmental services, and other supplies) as well as on goods used by indirect suppliers and taxable retail consumer goods bought by households with earnings from the project. NTP also would be expected to increase some property values (notably, because of the addition of the utility's tangible personal property to lands in the right-of-way), resulting in increased property taxes.

To predict the socioeconomic impacts of NTP, investigators used the IMPLAN system of regional input-output economic modeling. IMPLAN was originally developed by the Forest Service to assess regional economic and social impacts of timber sales, and now is used by many economists to estimate the effects of projects on employment, income, and local taxes. Inputs to the model included estimates of capital costs (per-mile averages for line construction and per-unit totals for substations), estimates of locally procured construction materials, and estimated labor costs. Output of the models included estimated direct, indirect, and induced changes in economic output, employment, and income for each county in New Mexico, Arizona, and Nevada that would be affected by construction of NTP. These output projections of jobs and income became the basis for estimating short- and long-term impacts on the area's population and social characteristics. The model's projections are approximations, since such factors as wage rates and sourcing from local vendors during construction may turn out differently from those assumed for the IMPLAN model.

There are some commonly accepted measures of socioeconomic effects that can be used to indicate adverse impacts to communities. These include such things as changes in demand for housing and public services. However, it is not expected that NTP would create unavoidable adverse impacts of the sort that would require mitigation.

The following describes the assumptions used to determine impacts including duration of construction, costs of construction and right-of-way acquisition, local procurements, locations of work camps and materials yards, and local hiring.

Duration of Construction—Construction activities are discussed in Chapter 2. The estimated time required to complete construction of NTP is based on dividing the transmission line work among four contracts, each covering approximately 115 miles, plus work at three substations. The four transmission line contracts would occur in succession, with each starting six months after the previous one. Construction work at the three substation sites (consisting of additions to existing substations in San Juan County, New Mexico, and Clark County, Nevada, and construction of a new one in Coconino County, Arizona) would be done under a separate contract. The new substation would take about two years to build, while the two additions would require about one year each. Each transmission line contract would take about one year to complete, resulting in completion of the project in about 2.5 years.

Construction and Right-of-Way Acquisition Costs—Construction of NTP is expected to average $449,000 per mile (in constant 1995 dollars), exclusive of right-of-way costs. The substation contracts are projected to total $83.7 million. Costs in addition to construction and right-of-way associated with NTP include escalation, financing, allowance for funds used during construction, operating and maintenance expenses, and development costs. Those costs were left separate from costs of direct construction and right-of-way to more clearly reflect the direct impacts of the latter on the local economies.

Costs were estimated for 24 possible alternative route combinations. The direct (on-site) costs for construction and right-of-way acquisition for the transmission line for the most expensive route would be approximately $282.6 million (Alternatives GC1 and S2), while the substation projects would add another $83.7 million, for a maximum total direct (on-site) project cost of $366.3 million. Other routes would cost less, with the averaged route length yielding a mean value of approximately $332 million.

Table 4-3 shows line segment distances and costs. The analysis of costs for each county was based on using the average of the distances of each alternative segment that would occur with that county. The total costs of construction and right-of-way, by county, were calculated and have been tabulated in the bottom row of Table 4-3. Including substations, total average costs of direct (on-site) construction of NTP would be as follows:

San Juan County, NM	$41.0	million
Apache County, AZ	$38.7	million
Navajo County, AZ	$24.1	million
Coconino County, AZ	$140.2	million
Yavapai County, AZ	$7.0	million
Mohave County, AZ	$48.8	million
Clark County, NV	$32.3	million
Total	$332.1	million

These values were used in the IMPLAN models to project direct, indirect, and induced impacts on the value of economic output, employee income, property earnings, indirect business taxes, and employment for each affected county. The results are presented below in the section entitled "Local Economic Impacts."

TABLE 4-3
NTP CONSTRUCTION COST, BY ALTERNATIVE AND COUNTY

NTP RIGHT-OF-WAY CORRIDOR LENGTHS, BY ALTERNATIVE

Alternative	San Juan	Apache	Navajo	Coconino	Yavapai	Mohave	Clark	Total
Eastern	Miles							
GC1	34.8	61.6	43.9	120.3	0	0	0	260.6
K1	34.8	61.6	43.9	104.4	0	0	0	244.7
C1	40.2	62.8	42.8	40.9	0	0	0	186.7
C2	34.8	92.5	42.8	40.9	0	0	0	211.0
Average	*36.2*	*69.6*	*43.4*	*76.6*	*0*	*0*	*0*	*225.8*
Western	Miles							
N1	0	0	0	108	0	79	30	217.0
N2	0	0	0	107.2	4.1	83.8	30	225.1
N3	0	0	0	108	0	80.4	10.9	199.3
N4	0	0	0	107.2	4.1	85.2	10.9	207.4
S2	0	0	0	85.8	33.6	98.3	30	247.7
S4	0	0	0	85.8	33.6	99.7	10.9	230.0
Average	*0*	*0*	*0*	*100.3*	*12.6*	*87.7*	*20.5*	*221.1*
Total Miles (Avgs):	*36.2*	*69.6*	*43.4*	*177.0*	*12.6*	*87.7*	*20.5*	*446.8*

NTP ON-SITE TRANSMISSION CONSTRUCTION COSTS, BY ALTERNATIVE

(In thousands of 1995 $)

Alternative	San Juan	Apache	Navajo	Coconino	Yavapai	Mohave	Clark	Total
Eastern			(@ Cost/Mile $556)*					
GC1	19,349	34,250	24,408	66,887	0	0	0	144,894
K1	19,349	34,250	24,408	58,046	0	0	0	136,053
C1	22,351	34,917	23,797	22,740	0	0	0	103,805
C2	19,349	51,430	23,797	22,740	0	0	0	117,316
Average	*$20,100*	*$38,712*	*$24,103*	*$42,603*	*$0*	*$0*	*$0*	*$125,517*
Western			(@ Cost/Mile $556)*					
N1	0	0	0	60,048	0	43,924	16,680	120,652
N2	0	0	0	59,603	2,280	46,593	16,680	125,156
N3	0	0	0	60,048	0	44,702	6,060	110,810
N4	0	0	0	59,603	2,280	47,371	6,060	115,314
S2	0	0	0	47,705	18,682	54,655	16,680	137,722
S4	0	0	0	47,705	18,682	55,433	6,060	127,880
Average	*$0*	*$0*	*$0*	*$55,785*	*$6,987*	*$48,780*	*$11,370*	*$122,922*
Substations**	**San Juan**	**Apache**	**Navajo**	**Coconino**	**Yavapai**	**Mohave**	**Clark**	**Total**
Existing (2)	20,925	0	0	0	0	0	20,925	41,850
New (1)	0	0	0	41,850	0	0	0	41,850
Average	*$20,925*	*$0*	*$0*	*$41,850*	*$0*	*$0*	*$20,925*	*$83,700*
Grand Total								
Averages ($'000 '95)	*$41,025*	*$38,712*	*$24,103*	*$140,239*	*$6,987*	*$48,780*	*$32,295*	*$332,139*

Sources: Black & Veatch, 1995, and Dames & Moore estimates, 1995.

* Based on estimated costs (in constant $1995) of $107,000 per mile for right-of-way acquisition and $449,000 per mile for transmission construction. Excludes escalation, financing, AFUDC, operating and maintenance, and development costs (Black & Veatch, 1995).

** Based on estimated total cost for one new substation and two expansions of existing substations in San Juan and Clark counties (Black & Veatch, 1995).

Local Procurements—A substantial amount of construction materials, equipment maintenance, support services, and utilities is expected to be procured from local vendors in the counties along the transmission corridor. Table 4-4 presents this information.

TABLE 4-4
PROJECTED NTP LOCAL PROCUREMENTS OF CONSTRUCTION MATERIALS AND SERVICES (PER CONTRACT)

Construction Items	Unit Cost	Approximate Cost
Transmission Line Construction		
Concrete	$75/yard	$2,500,000
Fuel	$3,500/mile	$1,550,000
Food and lodging	$50/day/person	$3,200,000
Seed (1 acre/mile)	$1,000/acre	$460,000
Phone service	$2,000/month/contract	$100,000
Electric service	$500/month/contract	$30,000
Equipment maintenance	$2,000/month/contract	$100,000
Substation Construction		
Concrete	$75/yard	$700,000
Fuel	2% of labor cost	$200,000
Food and lodging	$50/day/person	$1,100,000
Phone service	$2,000/month/contract	$60,000
Electric service	$500/month/contract	$30,000
Equipment maintenance	$2,000/month/contract	$30,000
Source: Black & Veatch 1995		

Work Camp and Material Yards—Project engineers have identified potential locations for 11 work camps and 18 material yards. Due to the many route options it is not possible to narrow down the work camp and material yard locations to a specific set to be developed. The locations to be used actually would depend on the transmission line route selected for construction and the contractors' preferences. Most contractors want work camps spaced no more than 75 miles apart, and as close as 30 miles apart.

Material yards would be spaced approximately every 30 miles for conventional construction and every five miles for helicopter construction. Most contractors prefer to do line construction by conventional methods because of the high cost of helicopter construction. Therefore, it is assumed that the material yards for this project would be spaced approximately every 30 miles. The list of potential sites follows.

- Potential work camp locations
  - Farmington, NM
  - Kayenta, AZ
  - Page, AZ
  - Tuba City, AZ
  - Many Farms, AZ
  - Window Rock, AZ
  - Winslow, AZ
  - Flagstaff, AZ
  - Williams, AZ
  - Kingman, AZ
  - Peach Springs, AZ

- Potential material yard locations
  - Shiprock, NM
  - Toadlena, NM
  - Mexican Water, AZ
  - Kayenta, AZ
  - Many Farms, AZ
  - Ganado, AZ
  - Kaibito, AZ
  - Page, AZ
  - Tuba City, AZ
  - Hotevilla, AZ
  - Bidahochi, AZ
  - Sunrise, AZ
  - Winona, AZ
  - Gray Mountain, AZ
  - Valle, AZ
  - Peach Springs, AZ
  - Dolan Springs, AZ
  - Boulder City, AZ

Local Hiring—Western estimates that up to 50 percent of the total construction workforce would be hired locally. Members of the American Indian communities would be hired for construction activities on NTP. Hiring periods could range, depending on skill requirements, between one and 24 months. Most local hires would be employed as laborers with fewer hired in classifications such as iron workers, groundsmen, truck drivers, and equipment operators. Davis-Bacon wages would be paid. Including fringe benefits, wages would range from $15 per hour for laborers to $25 per hour for more skilled crafts. Assuming a local hire is employed for the duration of a one-year contract, Western estimates that annual wages (including fringe benefits) could range from $30,000 to $50,000.

Turn-over rates for local hires may be high due to reluctance of workers to be separated for any distance or time from family groups, although there would be exceptions. Consequently, individuals' annual earnings from the project for most local hires probably would be less than cited since employment would be less than one year. Traditionally, transmission line construction companies permanently employ workers in specialized classifications, such as linemen or line equipment operators, who travel from job to job with the company. These, and administrative and supervisory staff, comprise the remainder of the transmission construction workforce. At the peak of construction activity Western estimates that the total number of workers on the project would be around 225. They would be located at several sites since various contracts will be in progress simultaneously. Details on the construction workforce are provided in Table 2-5.

RESULTS

No-action Alternative

Under this alternative, no new rights-of-way would be acquired and no new transmission line and associated facilities would be constructed, thereby resulting in a loss of the anticipated socioeconomic benefits from the project. The no-action alternative would mean that land owners or land users (on and off the reservations) would not benefit from compensation for rights-of-way. Counties and local communities would not benefit from the purchase of goods and services during construction, nor from potential long-term tax benefits. Short-term employment during construction and long-term employment opportunities in operation and maintenance would not be realized.

In addition, the Navajo Nation would forego this opportunity to enter the electric utility industry, thereby delaying opportunities for increased revenues and economic diversity. The no-action alternative does not contribute to future development of Navajo Nation energy resources and does not allow the Nation to extend its sovereign authority from natural resource supplier to energy supplier. The no-action alternative would not allow for an opportunity to facilitate the process by which electrical service is provided by NTUA to homes and businesses on parts of the Navajo Nation.

From the perspective of the regional electrical system, Western would not be able to improve existing operational flexibility to provide improved and more efficient services to CRSP customers (of which NTUA is one), or to provide additional opportunities for nonfirm energy transactions. The no-action alternative would preclude Western from realizing more flexibility in purchasing firm energy and reducing costs by increasing capacity of the transmission system into and out of the Four Corners area.

The no-action alternative would prevent facilitating additional economic transmission through interconnections with other regional systems in the Four Corners area to meet a portion of the projected load growth in southern Arizona, Nevada, and southern California. The no-action alternative would not enable economic transfer of seasonal surpluses of electrical generation from resources in the Rocky Mountains and Four Corners areas.

Proposed Project

Local Economic Impacts

In general, NTP construction would have a small but positive socioeconomic effect on residents of the counties where the transmission line would be located. No permanent changes in population are expected to occur, due to the relatively short-term duration of the project at any given location. Coconino County would experience the greatest benefits since that is where the most mileage of transmission line and new substation would be built. Yavapai would have the least amount of benefit, having little or no mileage depending on the alternative route. San Juan, Apache, Navajo, and Mohave counties in general, and the American Indian communities in particular, would experience small but positive employment and income effects from project construction, but it is not known how much they might benefit from the operation of the system. Special hiring and training programs by the construction contractors could potentially benefit local residents.

Impacts on Clark County would be positive but negligible. Regardless of county, however, the construction impacts would be transitory, lasting generally for less than a year except where substation work also would occur. Fiscal impacts would be positive and of some significance in the lesser developed counties. Indirect business taxes (sales, use, and property taxes) related to project construction could temporarily increase some local governments' revenues by appreciable amounts. Over the longer term, taxes from operations could be a source of new revenues for some jurisdictions where NTP facilities would be located, depending on ownership and local tax codes. Information for estimating taxable values of project land, facilities, and operations was not available at the time of this investigation.

The results of the IMPLAN modeling are included in Table 4-5 and discussed by county below.

TABLE 4-5
POTENTIAL ECONOMIC IMPACTS OF CONSTRUCTION:
TOTAL OUTPUT BY COUNTY (Values in millions of 1995 dollars)

County	Direct	Indirect + Induced	Total
San Juan	41.02	11.86	52.88
Apache	20.11	7.52	27.63
Navajo	19.29	6.83	26.13
Coconino	91.00	50.10	141.09
Yavapai	6.99	2.43	9.41
Mohave	48.78	10.78	59.56
Clark	32.30	11.59	43.89

New Mexico

San Juan County—The length of transmission line to be constructed within San Juan County would range from 35 to 40 miles (see Table 4-3), averaging about 36 miles. The existing Shiprock Substation would be expanded. Work on the transmission line would last for about four months (based on an average progress rate of 115 miles per year per contract), while the substation addition would require a full year. Total direct costs of the segment (average for the eastern area alternatives in the county) would be $20.1 million for transmission line plus an estimated $20.9 million for the substation, for a total of $41.0 million (in 1995 dollars).

Arizona

Most of the value of the NTP construction would be expended in Arizona, where more than 85 percent of the transmission mileage would be located. Total construction expenditures within the state could amount to $258.8 million based on average link distances in the five Arizona counties to be crossed and including the new substation constructed in Coconino County. Following is an analysis of the IMPLAN modeling results for impacts in each Arizona county.

Apache County—The projected impacts on the Apache County economy are based on expenditures of about $38.7 million in utility construction over an average of 70 miles of right-of-way. Construction could require about seven months to complete, so NTP's effects on local employment, income, and local taxes would be relatively short-lived in Apache County.

Navajo County—The projected impacts on the Navajo County economy are based on expenditures of about $24.1 million worth of utility construction over an average of 43 miles of right-of-way.

Coconino County—The projected impacts on the Coconino County economy are based on expenditures of about $98.3 million worth of transmission line over an average of 177 miles of right-of-way, plus $41.8 million for new substation construction, for a total of $140.2 million. This work would extend over approximately two years. Coconino County would be the principal economic beneficiary of NTP construction work, as reflected by the potential employment, income and output gains summarized in Table 4-5.

Yavapai County—The projected impacts on the Yavapai County economy are derived from expenditures of about $7.0 million worth of transmission line over an average of 12.6 miles of right-of-way. Based on total projected direct expenditures, Yavapai County would be the smallest economic beneficiary of the NTP construction work.

Mohave County—The projected impacts on the Mohave County economy are based on expenditures of about $48.8 million worth of utility construction over an average of 88 miles of right-of-way. Mohave County would have the second longest segment of the NTP. Accordingly, the county would derive a positive, albeit short-term, stimulus from the project.

Nevada

Clark County—The projected impacts on the Clark County economy are based on expenditures of about $11.4 million worth of transmission line construction over an average of 20.5 miles of right-of-way plus about $20.9 million for substation expansion. In terms of regional economic impact, the Clark County portion of NTP would be negligible. Total employment in the county exceeded 400,000 in 1991, and is expanding rapidly in response to relocation of industries and expansion of gaming and tourism. NTP would represent an insignificant positive force on the local economy.

VISUAL RESOURCES

Strategic siting combined with the application of mitigation (e.g., nonspecular conductors would be used for the entire project) has resulted in overall residual visual impacts that are expected to be lower than those typically associated with a transmission facility the size and magnitude of NTP.

The majority of each alternative route would parallel existing transmission lines, resulting in overall visual impacts of low to moderate. In these areas, construction activities and the introduction of new structures would not substantially change the existing visual conditions. Minimizing new access roads, matching structure locations and types, and using nonspecular conductors are mitigation measures that effectively reduce the short- and long-term visual impacts where NTP would parallel existing lines.

Where NTP would be establishing a new corridor, the construction and operation of the transmission line could result in residual impacts that range from moderate to high. In new corridor locations, mitigation included nonspecular conductors, clearing vegetation in natural patterns, limiting construction of access roads, selective locations for towers, and dulled metal finishes of towers to reduce visual impacts.

The impact assessment was based on the fundamental elements of previous visual studies for transmission lines and the concepts outlined in the BLM's 8400 Series Visual Resource Manual (BLM 1986) and the Forest Service Visual Resource Management Systems (Forest Service 1974). In addition, compliance with BLM and Forest Service visual resource management objectives were assessed. The methods and procedures described in these documents served as a foundation for the impact assessment and were adapted to address the specific issues related to the construction and operation of NTP on private and public lands.

The measure of potential adverse impact on visual resources is based on visual 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 NTP. Visual contrast typically results from (1) landform modifications that are necessary to upgrade and construct new access roads, tower pad sites, and substations; (2) removal of vegetation to construct roads and maintain right-of-way and clearance zones associated with the conductors and towers; and (3) introduction of new structures in the landscape.

Types of visual impacts and definitions of impact levels are provided in Table 4-6. An overview of visual impacts identified are summarized below and illustrated on Figures MV-10E through MV-13W.

OVERVIEW

Visual impacts would be long term, remaining over the life of the project. Construction and operation of the proposed facilities may result in impacts that affect the scenic quality of an area and views from sensitive locations including residences; parks, recreation or preservation areas; travel routes and trails; and highly sensitive cultural resource sites (e.g., historic landmarks).

TABLE 4-6 VISUAL RESOURCE IMPACT TYPES AND LEVELS	
High	Visual contrasts resulting from construction disturbances (i.e., roads and vegetation clearing) and the presence of the transmission line that would substantially alter the scenic values of the landscape and would dominate views from sensitive viewpoints. For example, areas where the transmission line would be in the immediate foreground (0.0 to 0.5 mile) distance zone obstructing or dominating views from sensitive viewpoints, or where the transmission line would be seen in the foreground to middleground distance zones previously undisturbed landscapes. Also, where the transmission line would traverse previously undisturbed, highly scenic landscapes (Class A).
Moderate	Visual contrasts that would diminish the scenic values of the landscape and would be easily noticed where visible from sensitive viewpoints. For example, areas where the transmission line would be visible in the middleground (0.5 to 3 miles) to background (beyond 3 miles) distance zones from sensitive viewpoints; or, in the foreground distance zone from moderate sensitivity viewpoints; or, where the transmission line would be seen in the foreground to middleground distance zones and parallel to existing transmission line facilities or traversing previously disturbed landscapes. Also, where the transmission line would traverse highly scenic landscapes (Class A) that have been previously disturbed or in other previously undisturbed landscapes of common or minimal scenic quality (Class B or C).
Low	Visual contrasts that would diminish the scenic values of the landscape slightly and may be noticeable where viewed from sensitive viewpoints. Some examples include where the transmission line would be visible in the background distance zone, where viewing conditions (e.g., screening, backdrop, viewer orientation, etc.) would partially obscure visibility of the transmission line in the middleground distance zone, where viewing conditions would substantially reduce visibility in the foreground distance zone; where the transmission line would parallel existing transmission line facilities or traverse other previously disturbed landscapes, and where the transmission line would traverse previously disturbed or landscapes of common to minimal scenic quality (Class B or C).

Scenic Quality—A majority of the residual impacts on scenic quality would be low to moderate, with only limited areas of high impact as shown on Figures MV-10E and MV-10W. This is due to (1) the predominance of lands with minimal or average diversity (Class C and Class B Scenery); and/or (2) the presence of existing transmission lines, which already have modified the local setting, along a majority of the alternatives. In these locations, the introduction of facilities would not substantially alter the scenic values of the landscape.

High residual impacts on scenic quality have been designated only in those areas where NTP would establish a new corridor in areas of outstanding or distinctive diversity (Class A Scenery). These areas would be restricted to three locations along certain alternative routes including the crossing of Red Point Mesa Cliffs (Link 501), the north face of the Black Mesa escarpments (Links 504 and 561), and southern portion of the Grand Wash Cliffs (Link 501). Visual contrast resulting from construction disturbance and the long-term presence of NTP in these areas would substantially alter the scenic value of the landscape resulting in high impacts. However, at Black Mesa the terrain is such that it could screen the transmission line from view.

Visual Sensitivity—Impacts on sensitive viewers could range from low to high based on (1) visibility, including distance from viewers, screening potential, and terrain factors that may affect visibility; (2) scenic quality; and (3) contrast with existing visual conditions. A brief description of viewer impact levels follows. These are illustrated on Figures MV-11E through MV-12W.

Low impacts on viewers are anticipated for a majority of the area crossed by the alternative routes. Low impacts occur most often in the following situations: (1) those areas seldom seen or in background viewing areas (e.g., in the western portion of the project area, which is very sparsely populated and where alternatives avoid major travel routes); and (2) locations where NTP would be visible in landscape settings already modified by high-voltage transmission lines (e.g., locations throughout the eastern and western portions of the project area where alternatives would parallel existing 345kV or 500kV transmission lines).

Moderate impacts on viewers would occur most often in the following situations: (1) those locations where NTP would cross previously undisturbed landscapes that are within middleground to background viewing areas (e.g., locations in the Chinle Valley); (2) where lower-voltage (115kV to 230kV) transmission lines would be paralleled within foreground views of Class B Scenery (e.g., Shonto area); and (3) views to distinctive Class A landscapes where NTP would parallel existing 345kV to 500kV transmission lines (e.g., Chuska Mountains).

Areas of high impact on viewers are limited, occurring only in areas where NTP would be located in new corridor characterized by Class B or Class A scenery and would be visible in foreground or near middleground areas (within 1 mile). Alternatives in the eastern portion of the project area would have high impacts primarily along the northern edge of Black Mesa; south of Dennehotso and Kayenta; north of Coppermine; and in the vicinity of Sweetwater, Rock Point, Many Farms, and Black Mountain Wash in the Chinle Valley. High impacts on viewers associated with alternative routes in the western portion of the project area would be limited primarily to the Hackberry, Truxton, Nelson, and Seligman areas.

Agency Visual Management Objectives—The majority of alternative routes would be located in areas that are considered to be compatible with agency visual management objectives established by BLM (VRM) and the Forest Service (VQO) as shown on Figures MV-13E and MV-13W. This includes all areas where existing high-voltage transmission lines would be paralleled. These locations have been designated as utility corridors within agency management plans in Arizona and Nevada (Table E-2). In New Mexico, new lines are reviewed on a case-by-case basis to determine compatibility. The only areas currently identified that would not meet visual management objectives are located in the western portion of the project area where alternatives N2 and N4 would cross areas designated by BLM as VRM Class II (Link 1980), and where alternatives S2 and S4 would cross areas designated by the Forest Service as Retention VQO (Links 1680 and 1720).

EFFECTS OF EACH ALTERNATIVE

No-action Alternative

Under this alternative, this environment would remain as it presently exists.

Eastern Area Transmission Line Alternatives

This section provides a summary of high residual impacts along alternative routes in the eastern portion of the project area, and focuses on areas where project facilities could substantially alter the scenic values of the landscape and dominate views from sensitive viewpoints. Moderate and high impacts on scenic quality and sensitive viewers are shown in Table 4-7 and illustrated on Figures MV-10E through MV-13E.

TABLE 4-7
SUMMARY OF POTENTIAL IMPACTS ON VISUAL RESOURCES
EASTERN AREA ALTERNATIVES

Alternative Route	Impact	Miles of Residual Impacts		
		NM	AZ	Total
Scenic Quality				
GC1	M	—	6.6	6.6
GC1	H	—	14.5	14.5
K1	M	—	5.0	5.0
K1	H	—	14.5	14.5
C1	M	1.2	5.1	6.3
C2	M	—	28.2	28.2
Views from Residences				
GC1	M	0.2	45.2	45.4
GC1	H	—	25.8	25.8
K1	M	0.2	57.0	57.2
K1	H	—	24.4	24.4
C1	M	4.0	12.0	16.0
C1	H	0.6	—	0.6
C2	M	0.2	49.0	49.2

TABLE 4-7 SUMMARY OF POTENTIAL IMPACTS ON VISUAL RESOURCES EASTERN AREA ALTERNATIVES				
Alternative Route	Impact	Miles of Residual Impacts		
		NM	AZ	Total
C2	H	—	23.8	23.8
High Sensitive Roads				
GC1	M	—	19.8	19.8
GC1	H	—	1.2	1.2
K1	M	—	7.8	7.8
K1	H	—	1.2	1.2
C1	M	1.2	0.3	1.5
C2	M, H	—	—	—
Moderate Sensitive Roads				
GC1	M	—	10.1	10.1
K1	M	—	10.1	10.1
C1	M, H	—	—	—
C2	M	—	6.6	6.6
C2	H	—	1.1	1.1
Parks, Recreation, and Sensitive Viewpoints				
GC1	M	—	3.2	3.2
K1	M	—	3.2	3.2
C1	M	—	1.3	1.3
C2	M	—	1.3	1.3

Glen Canyon 1 (GC1)

<u>New Mexico</u>

GC1 would not cross any areas identified as potentially high impact in New Mexico.

Arizona

A total of 14.5 miles of high residual impacts on scenic quality are expected to occur where GC1 crosses Class A scenery in the vicinity of the Red Point Mesa Cliffs and Black Mesa Escarpments in a new corridor (Links 501, 504, and 561). Selective placement of towers in the Black Mesa area could reduce impacts further based on the screening potential of local terrain.

High impacts on views from residences would occur for 25.8 miles where GC1 is in a new corridor and located within the foreground and middleground views from residences in the vicinity of Red Point Mesa, Baby Rocks Mesa, and Church Rock Valley (Link 501); south of Kayenta (Links 502 and 504); near Tsegi in the Marsh Pass area (Link 561); and from residences in the vicinity of Lechee (Link 627). High impacts along 1.2 miles would result because of brief views from State Highway 98 and U.S. Highway 89.

Kaibito (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1). This segment of K1 would be located within a new corridor.

This portion of K1 does not cross any additional areas of high impact on scenic quality. However, K1 would result in a total of 24.4 miles of high impacts on views from residences. Of this total, approximately 2.0 miles would occur in areas of new corridor on the Kaibito Plateau (Links 1390 and 1391). K1 also would cross Arizona State Route 98 in this area, resulting in approximately 1.2 miles of high impacts based on foreground and middleground views at the road crossing (Link 1390).

Central 1 (C1)

New Mexico

Impacts on scenic quality and residential views in areas of new corridor along The Hogback are moderate-to-low with the exception of 0.6 mile of high impacts on views from residences (Link 640).

Arizona

Impacts on scenic quality along C2 in Arizona would be low with the exception of approximately 5.1 miles of moderate impact at the crossing of the Chuska Mountains (Link 700). At this location, C1 parallels an existing 500kV transmission line resulting in moderate residual impacts on scenic quality and residences with foreground to near middleground views of NTP (within 1 mile). These impacts have been reduced by using nonspecular conductors, matching the spacing and type of existing structures, using dulled-metal finish on towers, and minimizing tree clearing in a fashion that conforms with existing natural vegetation patterns.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains along Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1.

C2 does not cross any areas identified as having high impact on scenic quality, but would result in a total of 23.8 miles of high residual impacts on residential views, and 1.1 miles of high impact on views from U.S. Highway 191 where the highway is crossed by Link 462 (a new corridor) south of Rock Point.

Substation Alternatives

Shiprock Substation—Impacts on visual resources at this location would be low due to the modified conditions at the existing substation site and the absence of sensitive viewers.

Honey Draw Substation Site—Moderate impacts on scenic quality and viewers in Lechee are expected to occur at this new substation site. The existing 345kV transmission lines in the vicinity have modified the visual conditions in this area, and low profile (shorter) structures would be used to reduce visibility of the facilities.

Red Mesa Substation Site—This substation would be situated immediately adjacent to an existing 345kV transmission line that has modified the visual conditions in this area. Moderate impacts on scenic quality and on middleground and background views from dispersed residences are expected to occur at this site with selective views to the substation that are partially screened by local terrain.

Copper Mine Substation Site—This substation would be located between two existing 345kV transmission lines that have modified the visual conditions in this area. Moderate impacts on scenic quality and on foreground and middleground views from dispersed residences are expected to occur at this new site; however, stands of piñon-juniper would provide partial-to-full screening of the substation from certain locations.

Moenkopi Substation—Impacts on visual resources at this location would be low due to the modified conditions at the existing substation site.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace

This section provides a summary of high visual impacts for alternatives in the western portion of the project area, and focuses on areas where project facilities could substantially alter the scenic values of the landscape and dominate views from sensitive viewpoints. Moderate and high impacts on scenic quality and sensitive viewers are shown in Table 4-8 and illustrated on Figures MV-10W through MV-13W.

TABLE 4-8
SUMMARY OF POTENTIAL IMPACTS ON VISUAL RESOURCES
WESTERN AREA ALTERNATIVES

Alternative Route	Impact	Miles of Residual Impacts		
		AZ	NV	Total
Scenic Quality				
Moenkopi to Marketplace				
N1W	M, H	—	—	—
N2	M	13.4	—	13.4
N2	H	8.1	—	8.1
S2	M	58.1	—	58.1
Moenkopi to Mead				
N3	M, H	—	—	—
N4	M	13.4	—	13.4
N4	H	8.1	—	8.1
S4	M	58.1	—	58.1

TABLE 4-8 SUMMARY OF POTENTIAL IMPACTS ON VISUAL RESOURCES WESTERN AREA ALTERNATIVES				
Alternative Route	**Impact**	**Miles of Residual Impacts**		
		AZ	**NV**	**Total**
Views from Residences				
Moenkopi to Marketplace				
N1W	M	0.6	—	0.6
N2	M	15.2	—	15.2
N2	H	2.6	—	2.6
S2	M	23.8	—	23.8
S2	H	10.2	—	10.2
Moenkopi to Mead				
N3	M	0.6	—	0.6
N4	M	15.2	—	15.2
N4	H	2.6	—	2.6
S4	M	23.8	—	23.8
S4	H	10.2	—	10.2
High Sensitivity Roads				
Moenkopi to Marketplace				
N1W	M	1.4	—	1.4
N2	M	9.4	—	9.4
N2	H	1.1	—	1.1
S2	M	12.0	—	12.0
S2	H	5.1	—	5.1
Moenkopi to Mead				
N3	M, H	—	—	—
N4	M	8.0	—	8.0
N4	H	1.1	—	1.1

TABLE 4-8 SUMMARY OF POTENTIAL IMPACTS ON VISUAL RESOURCES WESTERN AREA ALTERNATIVES				
Alternative Route	Impact	Miles of Residual Impacts		
		AZ	NV	Total
S4	M	10.6	—	10.6
S4	H	5.1	—	5.1
Moderate Sensitive Roads				
Moenkopi to Marketplace				
N1W	M, H	—	—	—
N2	M, H	—	—	—
S2	M	12.7	—	12.7
S2	H	1.7	—	1.7
Moenkopi to Mead				
N3	M, H	—	—	—
N4	M, H	—	—	—
S4	M	12.7	—	12.7
S4	H	1.7	—	1.7
Parks, Recreation, and Sensitive Viewpoints				
Moenkopi to Marketplace				
N1W	M	0.6	—	0.6
N2	M	12.1	—	12.1
N2	H	0.3	—	0.3
S2	M	14.1	—	14.1
S2	H	3.1	—	3.1
Moenkopi to Mead				
N3	M	0.6	—	0.6
N4	M	12.1	—	12.1
N4	H	0.3	—	0.3

TABLE 4-8 SUMMARY OF POTENTIAL IMPACTS ON VISUAL RESOURCES WESTERN AREA ALTERNATIVES				
Alternative Route	Impact	Miles of Residual Impacts		
		AZ	NV	Total
S4	M	14.1	—	14.1
S4	H	3.1	—	3.1

Northern 1 West (N1W)

Arizona and Nevada

Impacts on visual resources along N1W in both Arizona and Nevada would be low.

Northern 2 (N2)

Arizona

The Arizona portion of N2 is the same as N1W with the exception of Links 1742, 1800, 1980, and 2020, which are located to the south of the Hualapai Reservation (and replace Link 1790 on N1W).

The segment of N2 that varies from N1W would result in 8.1 miles of high impacts on scenic quality in the Music Mountains and Grand Wash Cliffs (Link 1980). In this area, N2 would be located within a new corridor.

N2 would result in a total of 2.6 miles of high impacts on views from residences in the vicinity of Nelson (Link 1742) and Truxton (Link 1980). In addition, 1.1 miles of high impact on views from U.S. Highway 66 would occur where it would be crossed by N2 in a new corridor northwest of Nelson (Link 1742).

Nevada

The Nevada portion of N2 is the same as N1W.

Southern 2 (S2)

Arizona

In Arizona, S2 varies from N2 beginning at the Moenkopi Substation and continuing west through Link 2006. At this point, S2 is then the same as N2 proceeding north and west along Links 2020 and 2060 to the crossing of the Colorado River and the Nevada border.

S2 does not cross any areas of high impact on scenic quality in Arizona. However, S2 would result in a total of 10.2 miles of high impacts on views from residences (Links 1420, 1680, 1720, 1960, and 2002). Other areas where high impacts would occur are at the crossing of U.S. Highway 66 for 5.1 miles (Links 1720, 1780, and 1820) and U.S. Interstate 40 at the crossing through the Juniper Mountains for 1.7 miles (Link 1720). High impacts on recreational views would occur at the crossings of the Beale Wagon Road for approximately 3.1 miles (Links 1680 and 1720).

Nevada

The Nevada portion of S2 is the same as N1W and N2.

Western Area Transmission Line Alternatives - Moenkopi to Mead

Northern 3 (N3), Northern 4 (N4), Southern 4 (S4)

Alternatives N3, N4, and S4 are identical to alternatives N1W, N2, and S2, respectively, with the exception of Links 2040 and 2080, which connect into the Mead Substation rather than Marketplace Substation (replacing Links 2060, 2200, and 2180). The following description focuses only on Links 2040 and 2080.

Arizona

Link 2040 crosses the Colorado River in an existing transmission line corridor and parallels 345kV and 500kV facilities. Impacts on visual resources are anticipated to be low.

Nevada

In Nevada, Links 2040 and 2080 would parallel existing 345kV and 500kV transmission lines and impacts on visual resources would be low. The crossing of the Colorado River, similar to Link 2060, is within an existing transmission line corridor.

Substation Alternatives

Red Lake Substation Site—Impacts on scenic quality and viewers are expected to be low to moderate based on the Class B and Class C scenery in this area, combined with the modified visual conditions associated with the presence of two existing 500kV transmission lines.

Marketplace Substation—Impacts on visual resources at this location would be low because of the existing modified conditions at the site.

Mead Substation—Impacts on visual resources at this location would be low because of the existing modified conditions at the site.

Microwave Communication Facility

Impacts on visual resources would be low because of the existing modified conditions and limited amount of change resulting from the existing communication facilities.

NOISE

If the project is not implemented (no action), the environment would remain as it presently exists.

If the project were implemented, some level of noise would result from construction, maintenance, and operation of the transmission line. During construction, noise would be generated by the equipment used for grading (access roads, tower sites, and substations), assembly and erection of towers, wire-pulling and splicing, equipment installation (substations), and rehabilitation activities. During maintenance activities, noise could be generated from a vehicle driving along the access roads for tower and line inspection, a helicopter flying along the right-of-way for tower and line inspection, or equipment and crew conducting maintenance and/or repairs. Calculations of noise from these activities is complicated by the fact that noise levels continuously rise and fall (e.g., the quantity, distribution, and usage of equipment vary with the type of activity).

In determining the impact of noise, the important factor is the closeness of the activity to wildlife and persons detecting the sound. The project area is almost entirely rural open space and remote, with background noise typical of such settings. In most cases, the closest humans would be construction workers. Where construction would occur near more populated areas, the noise from construction (and subsequent maintenance) might be audible; however, such noise would be temporary and possibly considered only as a nuisance. Wildlife most likely would avoid the temporary construction disturbance (see Biological Resources section).

Audible noise generated during operation of the transmission line is addressed below in the EMF section.

ELECTRIC AND MAGNETIC FIELDS AND EFFECTS

Potential impacts from NTP are discussed in context of electric and magnetic fields and their effects, including corona effects and short- and long-term field effects.

Both current and voltage are required to transmit electrical energy over a transmission line. The current, a flow of electrical charge measured in amperes (A), is the source of a magnetic field. The voltage, which represents the potential for an electrical charge to do work, expressed in units of volts (V) or kV and is the source of an electric field. The maximum current would be approximately 1,385 A. The proposed transmission line would operate at a nominal voltage of 525kV.

The electrical effects of the proposed 500kV transmission line can be characterized as "corona effects" and "field effects." Corona is the electrical breakdown of air into charged particles; it is caused by the electric field at the surface of the conductors. Effects of corona are audible noise, radio and television interference, visible light, and photochemical oxidants. Field effects are induced currents and voltages, as well as related effects that might occur as a result of electric and magnetic fields at ground level.

Corona Effects

Corona can occur on the conductors, insulators, and hardware of an energized high-voltage transmission line. Corona on conductors occurs at locations where the field has been enhanced by protrusions, such as nicks, insects, or water drops. During fair weather, the number of these sources is small and corona is insignificant. However, during wet weather, the number of these sources increases and corona effects are much greater. The types of corona effects are described below.

Audible Noise—Corona-generated audible noise from transmission lines is generally characterized as a crackling, hissing noise. The noise is most noticeable during wet-weather conditions such as rain, snow, or fog. Such weather is estimated to occur less than two percent of the time in the NTP area. Transmission line audible noise is measured and predicted in decibels (A-weighted), or dBA. Some typical noise levels are as follows: remote areas (no wind), 15 to 20 dBA; moderate rainfall on foliage and normal conversation, 60 dBA; and freeway traffic or freight train at 50 feet, 70 dBA. This last level represents the point at which a contribution to hearing impairment begins.

There are no noise codes applicable to transmission lines in New Mexico, Arizona, or Nevada. In most situations, the level of noise at the edge of the right-of-way of the proposed line would be less than 50 dBA. This level is lower than the EPA standard for outdoor areas—a day-night average sound level of less than 55 dBA (EPA 1978). Where the NTP line would parallel an existing transmission line, noise would be additive but not double. Audible noise from the line(s) most often would be masked by naturally occurring sounds at locations beyond the edge of the right-of-way. Noise levels at the edge of the right-of-way also would be less than those near existing 500kV transmission lines in Arizona.

Radio and Television Interference—Corona-generated radio interference is most likely to affect the amplitude modulation (AM) broadcast band (535 to 1,605 kilohertz); frequency modulation (FM) radio reception is rarely affected. Only AM radio receivers located very near to transmission lines have the potential to be affected by radio interference. An acceptable level of maximum fair weather radio interference at 100 feet from the conductors is about 40 dB μ volts/meter (V/m) (decibels above 1 microvolt per meter). The predicted fair weather level for the proposed transmission line is 36 dB μV/m, which is below the acceptable limit. Average levels during foul weather are, as a general rule, 16 to 22 dB higher than average fair weather levels. The predicted average level at 100 feet from the conductors in foul weather is 53 dB μV/m.

Television interference from corona occurs during foul weather, and is generally of concern for transmission lines with voltage of 345kV or above and only for receivers within about 600 feet of the line. The level of corona-generated television interference expected at 100 feet from the conductors of the proposed transmission line is 22 dB μV/m. This level is below that computed for existing 500kV lines in Arizona.

Typical transmission line engineering practice is to design lines to be as free from corona and other sources of interference as possible. However, mitigative techniques exist, if needed, for eliminating adverse impacts on radio and television reception. Individual complaints about radio interference and television interference would be settled by the project proponents.

Other Interference—Corona-generated interference can conceivably cause disruption on other communication bands such as the citizen's (CB) and mobile bands. However, mobile radio communications are not susceptible to transmission line interference because they are generally frequency modulated (FM). In the unlikely event that interference occurs with these or other communications, mitigation can be achieved with the same techniques used for television and AM radio interference.

Other Corona Effects—Corona is visible as a bluish glow or as bluish plumes. On the proposed line, corona levels would be so low that corona on the conductors would be observable only under the darkest conditions and probably only with the aid of binoculars. Without a period of adaptation for the eyes and without intentionally looking for the corona, it probably would not be noticeable.

When corona is present, the air surrounding the conductors is ionized and many chemical reactions take place, producing small amounts of ozone and other oxidants. Approximately 90 percent of the oxidants is ozone, while the remaining ten percent is composed principally of nitrogen oxides. The national primary ambient air quality standard for photochemical oxidants, of which ozone is the principal component, is 235 μg/m3 (micrograms/cubic meter) or 120 ppb (parts per billion). The maximum incremental ozone levels at ground level that would be produced by corona activity on this transmission line during foul weather would be much less than 1 ppb. This level is insignificant when compared with natural levels and fluctuations in natural levels.

Field Effects—Short-term Exposure

Electric Field—The electric field created by a high-voltage transmission line extends from the energized conductors to other conducting objects such as the ground, towers, vegetation, buildings, vehicles, and persons. The electric field is expressed in units of V/m or kilovolts/meter (kV/m).

The maximum electric field, at the minimum 29-foot conductor-to-ground clearance and at a voltage of 500kV, would be 12.2 kV/m. On the ground under a transmission line, the electric field is nearly constant in magnitude and direction over distances of a few meters. The field decreases rapidly as distance from the conductors increases. At the edge of the right-of-way nearest to the line, the field would be 0.9 kV/m. On the other edge of the right-of-way, the field would vary with the line configuration present. Maximum electric fields under the existing parallel transmission lines would vary from 4.7 to 10.8 kV/m, depending on voltage.

Induced Currents—When a conducting object, such as a vehicle or person, is placed in an electric field, current and voltages are induced in the object. The magnitude of the induced current depends on the electric-field strength and the size and shape of the object. If the object is grounded, then the induced current flows to earth and is called the short-circuit current of the object. In this case, the voltage of the object is effectively zero. If the object is insulated (not grounded), then it assumes some voltage relative to ground. These induced currents and voltages represent a potential source of nuisance shocks near a high-voltage transmission line. The proposed line would be designed to meet the NESC criterion of 5 mA for the short-circuit current from the largest anticipated vehicle under the line. To accomplish this, clearance of conductors above road crossings would be increased above the minimum clearance of 29 feet to allow for the large vehicles anticipated on roads and highways. In addition, permanent structures for the right-of-way (such as fences and metal buildings) would be grounded.

Steady-State Current Shocks—Steady-state currents are those that flow continuously after a person contacts an object and provides a path to ground for the induced current. Primary shocks are those that can result in direct physiological harm. The lowest category of primary shocks is "let go," which represents the steady-state current that cannot be released voluntarily. The 5 mA maximum induced current criterion for vehicles closely approximates the estimated 4.5 mA let-go threshold for 0.5 percent of children (Keesey and Letcher 1969). Primary shocks would not be possible from the induced currents under the proposed line.

Potential steady-state-current shocks from vehicles under the proposed line are all at or below the secondary shock level, where secondary shocks are defined as those that could cause an involuntary and potentially harmful movement but no direct physiological harm. Steady-state-current shocks are not anticipated to occur very often, and when they do they would represent a nuisance rather than a hazard.

Spark Discharge Shocks—Induced voltages appear on objects such as vehicles when there is an inadequate ground. If the voltage is sufficiently high, a spark-discharge shock will occur as contact is made with the object. This type of shock could occur under the proposed line. However, on much of the right-of-way, the magnitude of the electric field would be low enough that this type of shock would occur rarely, if at all. Only in the area under the line near midspan would fields be high enough for this type of discharge to be perceivable. The occurrence of such nuisance shocks is anticipated to be infrequent. Spark discharges also could occur between persons and plants such as tall grass, between a person and an animal, and between a person and a vehicle in the areas directly under the conductors.

Carrying or handling conducting objects, such as irrigation pipe, under the proposed line also could result in spark discharges that are a nuisance. The primary hazard with irrigation pipe or other long objects, however, is electrical flashover from the conductors if a section of pipe is inadvertently tipped up near the conductors.

Field Perception and Neurobehavioral Responses—When the electric field under a transmission line is sufficiently strong, it can be perceived by hair erection on an upraised hand. At locations directly under the conductors, it would be possible for some individuals to perceive the field while standing on the ground. The mechanism is similar to that involved when our hair responds to a comb indoors on dry winter days. The potential for this to occur under the proposed line would be similar to that under the existing Four Corners-Moenkopi-Eldorado 500kV transmission line. Perception of the field would not occur at or beyond the edge of the right-of-way.

Studies of short-term exposure to electric fields have shown that fields may be perceived (felt, for example on the arms as a result of hair movement) by some people at levels of about 2-10 kV/m, but studies of controlled, short-term exposures to even higher levels in laboratory studies have shown no adverse effects on normal physiology, mood, or ability to perform tasks. Some guidelines (e.g., the International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1990) propose that short-term exposures be limited to 10 kV/m for the general public. This level would occur directly below the proposed NTP transmission line, but levels are lower at the edge of the right-of-way. Nevertheless, the research literature suggests that, apart from direct perception of electric fields, few neurobehavioral responses would be expected and none are harmful. Magnetic fields even at levels much greater than those produced by the transmission line cannot be perceived.

Studies of nonhuman primates (e.g., monkeys, baboons) exposed to electric or magnetic fields have shown little evidence of effects on performance of tasks routinely used to assess sensory, memory, and other cognitive functions in animals. While there have been reports of responses of isolated neural tissues and cells, the findings are not consistent and the physiological relevance of responses of isolated tissues to whole organisms is unclear.

In the past, there had been considerable interest in the acute effects of electric field exposures on the hormonal responses of animals and humans (e.g., pituitary, adrenal, and sex hormones). No consistent or replicable responses are reported. Over the past 15 years, there has been a more specialized interest in the effects of both AC electric and magnetic fields on the release and synthesis of melatonin by the pineal gland. There are contradictory findings regarding the ability of electric and magnetic fields to affect melatonin levels in rodents. Electric and magnetic fields do not affect melatonin levels of sheep living underneath a 500kV transmission line. Some preliminary studies of melatonin levels in humans have been completed but provide no clear, reproducible evidence that 10 mG or 200 mG magnetic fields reduce melatonin secretion.

Grounding and Shielding—Induced currents are always present around transmission lines. However, the grounding policies for operation of the line would eliminate the possibility of nuisance shocks because of these currents from stationary objects such as fences and buildings.

Mobile objects cannot be grounded permanently, but coupled currents to persons in contact with mobile objects can be limited through adherence to the NESC and the use of conducting grounds. Conductive shielding reduces electric fields and the potential for induced effects, such as shocks. Persons inside a conducting vehicle cab or canopy will be shielded from the electric field. Similarly, a row of trees or a lower-voltage distribution line will reduce the field on the ground in their vicinity. Metal pipes, wiring, and other conductors in a residence or building will shield the interior from the electric field due to the transmission line. The prevalence of induced current shocks, spark discharge shocks, and field perception under the proposed line is anticipated to be comparable to that under the existing 500kV lines such as the Four Corners-Moenkopi-Eldorado line.

Magnetic Field—A 60-Hz magnetic field is created in the space around transmission line conductors by the electric current flowing in the conductors. The magnetic field is expressed in units of gauss or milligauss (mG), where one milligauss is one thousandth of a gauss.

The calculated 60-Hz magnetic field at 3.3 feet above ground for the proposed line is 318 mG. This field is calculated based on a maximum current of approximately 1,385 A and for conductors at a height of 29 feet. For this condition, the calculated magnetic field at the edge of the right-of-way nearest to the NTP line is about 35 mG. Slightly higher values would occur where the line parallels the Four Corners-Moenkopi-Eldorado 500kV line (44 mG) and the Glen Canyon-Shiprock 230kV line (39 mG). The maximum level is comparable with the maximum magnetic fields of other transmission lines and with levels of magnetic field measured near some common household appliances. The actual level of magnetic field will vary as the current on the transmission line varies and as the height above the ground changes.

The magnetic field at the edge of the right-of-way of the proposed line would be less than field levels set in other states. There are no limits established for peak magnetic fields. A possible short-term impact associated with the magnetic fields from an AC transmission line is induced voltages and currents in long conducting objects such as fences and pipelines. Grounding practices and the availability of mitigation measures would minimize these effects of the line. In areas where other lines would parallel the proposed line, such measures may already be in place. No adverse impact is expected from magnetically induced currents and voltages.

Field Effects—Long-term Exposure

Studies of the effects of long-term exposure to environmental agents on health include both epidemiology and laboratory research. Epidemiology is the study of diseases and potentially health-related exposures of people in their normal environment; laboratory research is the study of exposures to whole animals, or to cells or tissues isolated from the organism, under controlled laboratory conditions. These approaches have been used to examine the possible effects of long-term exposure to 60-Hz electric and magnetic fields from transmission lines on health.

Standards—There are no national standards for electric or magnetic fields from transmission lines, and the states of New Mexico, Arizona, and Nevada have not set recommended field limits for transmission lines. However, several states have established recommended field limits for maximum field on the right-of-way and field at the edge of right-of-way. The maximum electric field from the proposed line on the right-of-way would be along the centerline and would exceed the recommended limits of New York, Florida, Minnesota, Montana, and Oregon. The electric field at the edge of the right-of-way of the proposed line would be below limits set in these states, except Montana. Magnetic fields at the edge of the right-of-way would not exceed limits set by Florida and New York.

Several scientific organizations have proposed voluntary limits to exposure. These organizations include the American Conference of Governmental Industrial Hygienists (ACGIH 1995), ICNIRP (1990), and National Radiological Protection Board of Great Britain (NRPB 1993). Exposure guidelines are based on considerations of both the intensity of the field and the duration of exposure. The recommended intensity levels for daily electric field exposure are not exceeded at the edge of the right-of-way or at distances farther from the line.

The exposure guidelines of ICNIRP for electric fields could be exceeded on portions the right-of-way (even those specified for occupational exposures) unless the time spent on the right-of-way is limited and precautions are taken to prevent current discharges from charged objects. Furthermore, compliance with both ICNIRP and ACGIH guidelines for electric field exposures on the right-of-way would call for persons with implanted pacemakers and other similar devices to be discouraged from unshielded exposures (a passenger in an automobile underneath the transmission line would be shielded from the electric field). These guidelines are basically designed to (1) minimize the possibility of perception and annoyance from surface charge effects and shocks from contact with large ungrounded objects with short-term exposures and (2) minimize the possibility of electrical interference with implanted medical devices. No adverse effects of exposure are known to be associated with the levels of electric fields expected on the right-of-way. Moreover, the likelihood for long-term exposure is very small. Persons entering the right-of-way who are annoyed by detection of the electric field would move off the right-of-way; also, in general, there is no reason for people to spend extended periods of time on the right-of-way.

Recommended intensity limits for daily magnetic field exposure (ICNIRP 1990) are not exceeded within or at the edge of the right-of-way or at distances further from the line. The levels produced by this line are several fold below the recommended limit of 1,000 milligauss (mG).

Scientific Reviews, Guidelines, and Standards—A number of different groups of scientists and technical organizations have reviewed the epidemiology and the laboratory research studies. No group has concluded that adverse health effects occur from long-term exposures to power frequency fields at levels associated with transmission lines. No Federal regulatory agencies have set standards to limit exposures to power-frequency electric and magnetic fields.

International and United States technical groups have developed guidelines to limit exposures based on the potential for biological effects from exposures for a few hours or a day to levels of 1,000 mG or higher, and 10 kV/m (see discussion above, under short-term exposure). Magnetic fields associated with the proposed transmission line would be well below this level.

Electric Fields and Human Health—Because electric fields are shielded by buildings and vegetation, transmission lines outside of the home are not a significant source of electric fields in the residence. Therefore, questions about health and long-term exposure to sources of fields generally are not focused on electric fields.

The function of some models of cardiac pacemakers or defibrillators, which are implanted in persons to correct abnormalities in heartbeat, may be affected by electric fields greater than 2kV/m. Electric fields at this intensity and higher would occur in the right-of-way of NTP and are already present along existing transmission lines that would be paralleled by the alternative routes in the eastern and western portions of the study area for 60 to 100 percent of their entire length.

Modern pacemakers are designed to filter out electrical stimuli from sources other than the heart (e.g., muscles of the chest, currents encountered from touching household appliances, or currents induced by electric or magnetic fields). There remains a very small possibility that some pacemakers, particularly those of older designs and with single-lead electrodes, may sense potentials induced on the electrodes and leads of the pacemaker and provide unnecessary stimulation to the heart. For brief periods of time, at least, this reversion to a fixed pacing rate is not generally believed to be harmful. Less likely is the possibility that the pacemaker may not stimulate the heart when it is needed during the period of interference. Wearers of pacemakers are instructed by pacemaker manufacturers and physicians about potential incompatibilities of pacemakers with fields produced by a variety of electrical and medical devices. The sensitivity and operating mode of pacemakers can be programmed to virtually eliminate the possibility of potential interference by electric fields. As pointed out by cardiologists who have reviewed this issue (e.g., Griffin et al.), the opportunity and risk of pacemaker interference from power frequency fields is very small compared to that of contact currents from household appliances and other sources. From their perspective, an induced current of 25 μA induced by a 2kV/m electric field is of lesser concern than a household appliance that in normal operation is permitted to "leak" up to 500μA upon contact.

There is no practical way to determine whether persons living near, or traversing the right-of-way would have such devices, and whether an individual's particular device is susceptible to interference from electric fields. However, the likelihood of such an event is judged to be extremely small based upon three considerations that are summarized below.

Firstly, the alternative routes are generally located away from areas where large numbers of people live or congregate, and would parallel existing high-voltage transmission lines. Based on an initial review of existing land use within proximity to alternatives, it appears that only Link 580, along alternative routes GC1 and K1 in the vicinity of the town of Shonto, would require further study if selected as the final route, to consider whether it is advisable to limit access to the right-of-way or devise other mitigation strategies. However, the possibility for interference to pacemakers in this area already exists based on the presence of the Shiprock-to-Glen Canyon 230kV transmission line that would be paralleled along much of alternative routes GC1 and K1.

Secondly, only a small fraction of the population in the United States have implanted pacemakers. Among the Navajo population living in Arizona, New Mexico, and Utah, the fraction of the population that has pacemakers is estimated to be at least 20-fold smaller than the national percentage. Also, very few pacemakers are in use by Hopi and Hualapai populations.

Thirdly, only a small fraction (less than three percent) of pacemakers in use potentially might be susceptible to electrical fields because of recent design improvements that detect and filter out electrical interference.

Once a final route is selected, detailed studies would be conducted to verify assumptions and determine appropriate mitigation measures.

Magnetic Fields and Human Health—Over the past 17 years, many epidemiology studies have examined whether transmission lines could affect health or cause cancer. The focus of these studies was the magnetic fields from transmission lines, largely because electric fields from transmission lines are shielded by buildings and vegetation. Earlier studies raised the question of whether living near transmission lines that produced higher magnetic fields—those that carried higher current—could affect the risk of cancer, particularly childhood leukemia.

In the earlier epidemiologic studies, long-term exposure to magnetic fields was based only on assumptions about exposures from the transmission lines, rather than on measurements, creating uncertainty about actual exposures to magnetic fields and preventing clear interpretation of the results. Recent studies have used detailed calculations to improve the estimates of exposures to transmission line magnetic fields at residences, but any associations with childhood cancer are weak, and inconsistent across studies. Studies of transmission lines and cancer in adults have not provided evidence of an association with cancer in general or with any particular type of cancer.

Earlier epidemiology studies of workers in "electrical" occupations, jobs that were believed to include exposure to electric and magnetic fields, reported increased risks for leukemia or for brain cancer. However, since 1993, several larger and better designed studies of these cancers have been completed. Overall, these workers had less cancer than people in the general population, and associations with leukemia in one of the studies and brain cancer in another were weak. Thus, even in populations with high exposures to electric and magnetic fields, there is not consistent or convincing evidence that the occurrence of these rare cancers is changed.

In the laboratory, magnetic field exposures can be controlled by the researcher, and known steps in the process of cancer development can be studied. Cancer-related changes have not been found in cells exposed to electric and magnetic fields, and cancer was not increased in animals exposed to magnetic fields even after the cancer process had been started, or initiated, by chemicals known to cause this change. Long-term studies of exposures of laboratory animals to magnetic fields are in progress. Preliminary results from one completed study report no increase in cancer.

Both epidemiology and laboratory studies have examined the effect of exposure to magnetic fields on pregnancy. A recent, large epidemiology study estimated exposure from various sources in homes, including higher sources of exposure such as electric blankets and water beds. Pregnancy in those who used these heating sources progressed at the normal rate, and the infants were not different in birth weight than babies whose mothers were not exposed. This absence of effect is supported by the results of several long-term studies in pregnant laboratory animals. Animals exposed to electric or to magnetic fields during pregnancy had litters of normal size and healthy offspring no different from unexposed animals.

Effects on Agriculture and Wildlife—The electric fields from the proposed transmission line would be below levels where effects have been observed on crops.

High electric fields (15 kV/m) have been observed to induce corona on the uppermost parts of plants resulting in minor damage to the leaf tips. Electric fields of 16 kV/m did not affect growth, yield, or plant height under a high-voltage test line. The maximum electric field under the proposed line would be well below the level where induced corona has been observed on crop plants. Therefore, the phenomenon is very unlikely to occur on crops under the line.

Induced currents caused by electric fields under the transmission lines have been observed to disrupt performance of bees in hives. Unless hives are shielded, similar effects could occur under the proposed line. Hives located off the right-of-way would not be affected.

The plants and animals in the natural environment of this line would not be disturbed or affected by the electric and magnetic fields from the line. Domestic livestock including sheep, dairy cattle, swine, and beef grow and function normally on farms near transmission lines. A study of sheep kept for several months in electric and magnetic fields under a transmission line at the edge of the right-of-way showed normal growth, behavior, and wool production. Large mammals in the wild have been observed to pass through and to forage under transmission lines. Laboratory studies indicate that small mammals such as rats and mice would not be disturbed by or avoid electric and magnetic fields, even at levels higher than associated with the proposed line. In addition, species that live at ground level are shielded from the electric fields by vegetation. Birds routinely fly over transmission lines during migration, with no interference in that migration.

Safety

The greatest hazard from a transmission line is direct electrical contact with the conductors. Therefore, extreme caution must be exercised when operating vehicles and equipment for any purpose, including recreation near transmission lines. Maintaining safe electrical clearance from the lines is imperative. Therefore, long objects, such as irrigation pipes and antenna masts, should not be tipped up under the proposed line (or any line).

In high electric fields, it is theoretically possible for a spark discharge from the induced voltage on a large vehicle to ignite gasoline vapor during refueling. The probability for the precise conditions for ignition occurring is extremely remote. The additional clearance of conductors provided at road crossings reduces the electric field in areas where vehicles are common and reduces the chances for such events. Vehicles should not be refueled under the proposed line unless specific precautions are taken to ground the vehicle and the fueling source.

Because of the hazards associated with fires, storage of flammables, construction of flammable structures, and other activities that have the potential to cause or provide fuel for fires on rights-of-way are prohibited.

Transmission line towers, wires, and other tall objects are the most likely points to be hit by lightning during a thunderstorm. Therefore, the area near towers and other tall objects should be avoided during thunderstorms. The proposed line is designed with overhead ground-wires and well-grounded towers to protect the system from lightning.

CULTURAL RESOURCES

Cultural resources are not merely remnants of the past, but have an important role in connecting all contemporary societies to their heritage and traditions, thereby providing structure and perspective for contemporary lifeways. Once deteriorated, damaged, or destroyed, the tangible evidence of the past may be restorable or reconstructible, but these cultural resources are essentially nonrenewable. A description of potential impacts on cultural resources follows.

Three cultural resource impact issues, which focus on specific categories of resources, were defined:

1. loss or degradation of prehistoric and historic archaeological sites
2. loss or degradation of special status cultural resources
3. loss or degradation of traditional cultural places

Three types of impacts that could affect each of these categories of cultural resources were identified:

1. direct and permanent ground disturbance during construction
2. direct and long-term visual and auditory intrusions
3. indirect and permanent disturbance due to changes in public accessibility

OVERVIEW

Archaeological and Historical Sites—Impacts on archaeological and historical sites generally are rated as low to moderate throughout the project area, reflecting the high potential to satisfactorily mitigate impacts on these types of cultural resources (see Figures MV-18E and MV-18W). The only potential high residual impacts are projected in very limited areas of high archaeological and historical site sensitivity that lack existing roads. Although direct impacts would likely be satisfactorily mitigated in these zones, increased use of the areas stemming from new vehicular access is projected to have long-term, indirect impacts on archaeological and historical sites beyond the right-of-way. By using helicopter construction techniques to eliminate the need for new roads, these high impacts could be avoided or substantially reduced.

Special Status Cultural Resources—Impacts on most special status cultural resources are generally rated as low to moderate, because most of these resources are relatively distant from the reference centerlines, and their settings already have been affected by previous transmission lines. The few exceptions are primarily where new corridors would have high impacts at crossings of linear resources such as historic U.S. Route 66 and the Beale Wagon Road.

Traditional Cultural Places—Impacts on traditional cultural places are rated as high in much of the project area because several American Indian communities maintain strong, integral traditional cultural, religious, and emotional bonds to the landscape (see Figures MV-15E, MV-15W, MV-16E, MV-16W, and MV-17W). None of the alternative routes can avoid all of these high impact zones. At this time, no specific traditional places listed or determined eligible for listing on the National Register of Historic Places have been identified within any of the alternative routes. This reflects the incompleteness and confidential nature of information regarding traditional places. The assessment of high impacts is based on general sensitivities rather than a detailed assessment of impacts on specific places.

Degradation or loss of cultural resources along any of the alternative routes due to direct impacts would be irreversible and irretrievable because cultural resources are essentially nonrenewable. Degradation due to visual intrusions could be reversed if and when the transmission line were to become obsolete and be removed. Although hundreds of cultural resources could be affected, these numbers of resources represent only a small percentage of the regional database, which, though largely uninventoried, is projected to number hundreds of thousands of cultural resources.

IMPACT ASSESSMENT AND MITIGATION

The strategy used to assess impacts of NTP on cultural resources first involved defining impact issues and identifying specific types of impacts. Then criteria were established for rating the severity of projected impacts. The potential for mitigating projected impacts was considered and used to rate residual impacts.

Impacts were rated as low, moderate, and high. The criteria used to define impacts on archaeological and historical resources are summarized in Table 4-9. The rating of impact levels was based on the generic mitigation measures (see Table 2-3) incorporated into the project description, which consist of a commitment to pursue consultation as stipulated by a programmatic agreement negotiated for this project in compliance with Section 106 of the National Historic Preservation Act. This commitment states that:

TABLE 4-9
ARCHAEOLOGICAL AND HISTORICAL RESOURCE IMPACT CRITERIA

Impact Level	Description
Low (insignificant)	very low to low-moderate impacts (some resources may be present, and some of these may have significant information potential; mitigative data recovery studies probably would be required, but they would not be extensive and would result in no adverse effect)
Moderate (potentially significant)	moderate-low to moderate-high impacts (moderate to high density of simple to complex resources significant primarily for their information potential are likely to be present; moderate-high level of effort could be required to avoid or mitigate effects through data recovery studies, but are expected to result in few, if any, adverse effects)
High (significant)	high-moderate to very high impacts, but some are potentially mitigable to lower level (high density of resources with significant information potential are likely to be present and some resources are likely to be important for values other than their information content, such as traditional cultural concerns about ancestral sites or human burials; measures to avoid or mitigate impacts are likely to require substantial effort and may or may not eliminate high impacts; unmitigated, indirect, long-term, permanent impacts beyond the right-of-way due to new vehicular access are also rated as high)

Cultural resources will continue to be considered during post-EIS phases of the project in accordance with the programmatic agreement developed in conjunction with preparation of the EIS. This would involve intensive surveys to inventory and evaluate cultural resources within the selected route and any appurtenant impact zones beyond the corridor, such as access roads and construction equipment yards. In consultation with appropriate land managing agencies, tribal governments, and State Historic Preservation Officers, specific mitigation measures would be developed and implemented to mitigate any identified adverse impacts. These may include project modifications to avoid adverse impacts, monitoring of construction activities, and data recovery studies. American Indian groups will be involved in these consultations to determine whether there are effective or practical ways of addressing impacts on traditional cultural places.

Ratings of impacts along each alternative link were based on consideration of (1) the sensitivity (quantity and quality) of archaeological and historical sites, and (2) the extent of ground disturbance. Because intensive surveys have not been conducted along all the alternative links, detailed inventories of archaeological and historical sites are not available. Detailed construction plans have not been completed either, so both the sensitivity of the resources and the extent of ground disturbance were estimated by developing models.

The inventory section of Chapter 3 describes how archaeological and historical site sensitivities were characterized as low, moderate, or high. Six different levels of ground disturbance were modeled on the basis of terrain and presence or absence of existing roads (see Table 2-4). In general, impacts are projected to be low in low and moderate sensitivity zones where there are existing access roads; moderate in low and moderate sensitivity zones where there are no existing access roads; moderate in high sensitivity zones where access roads are present; and high in high sensitivity zones where there are no existing access roads.

The analysis of impacts on special status cultural resources was coordinated with the visual impact studies, and the criteria used to define impact levels are summarized on Table 4-10. In general, background intrusions (two to three miles) were characterized as low impacts, middleground intrusions (one to two miles) as moderate, and foreground intrusions (less than one mile) as high (Table 4-11).

Individual studies conducted for Navajo, Hopi, and Hualapai traditional cultural places each developed impact criteria tailored to each tribe's concerns. Although the assessment strategies varied, each study rated the results in categories of low, moderate, and high impacts, or finer distinctions of those general categories. The Hopi study also calculated "impact scores" to compare alternatives. These scores considered the number of traditional Hopi places within six-mile-wide corridors along each alternative link, the ritual or nonritual nature of those places, and whether the corridor followed an existing transmission line or pipeline.

TABLE 4-10 SPECIAL STATUS CULTURAL RESOURCES IMPACT CRITERIA	
Impact Level	**Description**
None	no impacts (towers and conductors not visible)
Low (insignificant)	very low to low-moderate impacts (potential visual intrusions into middleground settings of high-moderate sensitivity resources or background settings of high and very high sensitivity resources; no auditory impacts)
Moderate (potentially significant)	moderate-low to moderate-high impacts (potential foreground intrusions at high-moderate sensitivity resources, or intrusions into the middleground settings of high and very high sensitivity resources; no auditory impacts)
High (significant)	high-moderate to very high impacts, but potentially mitigable to lower level (potential intrusions into foreground settings of high-moderate, high, and very high sensitivity resources; typically assigned only to corridors where no transmission line currently exists; potential auditory intrusions, as well as potential for direct ground disturbance)

TABLE 4-11
IMPACT MODEL FOR SPECIAL STATUS CULTURAL RESOURCES

	Levels of Visual Impacts								
	Low (background)			**Moderate (middleground)**			**High (foreground)**		
Resource Sensitivity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
High-Moderate - state register properties - BLM ACECs - other agency plans	L	L	L	L	M	M	M	H	H
High - national register properties - Chaco protection site candidates - tribal parks	L	L	L	M	M	M	H	H	H
Very High - national monuments - national historic sites - national historic landmarks - national historic roads - Chaco protection sites	L	L	M	M	M	H	H	H	H

Measures were identified to mitigate projected impacts on each of the three defined categories of cultural resources. As explained above, the proposed mitigation of impacts on archaeological and historical sites is a generic commitment to conduct further studies and implement avoidance or mitigation measures. These measures have high potential to satisfactorily mitigate direct ground disturbance impacts and the impact rating reflects residual impacts in consideration of this commitment. The only potential for significant residual impacts is projected along new corridors where access roads would be developed in high sensitivity zones. New vehicular access in these areas could lead to gradual deterioration or loss of archaeological and historical sites as a long-term, indirect impact of increased use of such areas and by the potential for increased vandalism. Use of helicopter construction techniques to avoid construction of new roads in these areas is expected to be an effective mitigation strategy.

The visual resource study team developed recommendations for reducing visual impacts at affected resources including special status cultural resources. These specific mitigation measures, in addition to nonspecular conductors, include using modified tower designs to match existing towers, alteration of tower spacing, use of dulled-metal finish on towers to reduce visibility, and use of helicopters for construction to minimize landscape scarring due to access roads. The visual resource team evaluated the effectiveness of these measures and rated the residual impacts. Evaluations of residual impacts on special status cultural resources were based on these ratings and adjusted in consideration of the specific historic values of each of the special status cultural resources.

Mitigating impacts on traditional cultural places is not straightforward, and cultural resource specialists have far less experience with traditional cultural places than they do with other types of cultural resources. Avoidance of impacts on traditional cultural places is the best strategy, and was the motivation for conducting specific studies of traditional cultural places during the preparation of this DEIS. However, the inventory of traditional places is far from complete and more intensive studies would need to be undertaken along the route selected for construction in coordination with tribal representatives. Until a detailed inventory of traditional places is compiled, the potential for mitigation is unknown and therefore the rating reflects initial rather than residual impacts.

Potential measures to mitigate impacts on traditional cultural resources include (1) shifting tower locations to avoid direct impacts, (2) minimizing ground disturbance by careful placement of access roads and staging areas or use of helicopter construction techniques, (3) scheduling construction activities to avoid ceremonial activities, (4) designing and placing towers to minimize visual intrusions, (5) designing towers so as to not negatively affect populations of raptors that are collected for traditional ritual purposes, and (6) involving customary land users in detailed inventory and impact assessment of a selected route and compensating customary land users in accordance with relevant tribal procedures. Proponents of other projects in the region also have sponsored traditional ceremonies as a means of addressing traditional concerns about unavoidable impacts, and this may be a possible mitigative strategy.

One of the most sensitive issues for traditional communities is disturbance of human burials. Avoidance of burials is the preferred treatment, but is not always possible. General procedures for repatriation of human remains to groups claiming affinity have been developing since the passage of the Native American Graves Protection and Repatriation Act of 1990. Specific agreements to address the requirements of the Act may be negotiated by appropriate land-managing agencies.

EFFECTS OF EACH ALTERNATIVE

No-action Alternative

Under this alternative, the environment would remain as it presently exists. This option would forego the opportunity to develop detailed cultural resource inventories along a route, and any recovery of archaeological data that might be undertaken to mitigate project impacts. However, any conflicts with heritage preservation would be avoided by the no-action alternative.

Eastern Area Transmission Line Alternatives

The impacts on cultural resources of the four alternative transmission line routes for the eastern portion of the project are summarized on Table 4-12. Impacts on archaeology and historic resources are also shown on Figure MV-18E, on traditional Navajo cultural places on Figure MV-15E, and on traditional Hopi cultural places on Figure MV-16E.

TABLE 4-12
SUMMARY OF IMPACTS ON CULTURAL RESOURCES
EASTERN AREA ALTERNATIVES

Resource Type	New Mexico	Arizona	Total
Glen Canyon 1 (GC1)			
Archaeological and Historical Sites	19.8 miles (moderate) 15.0 miles (low)	77.0 miles (moderate) 148.8 miles (low)	96.8 miles (moderate) 163.8 miles (low)
Special Status Cultural Resources		Cameron Bridge (low)	Cameron Bridge (low)
Traditional Navajo Cultural Places	33.5 miles (moderate) 1.3 miles (low)	9.4 miles (high) 134.7 miles (moderate) 81.7 miles (low)	9.4 miles (high) 168.2 miles (moderate) 83.0 miles (low)
Traditional Hopi Cultural Places	27.8 miles (low) no identified places impact score = 0	6.0 miles (high) 96.7 miles (moderate) 123.1 miles (low) 48 ritual places, 12 crossed 12 nonritual places, 6 crossed impact score = 185	6.0 miles (high) 96.7 miles (moderate) 150.9 miles (low) 48 ritual places, 12 crossed 12 nonritual places, 6 crossed impact score = 185
Kaibito 1 (K1)			
Archaeological and Historical Sites	19.8 miles (moderate) 15.0 miles (low)	92.5 miles (moderate) 117.4 miles (low)	112.3 miles (moderate) 132.4 miles (low)
Special Status Cultural Resources		Cameron Bridge (low)	Cameron Bridge (low)

TABLE 4-12 SUMMARY OF IMPACTS ON CULTURAL RESOURCES EASTERN AREA ALTERNATIVES			
Resource Type	**New Mexico**	**Arizona**	**Total**
Traditional Navajo Cultural Places	33.5 miles (moderate) 1.3 miles (low)	9.4 miles (high) 128.4 miles (moderate) 72.1 miles (low)	9.4 miles (high) 161.9 miles (moderate) 73.4 miles (low)
Traditional Hopi Cultural Places	27.8 miles (low) no identified places impact score = 0	6.0 miles (high) 92.5 miles (moderate) 111.4 miles (low) 44 ritual places, 12 crossed 13 nonritual places, 7 crossed impact score = 168	6.0 miles (high) 92.5 miles (moderate) 139.2 miles (low) 44 ritual places, 12 crossed 13 nonritual places, 7 crossed impact score = 168
Central 1 (C1)			
Archaeological and Historical Sites	40.2 miles (moderate)	36.6 miles (moderate) 109.9 miles (low)	76.8 miles (moderate) 109.9 miles (low)
Special Status Cultural Resources	Pictured Cliffs (low) Mitten Rock District (low)	Hopi Taawa Tribal Park (moderate) Cameron Bridge (low)	Hopi Taawa Tribal Park (moderate) Cameron Bridge (low) Pictured Cliffs (low) Mitten Rock District (low)
Traditional Navajo Cultural Places	21.0 miles (high) 17.2 miles (moderate) 2.0 miles (low)	53.0 miles (high) 90.5 miles (moderate) 3.0 miles (low)	74.0 miles (high) 107.7 miles (moderate) 5.0 miles (low)
Traditional Hopi Cultural Places	23.6 miles (low) no identified places impact score = 0	96.5 miles (high) 50.0 miles (low) 64 ritual places, 1 crossed 5 nonritual places, 0 crossed impact score = 134	96.5 miles (high) 73.6 miles (low) 64 ritual places, 1 crossed 5 nonritual places, 0 crossed impact score = 134
Central 2 (C2)			
Archaeological and Historical Sites	19.8 miles (moderate) 15.0 miles (low)	71.6 miles (moderate) 104.6 miles (low)	91.4 miles (moderate) 119.6 miles (low)
Special Status Cultural Resources		Hopi Taawa Tribal Park (moderate) Cameron Bridge (low)	Hopi Taawa Tribal Park (moderate) Cameron Bridge (low)
Traditional Navajo Cultural Places	33.5 miles (moderate) 1.3 miles (low)	46.0 miles (high) 130.2 miles (moderate)	46.0 miles (high) 163.7 miles (moderate) 1.3 miles (low)

TABLE 4-12 SUMMARY OF IMPACTS ON CULTURAL RESOURCES EASTERN AREA ALTERNATIVES			
Resource Type	**New Mexico**	**Arizona**	**Total**
Traditional Hopi Cultural Places	27.8 miles (low) no identified places impact score = 0	162.2 miles (high) 14.0 miles (low) 66 ritual places, 1 crossed 4 nonritual places, 0 crossed impact score = 169	162.2 miles (high) 41.8 miles (low) 66 ritual places, 1 crossed 4 nonritual places, 0 crossed impact score = 169

Glen Canyon 1 (GC1)

New Mexico

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites in the New Mexico portion of the GC1 route are projected to be moderate for about 20 miles, and low for about 15 miles. This reflects construction through high and low sensitivity areas adjacent to existing transmission lines where there are existing access roads that could be used to minimize ground disturbance.

Special Status Sites—The New Mexico portion of the GC1 alternative is not projected to affect any special status cultural resources.

Traditional Cultural Places—Impacts on traditional Navajo places are projected to be moderate for about 34 miles and low for 1 mile.

Arizona

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites along the Arizona segment of the GC1 alternative are rated as moderate for about 77 miles and low for about 149 miles. These ratings are based on the use of helicopters to avoid construction of new roads in inaccessible high sensitivity areas for about 15 miles of the route along Links 504 and 561 on the northern edge of Black Mesa.

Special Status Cultural Resources—The only special status resource along this segment of GC1 is the Cameron Bridge, which is listed on the National Register of Historic Places. The bridge is more than two miles from GC1, and two existing transmission lines, a replacement bridge, and other development have altered the setting of the bridge (see Figure MV-14E). Therefore, impacts on the bridge are expected to be low.

Traditional Cultural Places—Impacts on traditional Navajo places along this segment of GC1 are projected to be high for about nine miles, moderate for about 134 miles, and low for about 82 miles. The projected high impacts are along Link 561 in the Marsh Pass area where the route goes through sacred areas or follows routes of travel recounted in ceremonial stories.

Impacts on traditional Hopi places are rated as high. This reflects the presence of 48 known ritual places within the corridor, of which 12 are likely to be crossed directly, and 12 known nonritual traditional use areas, of which 6 are likely to be crossed. These known traditional places are scattered between Marsh Pass and the Moenkopi Substation, and others may be present.

Kaibito 1 (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1).

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites along this segment of K1 are projected to be moderate for 19.7 miles and low for 0.7 mile.

Special Status Cultural Resources—No special status cultural resources are located near this segment of K1.

Traditional Cultural Places—Impacts on traditional Navajo places are projected to be low. Impacts on traditional Hopi places are rated as low for 18.5 miles and moderate for 1.9 miles. This reflects the presence of one nonritual traditional use area, which is unlikely to be directly crossed.

Central 1 (C1)

New Mexico

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites are projected to be moderate for the entire 40-mile length of this segment of C1. This reflects construction through high sensitivity areas adjacent to existing transmission lines or where other existing access roads can be used to minimize ground disturbance.

Special Status Cultural Resources—Two special status resources located along this segment of C1 are the Pictured Cliffs site and the Mitten Rock Archaeological District, both of which are listed on the New Mexico Register of Cultural Properties. Because these resources are approximately 1 to 1.5 miles from the C1 route and their settings have been previously altered by transmission lines and other development, impacts on these special status cultural resources are projected to be low.

Traditional Cultural Places—Impacts on traditional Navajo places are projected to be high for about 21 miles, moderate for about 17 miles, and low for 2 miles. The high impacts are along Links 700 in the Chuska Valley where the route goes through sacred areas or follows routes of travel recounted in ceremonial stories.

Arizona

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites along the Arizona segment of the C1 alternative are rated as moderate for approximately 37 miles. No high impacts are projected, reflecting the fact that C1 follows existing transmission lines or other developed access roads for its entire distance.

Special Status Cultural Resources—Two special status resources along this segment of C1 are the Taawa Park, designated by the Hopi Tribe to protect a group of petroglyphs (rock art), and the Cameron Bridge. The park is only about 0.25 mile from the reference centerline of C1, but impacts are projected to be moderate reflecting the prior alteration of the park setting by an existing transmission line (see Figure MV-14E). Impacts on the Cameron Bridge are projected to be low.

Traditional Cultural Places—Impacts on traditional Navajo places are projected to be high for about 53 miles, moderate for about 91 miles, and low for about 3 miles. The high impact ratings are along Link 700 across the Chuska Mountains and Black Mesa where the route goes through sacred areas or follows routes of travel recounted in ceremonial stories.

Impacts on traditional Hopi places are rated high reflecting the presence of 64 identified traditional ritual places within the corridor, of which one is likely to be directly crossed, and five nonritual traditional use areas, none of which are likely to be crossed. These known traditional places are scattered broadly between the Chuska Mountains and the Moenkopi Substation, and others may be present.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains on Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1.

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites along Link 462 are rated as moderate for 64.2 miles, and low for 1.5 miles.

Special Status Cultural Resources—No special status cultural resources are located along Link 462.

Traditional Cultural Places—Impacts on traditional Navajo places along Link 462 are projected to be moderate. Impacts on traditional Hopi places are rated high reflecting the presence of 8 identified traditional ritual places within the corridor, none of which is likely to be directly crossed.

Substation Alternatives

Shiprock Substation—The existing substation is within a high sensitivity zone for archaeological and historical sites. Several sites might be present, but the potential for acceptable mitigation is high. Residual impacts on archaeological and historical sites are projected to be low to moderate. Expansion of the substation would not affect any special status cultural resources. Navajo traditional cultural places are rated as having low-to-moderate sensitivity, and expansion of the existing substation is projected to have low-to-moderate impacts on traditional cultural places.

Honey Draw Substation Site—The site is within an area characterized as having moderate sensitivity for archaeological and historical sites, and the potential to satisfactorily mitigate impacts is high. Therefore residual impacts are expected to be low. There are no special status cultural resources in the vicinity of the substation site. Sensitivities for Navajo and Hopi traditional cultural places are characterized as moderate to high. Impacts on traditional cultural places are expected to be no more than moderate.

Red Mesa and Copper Mine Substation Sites—The sites are within areas characterized as having moderate sensitivity for archaeological and historical sites. A few sites might be present, but the potential for acceptable mitigation is high. Residual impacts on archaeological and historical sites are projected to be low. No special status cultural resources would be affected. Sensitivities for Navajo and Hopi traditional cultural places are characterized as moderate to high. Although the substation would be a new facility, it would be adjacent to an existing transmission corridor, and therefore incremental impacts on traditional cultural places are expected to be low to moderate.

Moenkopi Substation—The Moenkopi Substation is within an area characterized as having moderate sensitivity for archaeological and historical sites. A few sites might be present, but the potential for acceptable mitigation is high. Residual impacts on archaeological and historical sites are projected to be low. No special status cultural resources would be affected. Sensitivities for Navajo and Hopi traditional cultural places are characterized as moderate to high. The expansion of the existing substation would be expected to have low to moderate impacts on traditional cultural places.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace

The impacts on cultural resources in the western portion of the project are summarized on Table 4-13. Impacts on archaeological and historical resources are also shown on Figure MV-18W, on traditional

Navajo cultural places on Figure MV-15W, on traditional Hopi places on Figure MV-16W, and on traditional Hualapai places on Figure MV-17.

Northern 1 West (N1W)

Arizona

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites are projected to be low along the entire length of this segment. This reflects construction in low and moderate sensitivity zones adjacent to existing transmission lines.

Special Status Cultural Resources—Only one special status cultural resource, the Moqui Stage Station, is expected to be affected. This stage station is located about 0.5 mile south of the N1W route. Interpretive signs have been installed by the Kaibab National Forest in conjunction with development of the Arizona Trail (see Figure MV-14W). Impacts on the stage station are projected to be moderate because the N1W route would be built adjacent to an existing transmission line.

Traditional Cultural Places—Impacts on traditional Hualapai places are projected to be moderate for about 163 miles along this segment. This reflects construction adjacent to an existing corridor through high sensitivity areas, and the Hualapai Tribe's preference for this option over those that would create new corridors through their traditional territory south of their reservation.

Impacts on traditional Navajo places along this segment of N1W are projected to be moderate for about 24 miles, and low for about 67 miles. The moderate impact areas are located at the eastern end of the N1W route.

Impacts on traditional Hopi places are rated as low for about 91 miles. This reflects the presence of one identified traditional ritual place within the corridor, and one other traditional use area, neither of which would likely be crossed. These traditional places are at the eastern end of the N1W route.

Nevada

Residual impacts on archaeological and historical sites are projected to be low for the entire 30-mile length of the Nevada segment of the N1W route. No special status cultural resources would be affected. About 13 miles of Link 2060 extends into Nevada, and this link is projected to have moderate impacts on traditional Hualapai cultural places.

TABLE 4-13 SUMMARY OF IMPACTS ON CULTURAL RESOURCES WESTERN AREA ALTERNATIVES			
Resource Type	**Arizona**	**Nevada**	**Total**
Northern 1 West (N1W) (Moenkopi to Marketplace)			
Archaeological and Historical Sites	187.0 miles (low)	30.0 miles (low)	217.0 miles (low)
Special Status Cultural Resources	Moqui Stage Station (moderate)		Moqui Stage Station (moderate)
Traditional Navajo Cultural Places	24.4 miles (moderate) 66.7 miles (low)		24.4 miles (moderate) 66.7 miles (low)
Traditional Hopi Cultural Places	91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3		91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3
Traditional Hualapai Cultural Places	162.6 miles (moderate)	13.3 miles (moderate)	175.9 miles (moderate)
Northern 2 (N2) (Moenkopi to Marketplace)			
Archaeological and Historical Sites	37.0 miles (moderate) 158.2 miles (low)	30.0 miles (low)	37.0 miles (moderate) 188.2 miles (low)
Special Status Cultural Resources	Beale Road (high) Route 66 (high and moderate) (2 locations) Moqui Stage Station (moderate)		Beale Road (high) Route 66 (high and moderate) (2 locations) Moqui Stage Station (moderate)
Traditional Navajo Cultural Places	24.4 miles (moderate) 66.7 miles (low)		24.4 miles (moderate) 66.7 miles (low)
Traditional Hopi Cultural Places	91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3		91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3
Traditional Hualapai Cultural Places	49.6 miles (high) 121.2 miles (moderate)	13.3 miles (moderate)	49.6 miles (high) 134.5 miles (moderate)
Southern 2 (S2) (Moenkopi to Marketplace)			
Archaeological and Historical Sites	5.9 miles (moderate) 211.8 miles (low)	30.0 miles (low)	5.9 miles (moderate) 241.8 miles (low)

TABLE 4-13 SUMMARY OF IMPACTS ON CULTURAL RESOURCES WESTERN AREA ALTERNATIVES			
Resource Type	**Arizona**	**Nevada**	**Total**
Special Status Cultural Resources	Beale Road (high, low and low) (3 locations) Route 66 (moderate and moderate) (2 locations) Wupatki National Monument (low)		Beale Road (high, low and low) (3 locations) Route 66 (moderate and moderate) (2 locations) Wupatki National Monument (low)
Traditional Navajo Cultural Places	48.4 miles (moderate)		48.4 miles (moderate)
Traditional Hopi Cultural Places	31.4 miles (low) 2 ritual places, 1 crossed 1 nonritual trail, possibly crossed impact score = 6		31.4 miles (low) 2 ritual places, 1 crossed 1 nonritual trail, possibly crossed impact score = 6
Traditional Hualapai Cultural Places	81.6 miles (high) 66.0 miles (moderate)	13.3 miles (moderate)	81.6 miles (high) 79.3 miles (moderate)
Northern 3 (N3) (Moenkopi to Mead)			
Archaeological and Historical Sites	188.4 miles (low)	10.9 miles (low)	199.3 miles (low)
Special Status Cultural Resources	Moqui Stage Station (moderate)		Moqui Stage Station (moderate)
Traditional Navajo Cultural Places	24.4 miles (moderate) 66.7 miles (low)		24.4 miles (moderate) 66.7 miles (low)
Traditional Hopi Cultural Places	91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3		91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3
Traditional Hualapai Cultural Places	164.0 miles (moderate)	10.6 miles (moderate)	174.6 miles (moderate)
Northern 4 (N4) (Moenkopi to Mead)			
Archaeological and Historical Sites	37.0 miles (moderate) 159.6 miles (low)	10.9 miles (low)	37.0 miles (moderate) 170.5 miles (low)
Special Status Cultural Resources	Beale Road (high) Route 66 (high and moderate) (2 locations) Moqui Stage Station (moderate)		Beale Road (high) Route 66 (high and moderate) (2 locations) Moqui Stage Station (moderate)

TABLE 4-13 SUMMARY OF IMPACTS ON CULTURAL RESOURCES WESTERN AREA ALTERNATIVES			
Resource Type	**Arizona**	**Nevada**	**Total**
Traditional Navajo Cultural Places	24.4 miles (moderate) 66.7 miles (low)		24.4 miles (moderate) 66.7 miles (low)
Traditional Hopi Cultural Places	91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3		91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3
Traditional Hualapai Cultural Places	49.6 miles (high) 122.6 miles (moderate)	10.6 miles (moderate)	49.6 miles (high) 133.2 miles (moderate)
Southern 4 (S4) (Moenkopi to Mead)			
Archaeological and Historical Sites	5.9 miles (moderate) 213.2 miles (low)	10.9 miles (low)	5.9 miles (moderate) 224.1 miles (low)
Special Status Cultural Resources	Beale Road (high, low and low) (3 locations) Route 66 (moderate and moderate) (2 locations) Wupatki National Monument (low)		Beale Road (high, low and low) (3 locations) Route 66 (moderate and moderate) (2 locations) Wupatki National Monument (low)
Traditional Navajo Cultural Places	48.4 miles (moderate)		48.4 miles (moderate)
Traditional Hopi Cultural Places	31.4 miles (low) 2 ritual places, 1 crossed 1 nonritual trail, possibly crossed impact score = 6		31.4 miles (low) 2 ritual places, 1 crossed 1 nonritual trail, possibly crossed impact score = 6
Traditional Hualapai Cultural Places	81.6 miles (high) 67.4 miles (moderate)	10.6 miles (moderate)	81.6 miles (high) 78.0 miles (moderate)

Northern 2 (N2)

Arizona

The Arizona portion of N2 is the same as N1W with the exception of Links 1742, 1800, 1980, and 2020, which are located to the south of the Hualapai Indian Reservation (and replace Link 1790 on N1W).

Archaeological and Historical Sites—The section of N2 that diverges from N1W and descends from the Hualapai Plateau down onto the Truxton Plain is projected to have moderate residual impacts for 36.9

miles and low impacts for 23.4 miles. The moderate impacts reflect construction through moderate sensitivity zones adjacent to existing transmission lines or construction of new corridors through low sensitivity zones. Low impacts reflect use of existing roads through low sensitivity zones.

Special Status Cultural Resources—The corridor for the Truxton Plain section of N2 is projected to have high impacts on the Beale Wagon Road and U.S. Route 66, because the crossings are in relatively pristine settings (see Figure MV-14W). Impacts at a second crossing of U.S. Route 66 are projected to be moderate because rolling terrain would limit views. The Truxton Plain section of N2 also crosses another recently identified historic road developed in the 1860s by Mormon missionary Jacob Hamblin. Although this road has not been assigned special status at this time, it is related to the Beale Wagon Road and development of a new transmission corridor across this historic road could lead to high impacts.

Traditional Cultural Places—Impacts on traditional Hualapai cultural places are projected to be high for 41.5 miles of the Truxton Plain section of N2, and moderate for 18.8 miles. No impacts on traditional Navajo or Hopi cultural places are projected along this Truxton Plain section.

Nevada

The Nevada portion of N2 is the same as N1W.

Southern 2 (S2)

Arizona

In Arizona, S2 varies from N2 beginning at the Moenkopi Substation and continuing west through Link 2006. At this point, S2 is then the same as N2 proceeding north and west along Links 2020 and 2060 to the crossing of the Colorado River and the Nevada border.

Special Status Cultural Resources—The eastern section of S2 that varies from N2 crosses the Beale Wagon Road in three locations. One would be near Russell Tank, a camp site along the Beale Road that has been publicly interpreted by the Kaibab National Forest. Impacts at this crossing are projected to be high. The other two crossings are where the road is poorly preserved and the setting has been altered by previous development. Impacts at those crossings are projected to be low. This section of S2 also would cross U.S. Route 66 at two locations where impacts are projected to be moderate. One is southeast of Seligman adjacent to a pipeline corridor, and the other is northwest of Hackberry adjacent to two existing transmission lines. The eastern section of S2 also would be visible from parts of the Wupatki National Monument, but would be more than 10 miles distant and impacts are projected to be low.

Traditional Cultural Places—Impacts on traditional Hualapai cultural places along the eastern section of S2 that varies from N2 are projected to be high for about 82 miles and moderate for about 12 miles. Impacts on traditional Navajo cultural places are rated as moderate for about 48 miles. Impacts on traditional Hopi cultural places are rated as low for about 31 miles. This reflects the presence of two known traditional Hopi ritual places and one trail within the corridor. One of these ritual places and perhaps the trail would be crossed at the eastern end of the S2 route.

Nevada

The Nevada portion of S2 is the same as N1W and N2.

Western Area Transmission Line Alternatives - Moenkopi to Mead Alternatives

Northern 3 (N3), Northern 4 (N4), Southern 4 (S4)

Alternatives N3, N4, and S4 are identical to alternatives N1W, N2, and S2, respectively, with the exception of Links 2040 and 2080, which connect into Mead Substation instead of Marketplace Substation (replacing Links 2060, 2200, and 2180). The following discussions focus on Links 2040 and 2080.

Arizona

The Arizona portion of Link 2040 is expected to have impacts very similar to those of Link 2060. The only difference is that Link 2040 is slightly longer in Arizona and would cross an additional mile of zones projected to have low residual impacts on archaeological and historical resources, and moderate impacts on traditional Hualapai cultural places.

Nevada

Residual impacts on archaeological and historical sites are projected to be low for the 10.9 miles of Links 2040 and 2080 in Nevada. No special status cultural resources would be affected. The 10.6 miles of Link 2040 in Nevada are projected to have moderate impacts on traditional Hualapai cultural places.

Substation Alternatives

Red Lake Substation Site—The site is within an area characterized as having moderate sensitivity for archaeological and historical sites. The potential to satisfactorily mitigate impacts is high, and residual impacts are expected to be low. A segment of the Beale Wagon Road is the only special status cultural resource in the vicinity of the substation site. This poorly preserved segment is about a mile to the west on the opposite side of State Route 64, and impacts are projected to be low. No traditional Hopi or Hualapai cultural places are identified in the vicinity, but a place sacred to traditional Navajos is located within approximately three miles of the substation site and impacts are characterized as moderate.

Marketplace Substation—The existing substation is within an area characterized as a low sensitivity zone for archaeological and historical sites. There are no special status cultural resources in the vicinity, nor have any traditional cultural places been identified in the area. In summary, no impacts on cultural resources are projected.

Mead Substation—The existing substation is within an area characterized as a low sensitivity zone for archaeological and historical sites and residual impacts are projected to be low. There are no special status cultural resources in the vicinity of this substation, nor have any traditional cultural places been identified in the area.

Microwave Communication Facility

No archaeological or historical sites would be affected. No special status cultural resources are present in the vicinity. Bill Williams Peak is named in Navajo ceremonial stories and Hopi sacred places are present on the mountain, but the Kaibab National Forest, which manages the land, has consulted with Native Americans and continued use of the communications facilities is not expected to affect traditional cultural places.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

No significant unavoidable adverse impacts were identified for air, water, earth, biological, paleontological, land use, socioeconomic, or acoustical (noise) resources for the proposed NTP. Further, there are no anticipated significant unavoidable adverse impacts associated with EMF. Table 4-14 shows the significant unavoidable adverse impacts on visual and cultural resources associated with alternatives in the eastern and western portions of the project area.

CUMULATIVE EFFECTS

Cumulative effects are the incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions within the same geographic region. This section addresses past and present actions, which predominantly include transmission lines and other utilities; future development projects; and global warming.

Transmission Lines

Numerous existing transmission lines, power distribution lines, agency-designated corridors, and other linear facilities are located throughout the project area. Several of the most significant transmission lines along the final alternative routes are listed below:

- two 345kV Glen Canyon-to-Pinnacle Peak
- two 500kV Navajo-to-Westwing

ALTERNATIVE ROUTES	Visual (Miles)					Cultural				
						Traditional Cultural Properties				
	Views from Residences	Scenic Quality	Views from High Sensitivity Roads	Views from Moderate Sensitivity Roads	Views from Recreation	Archaeology and History (miles)	Special Status Sites (number)	Navajo (miles)	Hopi Impact Score*	Hualapai (miles)
Eastern Area										
GC1	25.8	14.5	1.2	–	–	–	–	2.0	185	–
K1	24.4	14.5	1.2	–	–	–	–	9.0	168	–
C1	0.6	–	–	–	–	–	–	74.0	134	–
C2	23.8	–	–	1.1	–	–	–	46.0	169	–
Western Area										
N1W	–	–	–	–	–	–	–	–	–	–
N2	2.6	8.1	1.1	–	0.3	–	2	–	–	50.0
S2	10.2	–	5.1	1.7	3.1	–	1	–	–	82.0
N3	–	–	–	–	–	–	–	–	–	–
N4	2.6	8.1	1.1	–	0.3	–	2	–	–	50.0
S4	10.2	–	5.1	1.7	3.1	–	1	–	–	82.0

* The Hopi "impact scores" reflect the types and numbers of traditional places within the alternative corridors, whether these places were likely to be crossed, and whether utilities had been previously developed within the corridors. The scores reflect relative preference, but all of the alternatives in the eastern area are likely to adversely affect traditional Hopi places. The Hopi Tribe did not identify high impacts by milepost because of concerns about revealing confidential information.

Significant Unavoidable Adverse Impacts

- 230kV Glen Canyon-to-Shiprock
- 500kV Four Corners-to-Mohave
- 345kV Liberty-to-Mead
- 500kV Mead-to-Phoenix
- two 230kV Davis-to-Pinnacle Peak

FLPMA mandates that, to the extent practical, future utility projects should be consolidated within established corridors, thereby limiting cumulative impacts. The BLM in Arizona and Nevada designate utility corridors through their Resource Management Plan process. The BLM and Forest Service recognize existing utility lines as corridors. NPS also has designated utility corridors (Lake Mead NRA). The majority of the environmentally preferred alternatives follow existing corridors, making cumulative impacts relatively small.

In the future (estimated ten years or more), another 500kV transmission project on the Navajo Reservation could be constructed and operated potentially in the same corridor as NTP from Shiprock to Moenkopi. This assumption is based on DPA's initial project description as well as a Navajo Nation conditional right-of-way grant, which includes a 400-foot-wide right-of-way across the Navajo Reservation. Planning for or securing right-of-way for a second transmission line was based on the potential for additional generation because of resource availability (gas and coal) in the Four Corners area. Cumulative impacts are discussed further by resource below.

Air Quality Effects—The air quality may be improved in some areas and may be degraded in others because of the development of NTP, depending upon the specific operation of the electrical system by NTP participants. However, since the participants have not been determined and no Federal action regarding electrical system operation in the western United States is required, the nature and extent of possible beneficial or adverse impacts cannot be determined.

For example, if excess hydroelectric power is transferred to the Southwest in the spring or summer during peak electrical demand periods and fossil fuel generation is reduced, air quality in the Northwest and the Southwest should improve. Also, if fossil fuel generated power is transferred to the Northwest in the winter during peak electrical demand periods, the potentially degraded air quality near the generation source may be offset by fewer emissions in other parts of the western United States. Some fossil fuel plants in the Southwest are scheduled to be retrofitted with pollution-control equipment, thereby reducing air quality concerns of potentially increasing use of these plants in seasonal exchanges with the Northwest. Specific operation of NTP, the western interconnection transmission system in the United States, and potential atmospheric emission of pollutants also would depend on annual weather conditions (e.g., water storage for hydroelectric generation) and the changing mix of nuclear and other generation sources (e.g., cogeneration, solar).

As a result of electric generating capacity in the Southwest, it is anticipated that the majority of the power transmitted over the proposed NTP would come from existing capacity. A potential indirect cumulative impact associated with the transmission line is increasing emissions from existing fossil-fueled power generation in the Four Corners region. Existing generating stations that would use the proposed NTP would be determined by both long-term power supply contracts and short-term power markets.

Existing generating stations in the region with potential excess capacity are the San Juan, Four Corners, and Navajo generating stations. Emissions of criteria pollutants from these sources have already been permitted at full facility capacity under state and Federal permit programs to assure compliance with NAAQS. Sulfur dioxide and nitrogen oxide emissions from these facilities also will be limited by the Clean Air Act (CAA) Phase II sulfur dioxide allowance program and by CAA nitrogen oxide emission limits. All three of these facilities have particulate emissions controls. San Juan and Four Corners have sulfur dioxide scrubbers and the Navajo Generating Station is in the process of installing sulfur dioxide removal equipment. Both San Juan and Four Corners have boilers or burners designed to minimize formation of nitrogen oxides. However, all three regional plants with potential capacity have been permitted at full facility capacity and allowed for under state and Federal permit programs. Therefore, air quality cumulative impacts should not increase over levels currently permitted.

Water Resources Effects—Cumulative effects on water resources would be minimal with the addition of NTP. There is a potential that ground-disturbing activities could result in streambank degradation, sedimentation in streams, and disturbance of floodplains. However, mitigation would minimize impacts on water resources.

Earth Resources Effects—The cumulative effects on earth resources would not be measurably different than the additive effects of NTP. A second line in addition to NTP could add to potential for wind and water soil erosion, stream bank degradation, and sedimentation in water bodies, dependent on the mitigation implemented. Generally, ground disturbance and new access would be incrementally less for the second project. Ground disturbance is generally low for NTP because of the majority of the alternatives parallel to existing transmission lines and associated access roads. However, the cumulative effects of two transmission lines would likely be somewhat more than any single project.

Biological Effects—The cumulative biological effects with NTP also would be generally additive, and would usually be directly proportional to the amount of ground disturbed. Cumulative effects also depend to some extent on whether NTP construction activities are concurrent or overlapping in a given area. If construction is occurring concurrently, a higher volume of traffic may result and possibly greater amounts of ground disturbance (erosion, etc.) would occur. Overlapping activity, on the other hand, may create disturbance to wildlife for a longer period of time, resulting in prolonged or permanent displacement of wildlife from crucial habitats.

Where utility rights-of-way are adjacent to one another, the increased width of clearing would create a larger gap in the protective cover for large animals in some areas (forested habitats), and create a more visually noticeable corridor, which could deter animals from crossing. In some situations, the increase in vegetation diversity due to an expanded corridor can provide additional habitat for some species. However, where designated corridors are used, access roads may serve more than one line and would therefore minimize ground disturbance and the amount of increased access in some areas.

Impacts from a second future transmission line project would be expected to be similar to those identified for NTP. The cumulative effect of three projects in one corridor (e.g., existing line, NTP, and a future 500kV line) is likely to produce impacts that are of slightly higher degree and possibly of longer duration.

Paleontological Resources Effects—Regardless of the route selected for the transmission line, much of it would parallel existing transmission lines. Where NTP would parallel existing linear facilities, impacts of NTP and a second line would result in incremental impacts along the existing corridors rather than entirely new impacts. Furthermore, there is a very high potential to satisfactorily mitigate impacts by recovering important information prior to or during construction. In areas of new access road, indirect impacts on paleontological resources could result from vandalism because of increased access into a previously less accessible area.

Land Use Effects—Most cumulative impacts on land uses are expected to be minimal with the addition of NTP. Small areas of rangeland used for grazing and forage would be permanently removed from production by tower foundations and permanent access roads. These impacts would accumulate with the second 500kV project although the total area lost from production would be small in the context of the region.

Alternatives resulting in direct impacts on residences from NTP (150-foot separation from existing lines) are not anticipated. Significant cumulative impacts on residences could potentially occur if NTP were to be paralleled by a second line in the future. Assuming the second line across the Navajo Reservation would not parallel NTP and would instead use one of the three remaining alternatives evaluated, no direct land use impacts are anticipated.

Socioeconomic Effects—Cumulative socioeconomic impacts are generally only a concern if they would over-extend public services and accommodations in the project area. If NTP is built, the cumulative beneficial impact on the Navajo Nation could be significant including operational revenues, employment revenues to the Navajo Nation, and increased availability of electricity on the reservation. It is reasonable to assume a second line would be built by the Navajo Nation and would have similar cumulative beneficial impacts if NTP accomplished the beneficial impacts mentioned previously.

Visual Effects—The proposed transmission line would increase the cumulative visual impacts on views from highways, residences, recreational areas, and on natural scenic quality. Typically, the first transmission line built in a natural setting would cause the most noticeable incremental change because of the contrast of form, line, color, and texture to the surroundings. Each successive change, such as NTP, becomes less noticeable than the first, although the new sum of all the changes (e.g., form, line, color, and texture) are more evident.

If NTP and a second 500kV line are built on the Navajo Reservation, a multi-line corridor (three lines) would be more visible at greater distances because of the cumulative physical contrast with the natural landscape than two transmission lines (assuming NTP is paralleling an existing line). However, two separate existing corridors used by NTP and a potential second line (two lines in each corridor) would result in fewer cumulative impacts across the Navajo Nation than three lines in one corridor.

Noise Effects—Cumulative effects of corona-generated audible noise would be additive (but not double) with the addition of NTP. For example, the NTP line would increase the level of noise at the edge of the 230kV line by about 5dBA, which would be barely discernible. During fair weather, which is about 98 percent of the time, audible noise levels would be about 20 dBA lower if corona is present. Although noise may be audible during wet-weather conditions, line noise would most often be masked by naturally occurring sounds at locations beyond the right-of-way.

Electric and Magnetic Field Effects—With the addition of the NTP 500kV line, cumulative effects of electric and magnetic fields would be additive within the right-of-way; however, there should be little or no difference of one or more lines at the edge of the right-of-way.

Cultural Resource Effects—Over time, cultural resources are subject to attrition as cultures change, and archaeological and historical sites weather and erode. In addition, prior development of various types of projects has degraded and destroyed cultural resources. NTP may affect 200 to 300 archaeological sites. However, the cultural resource base of the region is quite extensive. For example, several thousand archaeological and historical sites have been recorded in the region, and there are likely to be hundreds of thousands that have not been discovered and recorded.

Traditional cultural places are not as well documented as archaeological and historical sites, but they are unlikely to be as numerous. Traditional cultural places perhaps also are more threatened because they have not been as actively managed for protection as archaeological and historical sites.

Much of NTP would follow existing utility corridors. Many of these were established prior to current environmental planning and mitigation practices, nevertheless NTP would result in incremental impacts on these existing corridors rather than totally new impacts. There is very high potential to satisfactorily mitigate impacts on archaeological and historical sites by recovering important information prior to construction. The potential to mitigate impacts on traditional cultural places is less clear, although traditional tribal groups would be involved in detailed inventory, assessment of impacts, and attempts to identify and implement any mitigating measures for a selected route. The decision to pursue developments such as NTP may involve tradeoffs for preserving traditional cultural places.

The potential construction of an additional future transmission line within a route selected for NTP would have additional cumulative effects on cultural resources. Again, impacts would be incremental rather than totally new. The potential to satisfactorily mitigate impacts on archaeological and historical sites is high. The potential to mitigate impacts on traditional cultural places is likely to be less.

Indirect impacts on cultural resources can result from degrading the setting of a significant cultural feature and incidental destruction of cultural sites or traditional cultural properties by OHV recreationists. In the case of the latter, if transmission lines make formerly remote areas of the landscape more accessible (due to construction access roads), OHV users may use these roads to gain easier access to these areas. Cumulative damage to cultural resources could result over time from repeated incremental damage caused by being run over by OHVs. Illegal "pot hunting" also could increase over time due to increased accessibility into remote areas depending upon public access control by utilities and land-managing agencies. The presence of multiple transmission lines would not likely contribute measurably to this type of cumulative effect over a single transmission line.

Visual effects on the setting of significant cultural resources would increase with each successive transmission line, but would likely be less than additive.

Future Development Projects

In addition to a second 500kV line across the Navajo Reservation, the operation of NTP would use existing regional generation resources more efficiently. Although not directly connected or related to NTP, several electrical generating projects of various sizes in the Four Corners area have been discussed. Potential projects have been or are being considered as alternative means of meeting current or projected electrical energy needs in various locations of the West. Future coal-fired or cogeneration projects would cumulatively affect air quality, increasing particulate, carbon dioxide, nitrogen oxide, and other gaseous emissions. The largest of these projects is Navajo South Generating Station (NSGS). The Broken Hill Proprietary Company and Calpine Corporation, an independent power producer, are evaluating the feasibility of constructing a new surface coal mine and a coal-fired electrical power generating station in northwest New Mexico. The project would be located on the Navajo Reservation at a location near an existing surface coal mine, Navajo Mine, approximately 25 miles southwest of Farmington, New Mexico. Although the potential NSGS may use NTP, it is anticipated that a new transmission system would be needed for transporting NSGS power. Should the project proceed, it is anticipated that a separate EIS would be prepared to address new generation and transmission. Cumulative impacts from a second 500kV line, in addition to transmission for NTP, were discussed earlier in this chapter.

Gas generation projects are typically smaller (up to 200 MW) and may use NTP to transport power, but would not likely require a second transmission line. Therefore, there would be less cumulative impact than for a project such as NSGS that would require a second transmission line.

Future potential corridor uses include fiber optic cables and gas and water pipelines. Although the cumulative effects of a fiber optic cable is minimal, a potential gas and water pipeline could increase cumulative impacts on vegetation and ground disturbance. Currently, no additional projects using the environmentally preferred alternative routes have been identified.

Global Warming

Operation of the NTP itself is not expected to contribute to global warming or the buildup of carbon dioxide in the atmosphere. NTP may contribute positively or negatively to the buildup of carbon dioxide from burning fossil fuels depending upon how the electrical system in the western United States is operated on a day-to-day, seasonal, or long-term basis. However, since participants have not been determined and no Federal action (e.g., EIS) regarding electrical system operation in the western United States is required, the nature and extent of possible beneficial or adverse impacts cannot be determined.

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

For the purposes of this discussion, short term has been defined as the period during construction and shortly thereafter, and long term has been defined as the life of the project (50 years) and beyond.

During the life of the proposed project, the construction phase would represent the period of greatest impact on the environment. Depending on the final route selected, the shortest alternative (C1 and N3) would result in temporary disturbance of approximately 2,091.3 acres, while temporary disturbance for the longest alternative (GC1 and S2) would be approximately 2,838.4 acres (Table 4-15) during construction of the transmission line. Following construction of the line, the majority of the land disturbed would revert to its preconstruction use (e.g., grazing). As shown on Table 4-15, towers would occupy 242.2 acres for the shortest alternative (C1 and N3) and 402.8 acres for the longest alternative (GC1 and S2). The acreage calculated for long-term occupation reflects worst case conditions. That is, if a four-legged structure is used instead of a single pedestal structure, the amount of area displaced would be somewhat more. However, compatible uses (e.g., grazing [see Tables A-2 and A-3]) could continue in areas occupied by structures. The three substations would occupy approximately 116 acres total.

TABLE 4-15
ACRES OF DISTURBANCE AND OCCUPATION

Alternative	Length of Alternative	Short Term	Long Term
Eastern Area Alternatives			
GC1	260.6	1,435.7	187.0
K1	244.7	1,373.8	201.2
C1	186.7	1,018.1	123.5
C2	211.0	1,206.7	195.6
Western Area Alternatives			
N1W	217.0	1,189.1	149.3
N2	225.1	1,279.0	200.3
S2	247.7	1,402.7	215.8
N3	199.3	1,073.7	118.7
N4	207.4	1,163.6	169.7
S4	230.0	1,287.3	185.2

Potential effects on air quality would be short term, mainly localized, and largely the result of construction and abandonment activities, which would create fugitive dust and gaseous emissions from ground and air transport. No short- or long-term effects on water resources are anticipated. However, there would be some short- and long-term soil erosion.

Potential effects on biological resources would be both short and long term, because of loss and displacement of vegetative and wildlife species, although no vegetative or wildlife species are expected to become extinct as a result of project-related activities. Wildlife habitat recovery would vary according to vegetative type; for example, riparian areas would recover more quickly from disturbance than desert areas.

Potential effects on land use would be both short and long term. Future land use plans and planning also would be affected, and to some extent determined, by the location of the proposed project facilities. Park, recreation, and preservation areas could be expected to experience limited and site-specific short-term impacts.

Paleontological resources are nonrenewable and degradation or destruction of these resources through direct impacts of construction would be permanent.

Regional and local economies could be expected to experience short-term benefits from project-related expenditures during construction. No long- or short-term dislocations to local infrastructures are anticipated, because of the numbers of workers that would be required for relatively short periods of time at various points over the construction period. Short-term benefits also would occur for the Navajo Nation because of increased employment during construction and operation and increased revenues for the Nation. In addition, NTP would allow the Navajo Nation the opportunity to acquire capacity to provide electricity to Nation residents. If the transmission line were constructed across the Hopi and/or Hualapai reservations, the affected tribes would be compensated for right-of-way.

Effects on visual resources would be long term, remaining for the life of the project.

Cultural resources are essentially nonrenewable and degradation or destruction of these resources through direct impacts of construction would be permanent. Short-term auditory and visual intrusions into the settings of cultural resources would be most intense during the period of construction. Construction noise and vehicle traffic, for example, could disrupt traditional places such as offering sites and eagle collection areas, or affect the experience of visitors to places such as tribal parks. Visual intrusions, and more limited auditory intrusions stemming from line noise under certain weather conditions, would continue to affect such resources through the life of the project. If the line were to be removed at the end of its useful life, the original settings of cultural resources, in concept, could be retrieved. Whether the historic values of affected cultural resources, particularly traditional cultural places, could be recovered after several decades is less ascertainable.

In brief, most environmental resources would experience short-term impacts, principally from construction activities. Long-term and cumulative effects and productivity would depend on the continued existence of the proposed project's facilities, or continued use of the route as a utility corridor.

Long-term productivity related to project development generally would reflect short-term increases in the supply of reliable regional electric power and the opportunity for increased availability of local power on the Navajo Nation. The proposed project would help meet long-term power requirements of existing regional population areas, both in terms of residential and commercial/industrial uses. The economic benefit of increased regional bulk transmission capacity would, therefore, contribute directly to long-term economic growth among wholesale and retail customers as well as the Navajo Nation.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Resources committed to the proposed project would be material and nonmaterial, including financial. Irreversible commitment of resources for the purposes of this section has been interpreted to mean that those resources once committed to the proposed project would continue to be committed throughout the 50-year life of the project. Irretrievable commitment of resources has been interpreted to mean that those resources used, consumed, destroyed, or degraded during construction, operation, maintenance, and abandonment of the proposed project could not be retrieved or replaced for the life of the project or beyond. Irreversible and irretrievable commitment of resources for the proposed project are summarized in Table 4-16.

TABLE 4-16
IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Resource	Type of Commitment/ Reason for Commitment	Irreversible	Irretrievable
Air	■ Degradation of air quality ■ Construction activities	No	Construction phase
Soils	■ Soil loss and erosion ■ Construction activities	Yes	Yes
Water	■ None (see construction materials below)	—	—
Geological	■ None (see construction materials below)	—	—
Paleontological	■ Disturbance or removal of fossils ■ Construction activities	Yes	Yes
Biological	■ Disturbance to and/or loss of vegetation, habitat, and wildlife species ■ Construction and operation	Yes	Project life
Land Use	■ Disturbance to agriculture, timber, and grazing ■ Exclusion of residential, institutional, and industrial uses ■ Construction and operation	Yes	Project life
Grazing	■ Disturbance to and loss of rangelands and vegetation ■ Construction and operation	Yes	Project life

TABLE 4-16
IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Resource	Type of Commitment/ Reason for Commitment	Irreversible	Irretrievable
Parks, Recreation, and Preservation	■ Increased recreational use of preservation areas and ORV areas ■ Increased access for construction ■ Construction and operation	Yes	Project life
Visual	■ Degradation of natural scenic quality, viewshed intrusion ■ Construction and operation	Yes	Project life
Acoustical (Noise)	■ Noise exceeding ambient levels ■ Construction and operation	Yes	Project life
Archaeological and Historical Sites	■ Disturbance or removal of sites ■ Construction, operation, maintenance, and abandonment	Yes	Yes
Special Status Cultural Sites	■ Disturbance or removal of sites, interference with visual setting ■ Construction, operation, maintenance, and abandonment	Yes Yes	Yes Project life
Traditional Cultural Places	■ Disturbance or removal of sites. Interference with visual setting, aural disturbance ■ Construction, operation, maintenance, and abandonment	Yes Yes Yes	Yes Project life Construction phase
Human Health	■ Potential adverse electrical effects ■ Operation	Unknown	Unknown
Socioeconomic	■ Increased regional and local employment and revenues ■ Construction and operation	Yes	Project life
Construction Materials and Fuels	Use of: Aggregate Water Steel Aluminum Concrete Wood Fossil Fuels	 Yes Yes Yes Yes Yes Yes Yes	 Yes Yes No No Yes No Yes

CHAPTER 5 - CONSULTATION AND COORDINATION

INTRODUCTION

In response to the elements of NEPA, CEQ, and Executive Order 12898 (EO 12898), a comprehensive agency coordination and public participation program is being conducted in concert with the environmental process (Figure 5-1). The intent of the program is to encourage interaction among the project team, agencies, and public both to keep the agencies and public informed about the project and to solicit information in a manner that assists in preparing the EIS, as well as planning and decision making. This chapter provides a brief description of the means employed for communication and interaction, which include scoping, cooperating agencies, steering committee, agency contacts, public information, public meetings, and formal agency consultation. Agency and public review of the EIS is incorporated throughout these elements. In addition, a summary of actions to address elements of environmental justice (EO 12898) in minority populations and low income populations is provided.

AGENCY AND PUBLIC SCOPING

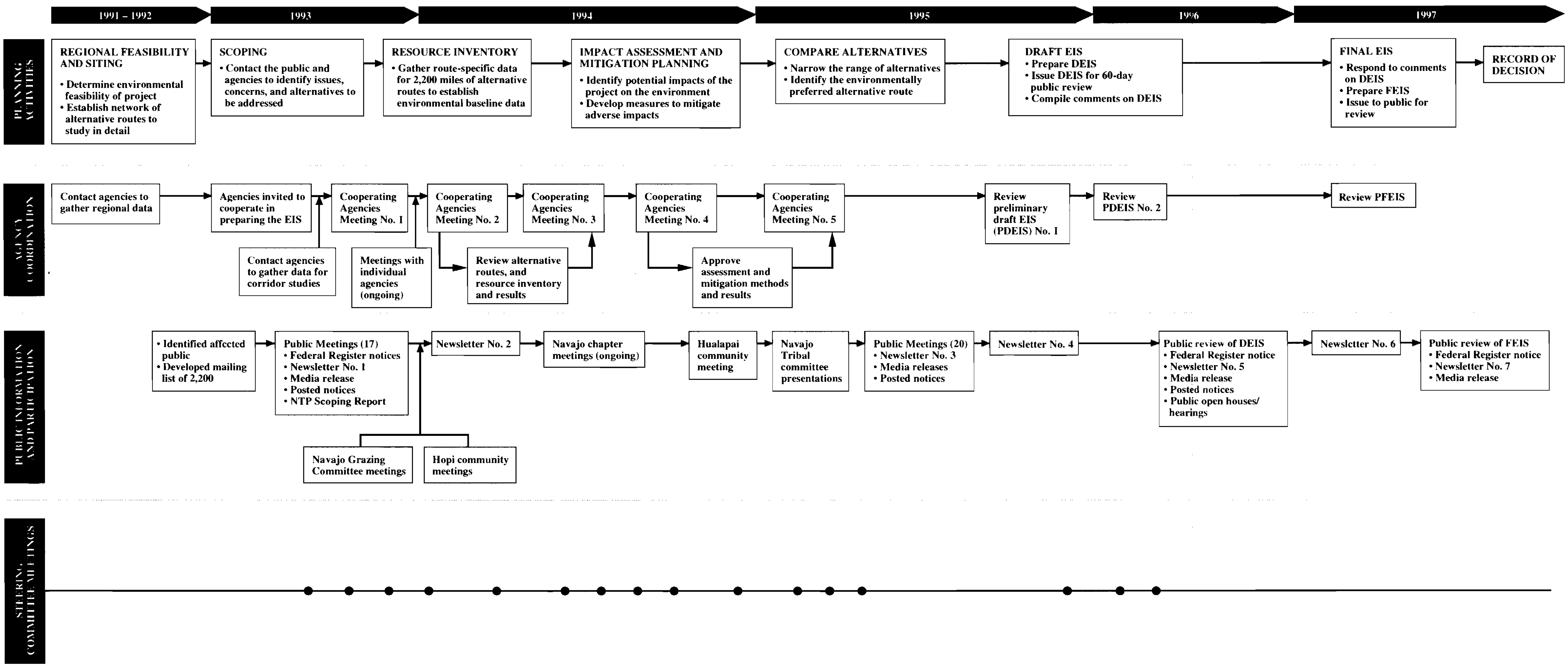
Scoping is the first step of the NEPA environmental process. Scoping is open to the public and conducted early in a project. Scoping identifies the range, or scope, of issues to be addressed during the environmental studies conducted for the EIS. A *Federal Register* Notice of Intent, which was released for NTP on July 13, 1993, announced the project and intent to prepare an EIS and conduct public meetings. Other announcements included letters, fact sheets, media releases, and notices posted on and off the Navajo Nation. Seventeen public meetings were conducted by Western—13 during August 1993 and 4 in October 1993 (Figure 5-2). At each meeting, a presentation was given to provide project information; the meeting was then opened for comments and questions from the audience. Meetings were conducted in local native languages when appropriate. All comments and questions were recorded and summarized for each meeting. More than 350 people attended these meetings. By the time the scoping period ended in October 1993, comments were received from 131 individuals. In addition, 25 agency scoping meetings were conducted by Western.

The results of scoping are documented in the NTP *Scoping Report* (January 1994). Numerous comments were received, which in summary related to five general categories, as shown in Table 5-1. This table also indicates where in the DEIS these issues are addressed. More specific environmental issues are listed in Table 2-6. The results of the regional environmental feasibility study and scoping served as the basis to develop a work plan, which provided the approach and schedule to accomplish the environmental studies and prepare the EIS.

TABLE 5-1 SUMMARY OF ISSUES FROM SCOPING	
Issues	**Where Addressed in DEIS**
Need ■ Will NTP result in an increase of power generation? ■ How does NTP fit into the existing electric power system? ■ Is NTP really needed? ■ Review all alternatives to the project.	■ Chapter 1 - Purpose and Need ■ Chapter 2 - Alternatives including the Proposed Action
Benefits ■ Who will own NTP? ■ How will the revenue be used? ■ Will electric service be available locally?	■ Chapter 1 - Purpose and Need
Siting ■ Effects on land uses ■ Effects on visual aesthetic character ■ Effects on cultural resources (archaeology, history, traditional cultural places) ■ Effects on special-status species, wildlife, vegetation	■ Methods employed for siting and studying the alternative routes in Appendix A ■ Results of the environmental studies in Chapters 2, 3, and 4
Right-of-Way ■ How will the right-of-way be acquired? ■ How will landowners/land users be compensated? ■ How will disturbed areas be reclaimed?	■ Chapter 2
Health and Safety ■ EMF ■ Are transmission lines safe to be around?	■ EMF addressed in Chapter 4 ■ Other health and safety issues addressed in Chapter 2

COOPERATING AGENCIES

In March 1993, prior to the official announcement of the project, representatives of Western and DPA met with agencies whose jurisdictional responsibilities (primarily land managers) could be affected by the project and who were considered potential cooperating agencies. At the meetings, the agencies were provided information about the project such as description, purpose of and need for the action, and proposed environmental process. The agencies provided preliminary information regarding issues, concerns, and agency responsibilities, and expressed whether or not there was an interest in participating in the project as a cooperating agency. Also, the agencies were asked to verify the status and availability of existing environmental data.

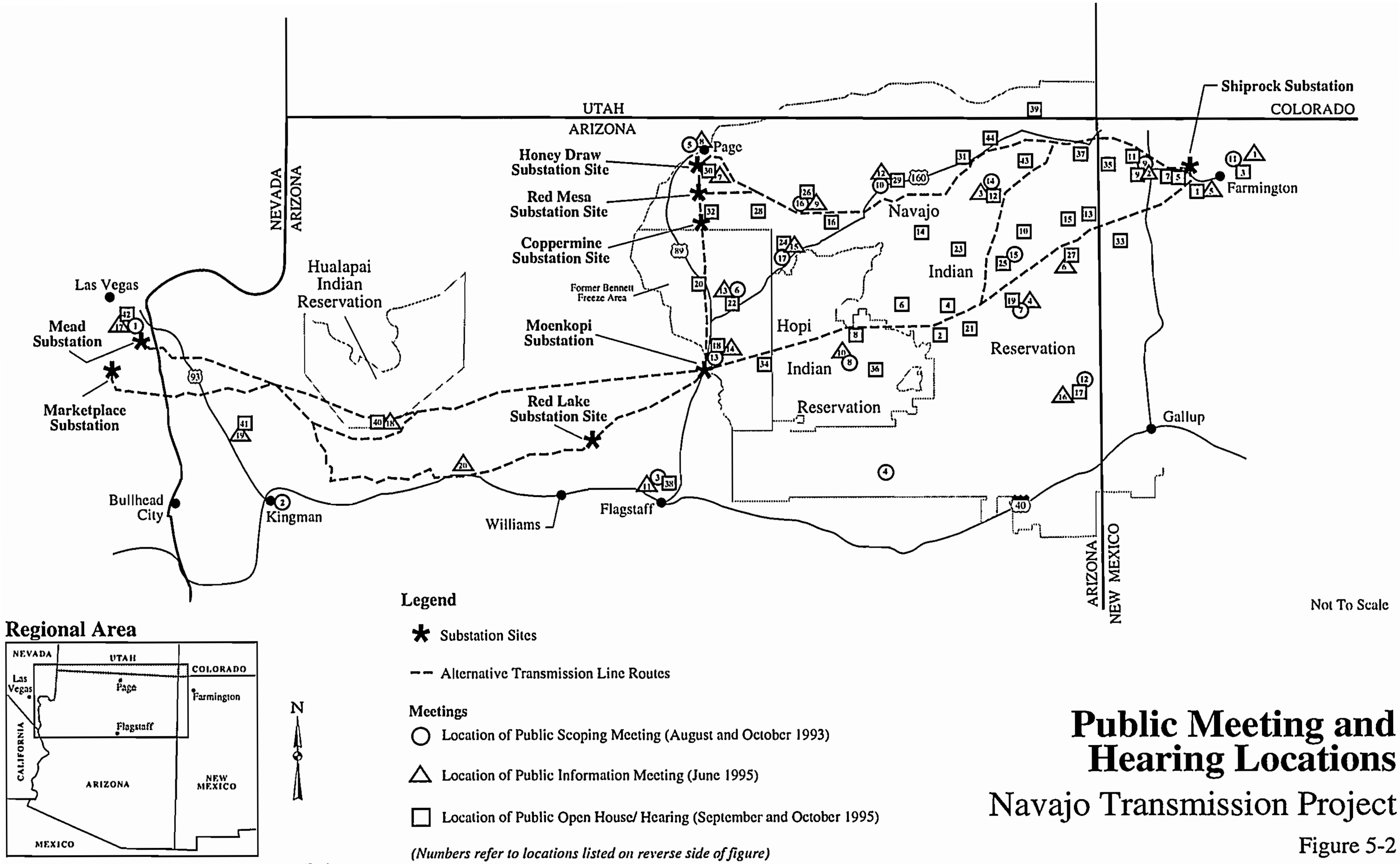


Cooperating Agencies	Steering Committee
• Bureau of Indian Affairs	• Diné Power Authority
• Bureau of Land Management	• Western Area Power Administration
• Forest Service	
• National Park Service	
• Navajo Nation	
• Hopi Tribe	
• Hualapai Tribe	

Public and Agency Participation in the Planning Process

Navajo Transmission Project

Figure 5-1



Public Meeting and Hearing Locations

Navajo Transmission Project

Figure 5-2

PUBLIC MEETING AND HEARING LOCATIONS

Scoping Meetings	Information Meetings	Hearings	
1. Boulder City, NV	1. Farmington, NM	1. Nenahnezad, NM	23. Rough Rock, AZ
2. Kingman, AZ	2. Shiprock, NM	2. Whippoorwill, AZ	24. Tonalea, AZ
3. Flagstaff, AZ	3. Rock Point, AZ	3. Farmington, NM	25. Many Farms, AZ
4. Dilkon, AZ	4. Chinle, AZ	4. TaChee/Blue Gap, AZ	26. Inscription House, AZ
5. Page, AZ	5. Nenahnezad, NM	5. San Juan, NM	27. Lukachukai, AZ
6. Tuba City, AZ	6. Lukachukai, AZ	6. Piñon, AZ	28. Kaibeto, AZ
7. Chinle, AZ	7. Lechee, AZ	7. Hogback, NM	29. Kayenta, AZ
8. Kykotsmovi, AZ	8. Page, AZ	8. Hard Rock, AZ	30. LeChee, AZ
9. Shiprock, NM	9. Inscription House, AZ	9. Shiprock, NM	31. Dennehotso, AZ
10. Kayenta, AZ	10. Kykotsmovi, AZ	10. Round Rock, AZ	32. Coppermine, AZ
11. Farmington, NM	11. Flagstaff, AZ	11. Cudeii, NM	33. Sanostee, NM
12. Window Rock, AZ	12. Kayenta, AZ	12. Rock Point, AZ	34. Coalmine Mesa, AZ
13. Cameron, AZ	13. Tuba City, AZ	13. Red Valley, AZ	35. Beclabito, NM
14. Rock Point, AZ	14. Cameron, AZ	14. Chilchinbeto, AZ	36. Second Mesa, AZ
15. Many Farms, AZ	15. Tonalea, AZ	15. Cove, AZ	37. Teec Nos Pos, AZ
16. Inscription House, AZ	16. St. Michaels, AZ	16. Shonto, AZ	38. Flagstaff, AZ
17. Tonalea, AZ	17. Boulder City, AZ	17. St. Michaels, AZ	39. Red Mesa, UT
	18. Peach Springs, AZ	18. Cameron, AZ	40. Peach Springs, AZ
	19. Dolan Springs, AZ	19. Chinle, AZ	41. Dolan Springs, AZ
	20. Seligman, AZ	20. Bodaway, AZ	42. Boulder City, NV
		21. Tselani, AZ	43. Sweetwater, AZ
		22. Tuba City, AZ	44. Mexican Water, AZ

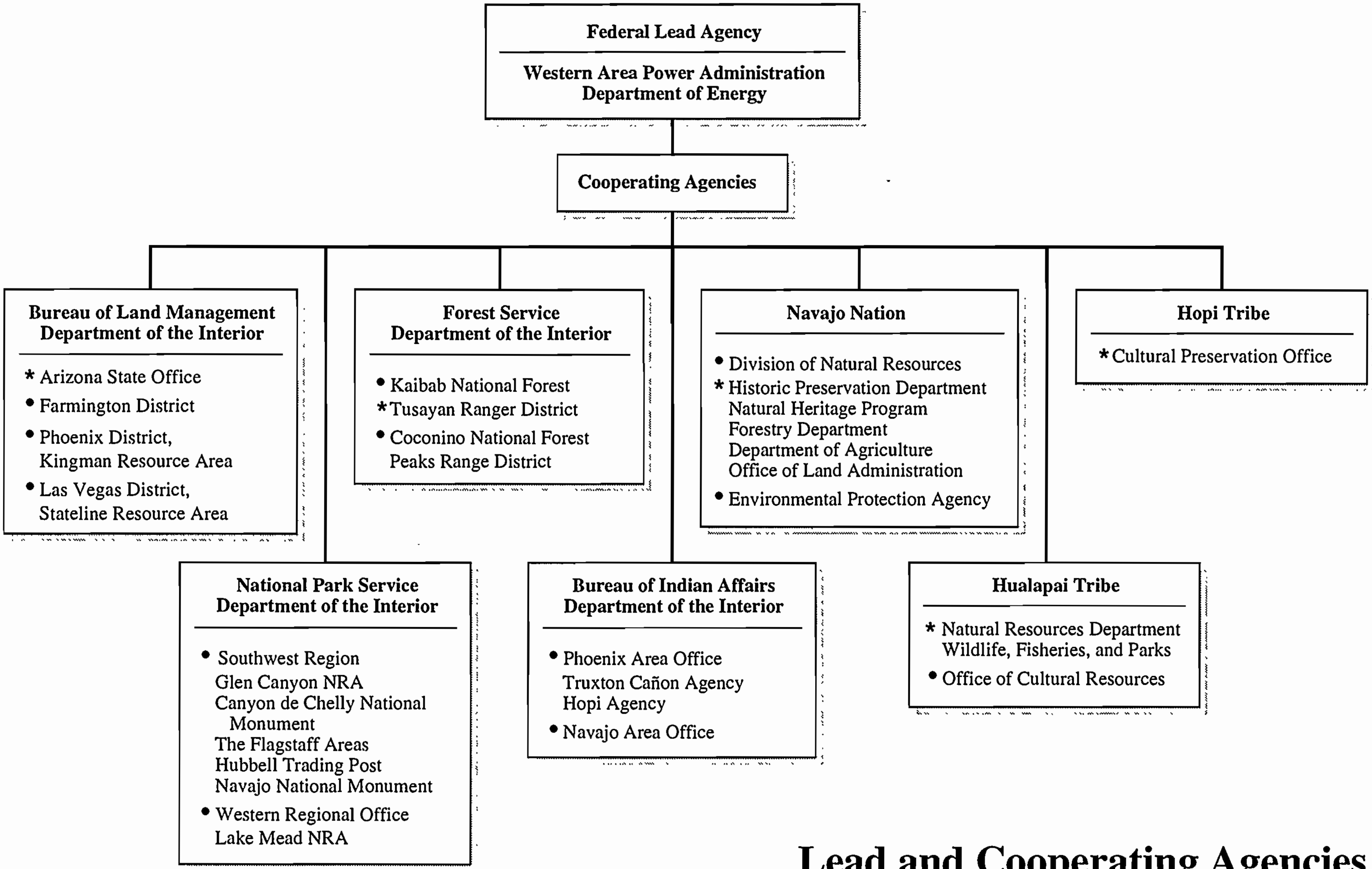
Following these meetings, Western sent formal letters to the BIA, BLM, NPS, and Forest Service requesting their participation and cooperation in preparing the EIS. In addition, the Navajo Nation, Hopi Tribe, and Hualapai Tribe were given cooperating agency status on the project. Over the ensuing months, the agencies entered into formal interagency agreements with Western. The cooperating agencies are shown on Figure 5-3.

According to the interagency agreements, the role of the cooperating agencies is to provide data needed for analyses, and review and comment on the various documents prepared by Western. The agencies were asked to review and comment on the methods used for each stage of the process (e.g., inventory, impact assessment and mitigation planning, and comparison of alternatives) before the project team proceeded to the next stage. Also, the agencies were asked to review the results of each stage of the process (i.e., preliminary draft resource inventory reports, preliminary draft resource impact reports, and preliminary draft EIS) before the project study team proceeded. The cooperating agencies will continue to participate in the project in a similar fashion through completion.

Since the beginning of the environmental process, there have been six cooperating agency meetings. Each of the meetings is described below.

- *October 22, 1993*—The project, roles of the participants, results of the scoping process, and the proposed environmental studies were discussed at the initial meeting.
- *January 18, 1994*—The focus of this meeting was to discuss the alternative routes, and the methods and results of the environmental resources inventory.
- *June 3, 1994*—The emphasis at this meeting focused on review of agency comments on the preliminary draft inventory reports. In addition, methods for the upcoming impact assessment and mitigation planning process were discussed.
- *September 20, 1994*—The focus of this meeting was to review the mitigation measures employed in the analyses and the results of the impact assessment and mitigation planning process.
- *March 9, 1995*—The primary purpose of this meeting was to briefly discuss the proposed methods for the upcoming comparison of alternative routes.
- *May 17, 1995*—During this meeting, the methods and results of the comparison of alternatives were reviewed.

Copies of the first preliminary DEIS were distributed to the cooperating agencies in August 1995. Comments on the preliminary DEIS were received in early November, and were reviewed and analyzed. A second preliminary DEIS, revised to incorporate new information and substantive comments from the agencies, was distributed in early April 1996 to cooperating agencies interested in a second review. Comments from the agencies were incorporated and the document was sent to DOE for review in July 1996 before issuing the DEIS for public review.



* Lead Office

Lead and Cooperating Agencies

Navajo Transmission Project

Figure 5-3

STEERING COMMITTEE

Early in the project, Western and DPA formed a steering committee that has and will continue to serve in an advisory role for the project. The committee includes the project proponents management staff of Western and DPA. DPA's engineering consultant and environmental consultant also participate. While the purpose of the steering committee is to coordinate on all matters of project management, steering committee meetings have provided the opportunity to exchange information during the environmental process. Western's environmental specialists and the environmental consultant provide updates on the progress of the EIS and discuss issues and concerns, which allow the project proponents an understanding of the process, public and agency concerns, and study results documented in the EIS. DPA discussed the ongoing coordination efforts with Navajo Nation's President's office, Council, chapters, and committees. The steering committee provides technical information and review. Since the beginning of the project there have been 16 steering committee meetings and 3 technical (engineering) meetings.

AGENCY CONTACTS

In addition to the cooperating agencies, other agencies and organizations having jurisdiction and/or specific interest in the project were contacted at the beginning of the resource inventory to inform them of the project, verify the status and availability of existing environmental data, request data and comments, and solicit their input about the study results. Additional contacts were made throughout the process to clarify or update information. All conversations with agency personnel were documented, distributed to the appropriate project personnel, and are maintained in the project files for further reference. Specific concerns and recommendations were discussed and documented for further action.

In addition to contacts by the resource specialists of the project team, management level contacts were made with key offices of the BLM, Forest Service, NPS, Navajo Nation, Hopi Tribe, Hualapai Tribe, and some state and county agencies. These meetings also were documented.

A list of the agencies and organizations contacted is provided in Table 5-2, at the end of this chapter.

PUBLIC PARTICIPATION

Public participation is an integral part of the environmental process. The objectives of public participation are to establish and maintain communication with the public; inform and educate the public as to the need for the project and possible effects on the natural, human, and cultural environment; accurately identify and consider the issues and concerns of the public; and ensure that public input is integrated with technical data into the overall decision-making process.

PROJECT INFORMATION

Prior to the scoping process, a mailing list of more than 2,200 relevant agencies, interested organizations, and individuals was established. Since then, the mailing list continues to be updated.

During the course of the environmental process, five newsletters were published to inform the public of the project and its progress. All of the newsletters provided the name of one or two project personnel to contact. Some of the newsletters contained a response sheet for readers to detach and mail to the project team. The response sheets were designed to provide respondents an opportunity to provide comments and request additional information.

The dates and contents of the newsletters are listed below.

- *August 1993*—The first publication announced and described the project, and announced public scoping meetings scheduled for August.

- *January 1994*—The second publication described the results of the scoping process and provided an update of the environmental studies.

  (Note: The gap between the second and third newsletters resulted from a delay in the project due to a lack of funding. Project activities continued, but at a much slower pace. Late in 1994, funds for the project were secured, and project studies continued.)

- *May 1995*—The third publication explained the progress made to date and announced a series of public meetings scheduled for June.

- *October 1995*—The fourth publication reported the results of the June public meetings and explained the reassertion of the Bennett Freeze in late September 1995 and its affect on NTP.

- *September 1996*—The fifth publication announced the completion of the DEIS and the public hearings to be conducted during the 60-day public review of the DEIS.

PUBLIC MEETINGS

In June 1995, public meetings were held at 20 locations within the project area (see Figure 5-1). The purpose of the meetings was to update area residents regarding the project; provide information about the environmental, engineering, and administrative elements of the project; and solicit comments from the public about their concerns related to the project, primarily the alternative routes being considered. When appropriate, meetings were conducted in native languages. Comments were documented in writing and the question-and-answer portion of the meetings was recorded on audio tape. Although the content of the questions and comments are often interrelated, they can be summarized into general categories, similar to those from scoping. The general categories included administrative and financial, need, benefits, alternative routing, engineering, right-of-way and access, and health and safety. These issues are summarized in Table 5-3. This table also indicates where in the DEIS the issues are addressed.

TABLE 5-3 SUMMARY OF ISSUES FROM PUBLIC INFORMATION MEETINGS	
Issues	**Where Addressed**
Administrative and Financial ■ Who will own NTP? ■ Where is the market for the power? ■ How long does a transmission lease last? ■ Where will the money for construction come from?	■ Chapter 1 - Purpose and Need ■ DPA developing business plan to address these issues in detail
Need ■ Will NTP increase generation? ■ How does NTP fit into the existing electric power system in the West? ■ Is NTP really needed? ■ Review all alternatives to the project.	■ Chapter 1 - Purpose and Need
Benefits ■ What are the annual revenues expected to be? ■ How will the revenue be used? ■ Will local groups and communities receive a portion of the revenues? ■ Will electric service be available locally? ■ What employment opportunities will result from NTP? ■ Are benefits specific to the Navajo Nation or would the Hopi and Hualapai realize benefits (if line were to cross their reservations)?	■ DPA is developing business plan to address many of these issues in detail ■ Benefits are addressed in Chapter 1 ■ Employment opportunities are addressed in Chapters 1 and 4 (Socioeconomics) ■ The revenues received from the transmission line would be deposited into Navajo Nation general funds and disbursed to Navajo families based on the estimated projection of revenues. The revenues generated from NTP could also be invested in long-range productive business opportunities (Vice Chair, Navajo Nation Economic Development Committee, April 20, 1996).
Alternative Routing ■ How were the alternative routes selected? ■ Concern about crossing the Hopi Reservation-may jeopardize project due to long-standing dispute over land rights. ■ Who will decide which route will be selected? ■ Concern about effects on environment (e.g., land uses, visual character, cultural resources, special-status species, wildlife).	■ Route selection process is addressed in Appendix A ■ Decisions to be made are addressed in Chapter 2 ■ Environmental effects addressed in Chapters 2 and 4

TABLE 5-3 SUMMARY OF ISSUES FROM PUBLIC INFORMATION MEETINGS	
Issues	**Where Addressed**
Engineering ■ What will be the source of the power? ■ Why can't NTP provide power to local areas and residences? ■ Why not build power plants where the needs are located? ■ Can additional lines be added to existing towers (double circuit)? ■ Why is a substation needed in the central area along NTP?	■ Chapters 1 and 2
Right-of-Way and Access ■ How will the right-of-way be acquired? ■ How will landowners/land users be compensated? ■ Will the right-of-way be cleared for construction? ■ How will disturbed areas be reclaimed? ■ What uses are allowed in the right-of-way?	■ Chapter 2
Health and Safety ■ Effects of electric and magnetic fields on humans and animals. ■ Are the lines and towers safe to be around? ■ Concern about static electricity. ■ Concern about lightning striking the line and towers.	■ EMF is addressed in Chapter 4 ■ Other health and safety issues are addressed in Chapter 2

PUBLIC REVIEW OF THE EIS

Public review and comment on the DEIS will occur during a 60-day period and through formal public hearings to be held in September and October of 1996. An open house will precede the hearing in each location to provide an opportunity for people to view project information displays and ask questions. A Federal hearing officer from Western will conduct each hearing, allowing individuals to formally provide comments on the DEIS. The comments will be documented by a court reporter. Interpretation in native languages will be provided as needed. A total of 44 open houses and hearings will be conducted in order to maximize the dissemination of project information and provide ample opportunity for the public, particularly in remote areas, to comment on the DEIS. All comments received from the DEIS review and public hearings will be compiled, analyzed, and summarized, and ultimately responded to in the FEIS. It is anticipated that the FEIS will be completed in the summer of 1997 followed by a public review, and finally release of the Record of Decision. Table 5-4 (at the end of this chapter) is a list of agencies, organizations, and persons to whom copies of the DEIS was sent.

ENVIRONMENTAL JUSTICE

Presidential EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires that each Federal agency identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.

The DEIS was prepared according to NEPA and CEQ, issues learned from agencies and the public during scoping and other public participation activities, and the professional judgment of the interdisciplinary study team. Based on the results of the DEIS, no disproportionately high and adverse environmental impacts on minority or low income communities are anticipated. A summary of actions to address elements of environmental justice in minority population and low-income population is provided in the following sections.

ACCESS TO INFORMATION

The project area encompasses a large geographic region within which are the reservation lands of three culturally different American Indian groups. Considering the magnitude of the project and the economic importance of its outcome to the Navajo Nation, it is important that information about the project reach and be understood by people residing throughout the project area for the project to be accepted.

In order to encourage public partnerships and communication with the low income and minority populations in the project area, the public involvement program was designed to be comprehensive, and to respect and incorporate the different socio-cultural perspectives into the environmental analysis criteria. Specifically, the program involved the following:

- holding numerous additional meetings to accommodate dispersed populations in remote areas
- interpreting presentations into local native languages
- involving appropriate tribal agencies in planning, implementing, and reviewing environmental studies
- working to ensure that graphic displays are understandable across different cultures
- distributing informational materials throughout the project

Throughout the project, numerous presentations were made at meetings of Navajo chapters; resource, grazing, and economic development committees; and cultural preservation groups. Presentations were made to communities of the Hopi, Hualapai, and San Juan Southern Paiute as well. Presentations were interpreted into local native languages, as needed, and visual displays for meetings were specifically designed to consider the cultural differences of the audiences and issues previously expressed.

Although the process was carefully planned at the beginning of the project, each step of the process was preceded by critical assessment to increase the project team's awareness and sensitivity, promote continued responsiveness, and improve methods and techniques. DPA community relations personnel and other American Indians provided insight and advice regarding cultural appropriateness of materials and information. Cooperating agencies provided regular input to the process and project progress was reviewed at periodic steering committee meetings. Generally this interaction focused on developing criteria, identifying and eliminating alternatives, and reviewing technical and environmental data, as well as the preferred alternatives. This planning process provided opportunities for public participation in and access to information on health and the environment as it relates to NTP (Table 5-5). Serious attention to all public comments enhanced the outcome of the process.

NATIVE AMERICAN, INDIGENOUS, AND TRIBAL INVOLVEMENT

NTP is unusual with regard to the concerns surrounding environmental justice because the Navajo Nation is, first, a project proponent through DPA; second, a cooperating agency through the Navajo Division of Natural Resources; and third, a major beneficiary of the outcome of NTP, as described in Chapter 1. In addition, funding for the development phase of NTP includes DOE grants appropriated by the U.S. Congress through Title XXVI of the Energy Policy Act of 1992. Western, as the lead Federal agency, was invited to participate in NTP by DPA and has been responsible for providing support to agencies and the Navajo in developing capabilities to manage NTP and to use the project's resources in achieving the goals of environmental justice.

Each of the three American Indian groups whose reservations are potentially traversed by NTP alternative routes—Navajo, Hopi, and Hualapai is a Federally defined minority group. The cultural resources investigations for the DEIS include ethnographic studies conducted by ethnographic consultants that were selected by the respective tribes. Also, several other American Indian groups, including the San Juan Southern Paiute Tribe, Yavapai-Prescott Tribe, Zuni Pueblo, Ute Mountain Ute Tribe, Las Vegas Paiute Tribe, Moapa Band of Paiutes, Paiutes of Pahrump, Havasupai Tribe, Camp Verde Yavapai-Apache Tribe, Fort Mojave Indian Tribe, Colorado River Indian Tribes, and the Chemehuevi Tribe, were invited to participate in these studies by communicating their concerns and knowledge of traditional cultural places. A focus of the DEIS has been on both the protection of those sociocultural resources and mitigation for their use.

In summary, no disproportionately high and adverse environmental impacts on minority or low income communities are anticipated. In fact, as a project proponent, the Navajo Nation (a minority and low income community) would receive major benefits including an increase in employment and income as well as the potential to increase electrical service on the reservation. In addition, depending on the route selected for construction, other American Indian communities could receive benefit in the form of compensation for right-of-way.

FORMAL CONSULTATION

For NTP, formal consultations apply to biological and cultural resources only.

INFORMATION MADE AVAILABLE TO MINORITY AND LOW INCOME POPULATIONS FOR REVIEW AND COMMENT	PUBLIC INVOLVEMENT/INFORMATION ACCESS										
	Scoping	Steering Committee Meetings	Public Meetings/Open Houses	Newsletters/Fact Sheets	Media Release (Newspaper/Radio)	Navajo Nation Resources Committee and/or Board of Directors Meetings	Posters for Public Meetings/ Open Houses/Hearings	Direct Mailings	Other Interested Party Meetings	Public Open Houses/Hearings	Native Language Presentations at Meetings
Regional Study Area Identification and Inventory Results	✓	✓	✓	✓	✓	✓		✓	✓	*	✓
Alternative Route Identification, Criteria, and Elimination	✓	✓	✓	✓	✓	✓	✓	✓	✓	*	✓
Study Corridor Inventory Results	—	✓	✓	✓	✓	✓	✓	✓	✓	*	✓
Impact Assessment Criteria and Results	—	✓	✓	✓	✓	✓	✓	✓	✓	*	✓
Mitigation Recommendations and Results	—	✓	✓	✓	✓	✓	✓	✓	✓	*	✓
Alternative Route Comparison and Results	—	✓	✓	✓	✓	✓	✓	✓	✓	*	✓
DEIS	—	—	✓	✓	✓	✓	✓	✓	✓	*	*
FEIS	—	✓	—	*	*	*	—	*	*	—	—

ACTIVITIES

✓ Completed or in Progress

* Anticipated

Actions to Address Environmental Justice

Navajo Transmission Project

Table 5-5

BIOLOGICAL RESOURCES

To comply with the Endangered Species Act of 1973, as amended, and the implementing regulations for Section 7 consultation, FWS offices in Albuquerque, Phoenix, and Las Vegas were contacted initially by Western in the spring of 1993. For the project area, each of these offices provided a list of endangered and threatened species, species proposed for listing as endangered and threatened, and species that are candidates for listing. This information was incorporated into the biological resources study for the DEIS. In April 1995, Western contacted these offices to request updates of the species lists.

Through the environmental studies, it has been determined that species listed as endangered or threatened are present in the project area and may be affected by the project. Therefore, Western, as lead Federal agency, will initiate an informal consultation with FWS as directed by Section 7 of the Endangered Species Act. Informal consultation provides an opportunity to ensure that FWS concerns are included and understood early in the consultation process. Then, Western will prepare a biological assessment (BA) and if Western determines that a species or its critical habitat may be affected, formal consultation will be initiated by submitting the BA to FWS. The formal consultation will result in a biological opinion issued by FWS that either concurs with the conclusions set forth in the BA or identifies additional site- and species-specific mitigation that must be implemented to reduce potential effects on a species or its critical habitat.

CULTURAL RESOURCES

Numerous agencies and organizations were consulted about cultural resources during preparation of this DEIS. These contacts were made in compliance with the requirements of NEPA, and also to initiate formal consultations required by Section 106 of the NHPA. The purpose of the consultations are to solicit expressions of concern, collect relevant data, obtain reviews of the analysis of the collected information, and negotiate a programmatic agreement specifying how cultural resources would be considered during the EIS and post-EIS phases of project planning and implementation.

The most intensive consultations were with cultural resource specialists of the agencies and Tribes designated as formal cooperating agencies. These included the Navajo, Hopi, and Hualapai Tribes; BIA, BLM, Coconino and Kaibab national forests; and NPS. Special studies were undertaken with the participation of tribal members to consider traditional Navajo, Hopi, and Hualapai cultural places.

Another dozen American Indian groups were contacted through letters, telephone calls, and meetings, including the Ute Mountain Ute, Zuni Pueblo, San Juan Southern Paiute, Camp Verde Yavapai-Apache, Yavapai-Prescott, Havasupai, Fort Mojave, Colorado River Indian Tribes, Chemehuevi, Moapa Band of Paiutes, Las Vegas Paiutes, and Paiutes of Pahrump. Major regulatory reviewers have included the SHPOs of New Mexico, Arizona, and Nevada, and the Federal ACHP. The Arizona State Land Department also has been involved in the negotiation of a programmatic agreement. Additional organizations contacted for information include the Museum of New Mexico, Museum of Northern Arizona, and University of Nevada, Las Vegas.

TABLE 5-2
CONTACTS WITH AGENCIES AND ORGANIZATIONS

FEDERAL AGENCIES

ADVISORY COUNCIL ON HISTORIC PRESERVATION

DEPARTMENT OF AGRICULTURE
Forest Service
- Southwest Regional Office
  - Coconino National Forest
    - Peaks Ranger District
  - Kaibab National Forest
    - Tusayan Range District

Natural Resources Conservation Services
Soil Conservation Service

DEPARTMENT OF DEFENSE
Department of the Army
- Corps of Engineers
  - Los Angeles District
  - Environmental Section (Albuquerque, NM)
  - Arizona Field Office Regulatory Branch

DEPARTMENT OF ENERGY
Western Area Power Administration
- Corporate Services Office
- Colorado River Storage Project - Customer Service Center
- Sierra Nevada Region
- Desert Southwest Region

ENVIRONMENTAL PROTECTION AGENCY
Region VI
Region IX

DEPARTMENT OF THE INTERIOR
Bureau of Indian Affairs
- Headquarters
  - Environmental Services
- Navajo Area Office
  - Eastern Navajo Agency
  - Fort Defiance Agency
  - Shiprock Agency
  - Western Navajo Agency
- Phoenix Area Office
  - Hopi Agency
  - Southern Paiute Field Station
  - Truxton Cañon Agency

Department of the Interior (con't)

Bureau of Land Management
- Arizona State Office
  - Phoenix District
    - Phoenix Resource Area
    - Tucson Resource Area
    - Kingman Resource Area
- New Mexico State Office
  - Farmington District
- Nevada State Office
  - Las Vegas District
    - Stateline Resource Area
  - Cedar City District

Bureau of Mines
- Intermountain Field Operations Center
- Minerals Information Office

Bureau of Reclamation
- Arizona Project Office
- Denver Office

Fish and Wildlife Service
- Albuquerque Regional Office
  - Phoenix Field Office
    - Arizona Ecological Services
- Portland Regional Office
    - Ecological Services
- Nevada State Office

National Park Service
- Headquarters
  - Division of Environmental Quality
- Denver Service Center
- Rocky Mountain Regional Office
  - Technical Information Center
    - Branch of Compliance
- Glen Canyon National Recreation Area
- Pipe Springs National Monument
- Southwest Regional Office
  - Environmental Coordination Division
  - Division of Anthropology
  - Branch of Long Distance Trails
  - Canyon de Chelly National Monument
  - Hubbell Trading Post National Historic Site
  - Navajo National Monument
  - The Flagstaff Areas

TABLE 5-2
CONTACTS WITH AGENCIES AND ORGANIZATIONS

Federal Agencies (continued)

National Park Service (continued)

Western Regional Office
Lake Mead National Recreation Area
Petrified Forest National Monument
Southern Arizona Office

STATE AGENCIES

NEW MEXICO
Public Service Commission
Department of Game and Fish
Habitat, Environmental Lands
Energy, Minerals, and Natural Resources Department
Energy Information Services Bureau
State Land Office
Field Division
Department of Highways and Transportation
Planning Division
Office of Cultural Affairs
Historic Preservation Division

ARIZONA
Office of the Governor
Corporation Commission
Document Control Center
Utilities Division
Department of Economic Security
Research Administration
Population Statistics Unit
Department of Environmental Quality
Game & Fish Department
Habitat Branch
Pinetop Region
Department of Mines & Mineral Resources
State Parks and Recreation
Homolovi Ruins State Park
State Historic Preservation Office
Department of State Lands
Land Resource Information System
Commercial Leasing Department
Right-of-Way
Department of Transportation
Parkways, Historic & Scenic Parks Advisory Committee
Roadside Development Services
Department of Water Resources

NEVADA
Colorado River Commission of Nevada
Public Service Commission of Nevada
Regulatory Operations Staff
Department of Conservation and Natural Resources
Division of Historic Preservation and Archeology
Natural Heritage Program
Division of State Parks
Administrative Office
Planning and Development
Parks and Recreation
Department of Transportation
Department of Wildlife
Region III
Division of State Lands
Land Use Planning Advisory

UTAH
Edge of Cedars State Park

COUNTY AGENCIES

NEW MEXICO
County of Los Alamos
Public Utilities Department
McKinley County
San Juan County

ARIZONA
Apache County
Development
County Manager's Office

TABLE 5-2 CONTACTS WITH AGENCIES AND ORGANIZATIONS	
County Agencies (continued)	
Arizona (continued)	

Coconino County
  Department of Community Development
  Department of Parks and Recreation
Mohave County
  Board of Supervisors
  Department of Engineering
  Department of Parks and Recreation
  Department of Planning and Zoning
  Economic Development
  Planning and Zoning Commission
Navajo County
  Parks and Recreation Department
  Planning and Zoning
	Yavapai County
	  Parks and Recreation Department
	  Planning and Building Department
	  Public Works Department
	
	NEVADA
	Clark County
	  Department of Comprehensive Planning
	  Department of Parks and Recreation
	  Department of Public Works

LOCAL AGENCIES	

ARIZONA
City of Page
  Planning
  Public Works
City of Williams
  Department of Community Development
City of Winslow
  Public Works
 	
NEW MEXICO
City of Farmington
  Electric Utility
City of Gallup
  Electric Utility
	NEVADA
	City of Boulder City
	  Community Development and Planning
	City of Henderson
	  Planning Department

SPECIAL INTEREST GROUPS	

American Rivers-Arizona
Arizona State Museum
Arizona Trails Foundation
Coalition of Arizona/New Mexico Counties
Diné CARE
  Diné Spiritual and Cultural Society
  Land and Water Fund Energy Project
Museum of Northern Arizona
Navajo Agricultural Products Industry
	Nevada Association of Counties
	Nevada League of Cities
	New Mexico Municipal League
	Northern Arizona Council of Governments
	Shiprock Agriculture Resources Advisory Council
	Sierra Club
	Utah League of Cities and Towns
	Western Association of Land Users
	  Southern Utah-Northern Arizona Chapter

TABLE 5-2
CONTACTS WITH AGENCIES AND ORGANIZATIONS

AMERICAN INDIAN GROUPS

CAMP VERDE YAVAPAI-APACHE TRIBE
- Historic and Cultural Preservation Committee

CHEMEHUEVI TRIBE

COLORADO RIVER INDIAN TRIBES
- Museum

FORT MOJAVE INDIAN TRIBE
- Aha Makav Cultural Society

HAVASUPAI TRIBE
Office of the Chair

HOPI TRIBE
Office of the Chairman
Cultural Resources Advisory Task Team
Cultural Preservation Office
Department of Land Operations & Range Management
Department of Natural Resources
Office of Research and Planning

HUALAPAI TRIBE
Office of the Chairman
Office of Cultural Resources
- Cultural Resource Program

Wildlife Management Department
- Wildlife, Fisheries, and Parks

LAS VEGAS PAIUTE TRIBE

MOAPA BAND OF PAIUTES

NAVAJO NATION
Executive Branch
- Office of the President/Vice President
- Office of the Navajo-Hopi Land Commission
- Natural Resources Committee
- Office of the Attorney General
  - Department of Justice
    - Natural Resources Unit
- Division of Community Development
  - Department of Community Planning
    - Chapter Government Development
  - Department of Transportation
- Division of Natural Resources
  - Department of Administration
    - Project Review
  - Department of Agriculture
    - Grazing Management Program
  - Archaeology Department
  - Environmental Protection Administration
  - Fish and Wildlife Program
  - Historic Preservation Department
  - Natural Heritage Program
  - Forestry Department
  - Office of Land Administration
  - Department of Minerals
  - Parks and Recreation
  - Water Resources Management

Legislative Branch
- Office of Legislative Services

SAN JUAN SOUTHERN PAIUTE TRIBE

SHIVWITS PAIUTE TRIBE

SOUTHERN PAIUTES OF PAHRUMP

UTE MOUNTAIN UTE TRIBE

YAVAPAI PRESCOTT TRIBE
- Cultural Resource Committee

ZUNI PUEBLO
- Archaeology Program
- Heritage and Historic Preservation Office

TABLE 5-2 CONTACTS WITH AGENCIES AND ORGANIZATIONS	
INSTITUTIONS	

Arizona State University
California State University-Long Beach
  Department of Anthropology
Northern Arizona University
  Native American Programs
	Tuba City Unified School District No. 15
	University of New Mexico
	  New Mexico Natural Heritage Program
	Western New Mexico University
	  Southwest Center for Resource Analysis

UTILITIES	

Arizona Public Service
AT&T
Black Mesa Pipeline
Citizens Utilities Company
Conoco, Inc.
El Paso Natural Gas Company
  Right-of-Way Department
Farmington Electric Utility System
Los Angeles Department of Water and Power
  Right-of-Way Department
  Transmission Planning and Systems Studies
MCI Telecommunications Corporation
  Nevada Field Office
  ATR Group
Metropolitan Water District of Southern California
  Substructures Section
	Navajo Communications Company
	Navajo Tribal Utility Authority
	Nevada Power Company
	Page Electric Utility
	Plains Electric
	Public Service Company of New Mexico
	Salt River Project
	Southern California Edison
	Southwest Gas Corporation
	Transwestern Pipeline Company
	  Technical Operations
	  Western Region-Flagstaff
	Tucson Electric Power Company
	Universal Telephone
	US Sprint CBYD
	US West Communications, Inc.

COMPANIES	

Blue Stake
CDR Associates
Cartographic Information Research Services
Chemstar Lime Company
Clyde Woods Consultant
Ecosphere Environmental Services
Glen Canyon Environmental Studies
	Grand Canyon Caverns/Motel
	Grand Canyon Railway, Inc.
	Institute of the NorthAmerican West
	New Mexico One Call System
	SWCA, Inc. Environmental Consultants
	  (to NNHPD)
	T.J. Fergusin, Consulting Anthropologist
	  (for Hopi Tribe)
	Western Cultural Resource Management

INDIVIDUALS	
Pamela Bunte (AZ)	Dale Shewalter (AZ)

TABLE 5-4
LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE DEIS WERE SENT

FEDERAL AGENCIES

Advisory Council on Historic Preservation
  Executive Director's Office (DC)
  Western Office of Project Review
Environmental Protection Agency
  Office of Federal Activities
Department of Agriculture
  Forest Service
    Coconino National Forest
      Peaks Ranger District
    Kaibab National Forest
      Tusayan Ranger District
  Rural Utilities Service
  Natural Resources Conservation Service
Department of Defense
  Army Corps of Engineers
Department of Energy
  Office of Environmental Compliance
  Federal Energy Regulatory Commission
  Office of NEPA Policy and Assistance
  Nevada Operations Office
    Environmental Protection Division
Department of Health and Human Services
  Public Health Service
    Navajo Area Indian Health Service
Department of the Interior
  Environmental Services (DC)
  National Resources Library (DC)
  Office of Environmental Policy and Compliance (DC)
  Office of Field Management (DC)
  Bureau of Indian Affairs
    Navajo Area Office
      Chinle Agency
      Eastern Navajo Agency
      Fort Defiance Agency
      Shiprock Agency
      Western Navajo Agency
    Phoenix Area Office
      Hopi Agency
      Truxton Cañon Agency
  Bureau of Land Management
    Resource Use and Protection (DC)
    Arizona State Office
      Phoenix District
        Kingman Resource Area
      New Mexico State Office
      Farmington District
      Nevada State Office
      Carson City District
      Las Vegas District
        Stateline Resource Area
    Denver Service Center
  Bureau of Reclamation
    Arizona Projects Office
      Environmental Division
    Denver Office
    Lower Colorado River Regional Office
  Fish and Wildlife Service
    Division of Enviornmental Coordination
    New Mexico Ecological Services State Office
    Arizona Ecological Services State Office
    Nevada Ecological Services State Office
      Desert National Wildlife Range
  National Park Service
    Division of Environmental Quality (DC)
    Colorado Plateau Systems Support Office
    Canyon de Chally National Monument
    The Flagstaff Area
    Glen Canyon National Recreation Area
    Hubbell Trading Post National Historic Site
    Lake Mead National Recreation Area
    Mesa Verde National Park
    Montezuma Castle National Monument
    Navajo National Monument
    Petrified Forest National Park
    Pipe Spring National Monument
Department of Transportation
  Environmental Division
U.S. Geological Survey
Federal Aviation Administration
  Western-Pacific Region
Federal Highway Administration
Government Printing Offices
  Marked Files
  Depository Receiving Station
Legislative Officials
  Senator Robert Bennett (UT)
  Senator Jeff Bingaman (NM)
  Senator Richard Bryan
  Senator Peter Domenici (NM)
  Senator Orrin G. Hatch (UT)
  Senator Jon Kyl (AZ)
  Senator John McCain (AZ)
  Senator Harry Reid
  Representative J.D. Hayworth (AZ)
  Representative William H. Orton (UT)
  Representative Bill Richardson (NM)
  Representative Barbara F. Vucanovich (NV)
  House of Representatives
    Committee on Natural Resources
    Committee on Appropriations

DC - Washington, DC

TABLE 5-4
LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE DEIS WERE SENT

AMERICAN INDIAN GROUPS

The Navajo Nation
- Washington Office
- Office of the President
- Tribal Council
- Tribal Chapters
- Division of Community Development
- Division of Economic Development
- Division of Education
- Division of Finance
- Division of General Services
- Division of Health Services
- Division of Human Resources
- Division of Natural Resources
- Division of Public Safety
- Division of Social Services
- Office of the Attorney General
- Office of Legislative Counsel
- Office of Legislative Personnel
- Office of Legislative Services
- Office of Management and Budget
- Office of Miss Navajo
- Office of Navajo Tax Commission
- Office of the Auditor General
- Navajo Agriculture Products Industry
- Navajo Communications Company
- Navajo Community College
- Navajo Engineering & Construction Authority
- Navajo Forest Products Industries
- Navajo Housing Authority
- Navajo Oil & Gas Company
- Navajo Tribal Utility Authority

Hopi Tribe
- Office of the Chairman
- Tribal Council
- Cultural Preservation Office

Hualapai Tribe
- Office of the Chairman
- Tribal Council
- Cultural Resources
- Natural Resources

Camp Verde Yavapai - Apache Tribe
- Sacred Sites Committee

Chemehuevi Tribe
Colorado River Indian Tribes
Fort Mojave Indian Tribe
Havasupai Tribe
Las Vegas Paiute Tribe
Moapa Paiute Indian Tribe
San Juan Southern Paiute Tribe
Shivwitz Paiute Indian Tribe
Southern Paiute of Pahrump
Ute Mountain Ute
Yavapai-Prescott Tribe
Zuni Pueblo

STATE AGENCIES

NEW MEXICO
- Office of the Governor
- Energy, Minerals, and Natural Resources Department
- Environment Department
- Department of Game and Fish
- Department of Transportation
- Historic Preservation Division (SHPO)
  - Office of Cultural Affairs
- Public Service Commission
- State Land Office
- State Clearinghouse

ARIZONA
- Office of the Governor
- Corporation Commission
  - Utilities Division
- Department of Commerce
  - Arizona State Clearinghouse
- Department of Environmental Quality
- Department of Mines & Mineral Resources
- Department of Tourism
- Department of Transportation
- Department of Water Resources
- Energy Office
- Game & Fish Department
- Geological Survey
- Land Department
- Parks Department
  - Historic Preservation Office (SHPO)
  - Homolovi Ruins State Park

TABLE 5-4
LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE DEIS WERE SENT

States (continued)

NEVADA

- Office of the Governor
- Department of Agriculture
- Department of Minerals
- Department of State Lands
- State Parks
  - Department of Conservation and Natural Resources
  - Division of Historic Preservation and Archaeology
- Department of Transportation
- Department of Wildlife-Region III
- Public Service Commission
- State Clearinghouse
  - Department of Administration

LOCAL AGENCIES

NEW MEXICO

- McKinley County
  - Board of Supervisors
  - County Manager
  - Roads Superintendent
- San Juan County
  - Planning Department
- City of Farmington
  - City Council
  - Office of the Mayor
  - Public Library
- City of Gallup
  - Public Library
- City of Bloomfield
- City of Cuba

ARIZONA

- Apache County
  - Board of Supervisors
- Coconino County
  - Board of Supervisors
  - Community Development
- Mohave County
  - Board of Supervisors
  - Economic Development
  - Planning and Zoning Commission
  - District Library (Kingman, AZ)
  - County Library (Bullhead City, AZ)
- Navajo County
  - Planning Department
- Yavapai County
  - Planning Department
- City of Flagstaff
  - Council
  - Public Library
- City of Page
  - Department of Public Works
  - Planning and Development
  - Public Library
- City of Phoenix
  - Public Library

Arizona (continued)

- City of Williams
  - Council
  - Public Library
- City of Winslow
  - Public Works
  - Public Library
- Fredonai City Council
- Seligman Public Library

NEVADA

- City of Boulder City
  - City Manager
  - Community Development Department
  - City Library
- Clark County
  - A95 Clearinghouse, Technical Committee
  - County Manager
  - Commissioners
  - Department of Comprehensive Planning
  - Health District
    - Air Pollution Control Division
  - County Library
  - School District
    - Real Property Management
  - Regional Flood Control District
- City of Henderson
  - Office of the Mayor
  - City Council
  - Survey and Properties
  - Public Library
  - Planning Department
  - Parks and Recreation
  - City of Las Vegas
  - Manager
  - Council
  - Community Planning and Development
  - Public Library
  - West Charleston Public Library
- City of Las Vegas
  - West Charleston Public Library

TABLE 5-4
LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE DEIS WERE SENT

Local Agencies (continued)

City of North Las Vegas
  Nye County Commissioner

INSTITUTIONS

Arizona State University
  Hayden Library
Navajo Community College
Northern Arizona University
  Cline Library
University of Arizona
  Main Library
University of Nevada-Las Vegas
  James Dickerson Library
University of New Mexico
  Zimmerman Library

ORGANIZATIONS

Amuedo & Ivey, Inc. (CO)
Archer Edwards Corporation (FL)
Arizona Cattlegrowers Association (AZ)
Arizona Power Pooling Association (AZ)
Avery Engineering Corporation (NV)
BHP (TX)
BHP World Minerals (NM)
Baccari & Associates (WY)
Bailey Research Associates (NY)
Bureau of Land Management Lands Foundation (CA)
California Energy Martat Newsletter (CA)
Citizens Coal Council (CO)
Class One Technical Services (NM)
Cleveland Museum of Natural History (OH)
Commission of the Arizona Environment (AZ)
Council of Energy Resource Tribes (CO)
CSWTA, Inc., Environmental Consultants (AZ)
Cuba Regional Economic Development Board (NM)
David Marcus Energy Consultant (CA)
Defenders of Wildlife (DC)
Diamond A Ranch (AZ)
Diné CARE (CO)
Dolan Springs Chamber of Commerce (AZ)
Ecosphere Environmental Services, Inc. (NM)
Environmental Law Institute (DC)
Forest Conservation Council (NM)
Southwest Regional Office
Friends of Walnut Canyon (AZ)
Gallup Independent (NM)
G.C. Wallace, Inc. (NV)
Grand Canyon Railway, Inc. (AZ)
Groves, Wray & Associates (NM)
Horizon Environmental Services, Inc. (NM)
Irrigation & Electric Districts Association of AZ
JBR Environmental Consultants (NV)
KAFF/KFLG-FM (AZ)
KVBC-TV Channel (NV)
Kerr-McGee Chemical Corporation (OK)
Land and Water Fund (CO)
Lewis Homes (NV)
Lost City Museum (NV)
Motorcycle Racing Association of Nevada (NV)
Museum of Northern Arizona (AZ)
National Wildlife Federation (AZ)
Native American Rights Fund (CO)
Northern Arizona Council of Governments (AZ)
Oxbow Power Services, Inc. (NV)
Page Chamber of Commerce (AZ)
Peabody Western Coal Mine (AZ)
  Environmental Affairs
Ray C. Cainski Consulting Engineer (NM)
Red Rock Audubon Society (NV)
Route 66 Association (AZ)
Seligman Chamber of Commerce (AZ)
Shiprock Agriculture Resources Advisory Council (NM)
Sierra Club (NM, AZ)
  Ramparts Group (AZ)
  Rio Grande Chapter (AZ)
Sloan and Company (NM)
Southern Nevada Grotto of the NSS (NV)
Spiritual and Cultural, Inc. (AZ)
The Center for Applied Research (CO)
The Southwest Center for Biological Diversity (NM)
Western Association of Land Users (UT)
  Southern Utah-Northern Arizona Chapter
Williams Field Services Company (UT)
Woodward-Clyde Consultants (CO)
Window Rock Library (AZ)

TABLE 5-4
LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE DEIS WERE SENT

UTILITIES

Colorado River Energy Distributors Association (UT)
Colorado Springs Utilities (CO)
Four Corners Power Plant (NM)
Kern River Gas Transmission Company (UT)
Las Vegas Valley Water District (NV)
Los Angeles Department of Water and Power (CA)
Salt River Project (AZ)
Southern California Edison (CA)
Environmental Services

INDIVIDUALS

ARIZONA
Akan, Kirin
Benson, Michael
Blue, Martha
Boutilier, Sylvia
Cassidy, Dan & Diane
Donley, Bill
Ford, Helen
John, Roberta
Ketchum, Lance and Laurie
Martori, Peter J.
Perry, Ella Rose
Pigmen, Beverly B.
Robbins, Stanley
Roberge, Roger M.
Robertson, S. Harry
Swift, Peggy
Tsosie, Marlene
Wilson, Ambrose and Rosita
Wyaco II, Virgil

CALIFORNIA
Casebier, Dennis
Dietz II, Sidney Bob
Wardlow, Charlene L.

COLORADO
Clark, Ralph E.
Curtis, Grapham R.
Stone, Glenn
Van Epps, Charles P.
Van Valkenburgh, Roger

NEW MEXICO
Anderson, Loretta
Benally, Eva M.
Benally, Dennis
Benally, Eva Mae
Brugge, David M.
Castillo, Billy
Charley, Harry T.
Duane, Thomas P.
Ebert, Dr. James

New Mexico (continued)
Frye, Paul E.
Geddie, John
Hansberry, Jerry
Hunt, Sandra
Joe, Charley P.
Kuhlen, John H.
Marges, Joseph
Miller, Gregory C.
Moore, Vernon
Riggs, Elliot
Smiley, Arcenio
Sweet, Mary
Tso, Daniel E.
Vecenti, Ella
Vesely, Allen
Wood, Brian

NEVADA
Arlidge, John W.
Cichowlaz, Scott D.
Harris, C.G.
Jorgensen, Ed
MacDonald, Ken
Pratley, Erika
Reid, Martin and Wanda
Rittenhouse, Franklin
Saylor, Mark
Snow, Charles D.
Stowater, David R.
Van Ee, Jeff

TEXAS
Molloy, William T.

UTAH
Anderson, Larry R.
Fehr, George D.

WYOMING
Baccari, Larry

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GLOSSARY

Access (road)
Road used for passage to and along transmission line for purposes of construction and maintenance.

Aesthetic Quality
A perception of the beauty of a natural or cultural landscape.

Affected Environment
A geographic area and the associated natural, human, and cultural resources that could be influenced by a proposed action. Also, the chapter in an environmental impact statement that describes the existing condition of the environment.

Aggradation
The deposition of sediment by running water, as in the channel of a stream.

Aggregate
A group or mass of distinct things gathered into, or considered as, a total or a whole.

Aggregation
The natural deposition of sediments in a river channel, gradually building up the slope or level of the riverbed.

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 would generally be allowed.

Alignment
The specific, surveyed route of a transmission line.

Alluvial Fan
A gradually sloping mass of alluvium (sand, clay, etc., deposited by moving water) that widens out like a fan from the place where a stream issues from a narrow mountain valley upon a plain or broad valley.

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 (action)
An option for meeting the stated need.

Alternative (route)
An optional path or direction for a transmission line.

Ambient
Characteristic of the atmosphere.

Anasazi
A prehistoric Native American group that practiced agriculture on the southern Colorado Plateau from roughly 200 BC to AD 1400.

Animal Unit Month (AUM)
Acres of forage required to sustain a cow, cow/calf, or equivalent for one month.

Annual (ecology)
A plant that completes its development in one year or one season and then dies.

Anticline
A sharply arched fold of stratified rock composed of strata that slope downward in opposite directions from the apex of the arch.

Aquatic
Growing or living in or near the water.

Aquifer
A stratum of permeable rock, sand, etc. that contains water. Water source for a well.

Archaeology
The science that investigates the history of peoples by the remains belonging to the earlier periods of their existence.

Archival
Pertaining to or contained in documents or records that preserve information about an event or individual.

Area of Critical Environmental Concern (ACEC)
A BLM designation for an area within public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life 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.

Assessment (environment)
An evaluation of existing resources and potential impacts to them from a proposed act or change to the environment.

Avifauna
Birds of a specified region or time.

Background
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.

Base Load
The minimum load of a utility over a given period of time.

Batch Plant Site
An area used for concrete mixing, temporary field office facility, material storage, and stations for equipment maintenance during construction of the transmission line. The area usually covers approximately two acres.

Bennett Freeze
In an effort to force the Navajo and Hopi to resolve their differences over land ownership, in 1966 Commissioner of Indian Affairs Robert L. Bennett issued a series of Federal administrative instructions restricting, or "freezing," development in certain areas of the Navajo Reservation without written consent of both tribes.

Bundle
Two or more conductors combined to form a phase.

Butte
A steep hill standing alone in a plain.

Caliche
Cemented deposit of secondary calcium carbonate found in layers or disseminated throughout the horizon of certain soils in arid to semiarid regions.

Cambrian
The earliest geologic period in the Paleozoic Era, spanning the time of 570 to 500 million years ago, and marked by a profusion of marine animals.

Candidate Species
A plant or animal species not yet officially listed as threatened or endangered, but which is undergoing status review by the FWS.

Capability
The ability to generate or transmit power.

Capacity
The maximum load that can be generated or transmitted by generating or transmission facilities for a given period of time without exceeding approved limits of temperature or stress.

Centerline
A line along the approximate middle of a transmission line right-of-way.

Chapter
Political districts within the Navajo Nation; there are 110 Chapters on the Navajo Nation.

Circuit
A complete closed conducting path over which electric current may flow.

Conductor
The wire cable strung between transmission line towers through which the electrical current flows.

Construction, Operation and Maintenance Plan {COMP)
A detailed plan depicting engineering, access, construction, environmental, and reclamation that is prepared prior to construction and operation of a proposed action.

Contrast
The effect of a striking difference in the form, line, color or texture of an area being viewed.

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).

Corona
The discharge of energy from an energized transmission line that occurs when the voltage gradient exceeds the breakdown strength of air.

Corridor
A continuous strip of land of defined width, through which a linear utility route (or routes) passes.

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 the environment studies, and advises the President on environmental matters.

Counterpoise

Conductive cable buried in the ground at a transmission line tower to lower the resistance of the ground to conduct electricity (if resistance is greater than 10 ohms).

Cretaceous

The third and latest period of the Mesozoic Era, spanning in time from 136 to 65 million years ago, marked by the dying out of toothed birds and dinosaurs, and the development of early mammals.

Cumulative Impact

The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Dead-end Structure

Transmission line tower structures that are more robust than tangent structures, used (1) to add longitudinal strength to the line, (2) at turning points (angles), (3) for added safety at crossings of other utilities such as other transmission lines and roads, and (4) to interrupt long distances of suspension structures that would otherwise provide more exposure to catastrophic line failure over long distance.

Degradation

The wearing down or away, and general lowering or reduction, of the earth's surface by the processes of weathering and erosion.

Devonian

A geologic period during the Paleozoic Era, spanning in time from 395 to 345 million years ago, marked by an abundance of fishes and the appearance of the first land plants and amphibians.

Dip Slope

The downward slope of geologic strata

Distance Zone

A visibility threshold distance where visual perception changes. The zones are usually defined as foreground, middleground and background.

Drainage Basin

The region or area bounded peripherally by a drainage divide or occupied by a river system.

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.

Ecotone

A transitional zone between two adjacent communities.

Effects (also see Impacts)

Direct Effects

Caused by the action and occur at the same time and place (40 CFR 1508.8(a)).

Indirect Effects

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.

Electric and Magnetic Field

A space or region within which magnetic forces are present around an electrical current.

Electrostatic Field

Pertaining to a space or region within which atmospheric electricity at rest interferes with radar, radio or television reception.

Emergent (vegetation)

Vegetation with all or part of their vegetative and reproductive parts above the water.

Endangered Species

Any species in danger of extinction throughout all or a significant portion of its range.

Endemic

Plants or animals that are native to a particular region or country.

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 formal public document prepared to analyze the impacts on the environment of the proposed project or action and released for comment and review. An EIS must meet the requirements of NEPA, CEQ guidelines, and directives of the agency responsible for the proposed project or action.

Environmental Impact Statement, Draft (DEIS)

A detailed written statement as required by Section 102(2)(c) of the National Environmental Policy Act (NEPA).

Environmental Impact Statement, Final (FEIS)

The final version of the public document required by NEPA (see above).

Eolian

Sediment carried, formed, or deposited by the wind, as sand dunes.

Ephemeral

Present only during a portion of the year. Generally refers to water courses.

Equestrian

On horseback; anything having to do with horses.

Erosion

The group of processes whereby earth or rock material is loosened or dissolved and removed from any part of the earth's surface.

Escarpment

A steep slope or cliff formed by erosion or, less often, by faulting.

Ethnography

That aspect of cultural and social anthropology devoted to the first-hand description of particular cultures.

Extirpation

To destroy completely.

Extraction

The act of extracting or drawing a substance out of the earth (e.g. mining).

Fault

A fracture or fracture zone in the earth's surface along which there has been displacement of the sides relative to one another parallel to the fracture.

Fauna

The wildlife or animals of a specified region or time.

Federal Energy Regulatory Commission (FERC)

Agency primarily responsible for ensuring adequate energy supplies at just and reasonable rates and providing regulatory incentives for increased productivity, efficiency, and competition.

Federal Land Policy and Management Act of 1976 (FLPMA)

Public Law 94-579 signed by the President on October 21, 1976. Established public land policy for management lands administered by the Bureau of Land Management (BLM). FLPMA specifies several key directions for the BLM, notably (1) management on the basis of multiple-use and sustained yield, (2) land use plans prepared to guide management actions, (3) public lands for the protection, development, and enhancement of resources, (4) public lands retained in Federal ownership, and (5) public participation used in reaching management decisions.

Firm Energy

Noninterruptible energy and power guaranteed by the supplier to be available at all times except for reasons of uncontrollable forces or continuity of service provisions.

Floodplain

That portion of a river or stream valley, adjacent to the river channel, which is built of sediments and is inundated with water when the stream overflows its banks.

Foliage

Leaves of a plant or tree.

Foreground

The visible area from a viewpoint or use area out to a distance of one-half mile. The ability to perceive detail in a landscape is greatest in this zone.

Foreground/Middleground

The area visible from a travel route, residence or other use area to a distance of 3 to 5 miles. The outer boundary of this zone is defined as the point where texture and form of individual plants are no longer apparent in the landscape. Vegetation is apparent only in patterns or outline.

Fossil

The remains or traces of an organism or assemblage of organisms that have been preserved by natural processes in the earth's crust; exclusive of organisms that have been buried since the beginning of historical time.

Generic Mitigation

Measures, techniques, or practices applied/used generally to reduce adverse impacts on a non-specific basis.

Genus

One of the major taxonomic groups used to scientifically classify plants or animals: several closely related species, or one species, make up one genus, while several genera, or one genus, make up a family.

Geologic Formations

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.

Grazing Potential

The potential of an area to support livestock grazing measured by the number of acres of land required to support one animal unit (AUM) for a month.

Ground Wire

Two wires installed along the transmission line at the top of the tower structures to protect the conductors from lightning strikes by transferring the energy from the lightning through the ground wires and structures into the ground below.

Habitat

The region where a plant or animal naturally grows or lives. A specific set of physical conditions that surround a single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and home range.

Herbaceous

Of, or having the nature of, an herb or herbs as distinguished from woody plants.

Herbivorous

Feeding chiefly on plants.

Hogback

A ridge with a sharp crest and abruptly sloping sides, often formed by the outcropping edge of steeply dipping rock strata.

Holocene

The second geologic epoch of the Quaternary period, commencing with the end of the last glacial period (the Pleistocene epoch). This era was marked by the establishment of modern climatic and environmental conditions, and spans from roughly 9,000 BC to present.

Homogenous

Having similarity in structure because of similarity in descent.

Hydrologic System

The distribution of surface and underground waters.

Hydrology

The science that relates to the water of the earth.

Igneous Rock
Rocks solidified from molten magma occurring as intrusives or extrusives (volcanics), at or below the surface of the earth.

Impact
A modification in the status of the environment brought about by a proposed action.

Infrastructure
The basic facilities on which a community depends, such as schools, power plants, or transportation and communication systems.

Insectivorous
Feeds chiefly on insects.

Insulator
A device that is resistant to electrical conduction used for isolating and supporting conductors.

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.

Intrusive Igneous
Molten magma forced into or between other rocks while in a molten state.

Jurassic
The second period of the Mesozoic Era, spanning in time from about 190 to 136 million years ago, characterized by the dominance of dinosaurs and the appearance of flying reptiles and birds.

Jurisdictions
The limits or territory within which authority may be exercised.

Kilovolt
1,000 volts (a volt is a measure of electrical potential difference which would cause a current of 1 ampere to flow through a conductor whose resistance is 1 ohm).

Kilovolts Per Meter (kV/m)
A unit measure of electric field strength.

Kilowatt
A unit of power equivalent to 1,000 watts.

Landform
A term used to describe the many types of land surfaces that exist as a result of geologic activity and weathering (e.g., plateaus, mountains, plains, and valleys).

Landscape Character Type

The arrangement of a particular landscape as formed by the variety and intensity of the landscape features and the four basic elements of form, line, color, and texture. These factors give the area a distinct quality that distinguishes it from immediate surroundings.

Link

A segment of a route alternative sharing common endpoints with adjacent links. Endpoints of a link are determined by the location of intersection with other segments (links) of other routes.

Lithology

The structure and composition of a rock formation, and the study of rocks with the unaided eye, or with little magnification.

Loam

A rich soil composed of clay, silt, sand, and some organic matter.

Megawatts (MW)

1,000 kilowatts or 1 million watts (a watt is a unit of electrical power equal to 1/756th horsepower).

Mesa

An isolated, nearly level land mass, formed of nearly horizontal rocks, standing above the surrounding country and bounded with steep sides.

Metamorphic

A rock that has been formed through metamorphism. Metamorphism is the change in the mineralogical, structural, or textural composition of rocks under intense heat and pressure (e.g., turning limestone into marble).

Microwave

A very short electromagnetic wave.

Migratory

Birds, animals, or people that migrate, or move from one region or country to another.

Milliampere (mA)

Measure of electric current induced in conductive materials within an electric field.

Milligaus (mG)

A unit of measurement for magnetic fields.

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.

Mississippian
A period of the Paleozoic Era, spanning in time from about 345 to 320 million years ago.

Mitigate
To alleviate, reduce, or render less intense or severe.

Monocline
A rock fold or strata that slope in one direction.

Mudstone
A hardened sedimentary rock consisting of clay that is similar to shale, but does not occur in distinct, bonded layers.

National Environmental Policy Act of 1969 (NEPA)
Public Law 91-190. Establishes environmental policy for the nation. Among other items, NEPA requires Federal agencies to consider environmental values in decision-making processes.

National Register of Historic Places (NRHP)
A listing of architectural, historical, archaeological, and cultural sites of local, state, or national significance, established by the Historic Preservation Act of 1966 and maintained by the National Park Service.

Native Vegetation
Vegetation originating in a certain region or country.

Neotoma
A pack rat.

Nonspecular Conductors
Conductors that have been treated to reduce reflection, rendering the conductor less shiny and noticeable.

One-hundred-year Flood
A flood with a magnitude that may occur once every one hundred years. A 1-in-100 chance of a certain area being inundated during any year.

Ozone
A form of oxygen, O_3, produced especially when an electric spark is passed through oxygen or air.

Paleontology
The science that deals with the life of past geological ages through the study of the fossil remains of organisms.

Paleozoic
The geologic era between the Precambrian and Mesozoic eras covering the time between 570 million and 225 million years ago. The era was characterized by the development of the first fishes, amphibians, reptiles, and land plants.

Panoramic
An unlimited view in all directions.

Parent Material
The rock formation that a soil originated from through chemical and physical processes.

Particulates
Minute, separate particles, such as dust or other air pollutants.

Pennsylvanian
A period of the Paleozoic Era, spanning from about 320 to 280 million years ago.

Perennial
Lasting, or active through the whole year. May refer to rivers, streams, or plants.

Permeability
The measure of the ease with which a fluid can diffuse through a particular porous material.

Permian
The seventh and last period of the Paleozoic Era, spanning from about 280 to 225 million years ago, characterized by increased reptile life and major mountain building in North America.

Petroglyph
A symbolic design or drawing of an animal or human pecked or carved into a rock or cliff face--generally prehistoric.

Phase
Consists of a bundle of two or more conductors.

Physiographic Province
An area characterized by distinctive topography, geologic structure, climate, drainage patterns, and other features and phenomena of nature.

Pictograph
A symbolic design or drawing of an animal or human painted onto a rock or cliff face—generally prehistoric.

Pithouse
A prehistoric dwelling partially constructed beneath the earth's surface.

Plateau

An elevated tract of relatively level land, such as a tableland or mesa.

Playa

The shallow central basin of a desert plain, in which water gathers after a rain and is evaporated.

Pleistocene

The first geologic epoch during the Quaternary period, spanning from 1.8 million years ago to about 9000 BC, characterized by extensive continental glaciation in the Northern Hemisphere.

Policy

A guiding principle upon which is based a specific decision or set of decisions.

Power Withdrawal

Land that was withdrawn by the Bureau of Reclamation for development of power-related facilities (e.g., hydropower plants, dams, reservoirs, substations).

Precambrian

The earliest geologic era covering all time from the formation of the earth and ending at the Paleozoic Era which began about 570 million years ago.

Prey

An animal hunted or killed for food by another animal.

Primitive

An area that is not developed, a pristine natural area.

Protective Withdrawal

Lands that have been withdrawn from availability under the various land and mining laws for administrative or protective reasons (e.g., recreation sites, office, or warehouse sites).

Quaternary

The geologic period following the Tertiary in the Cenozoic Era, beginning about 1.8 million years ago, composed by the Pleistocene and Holocene epochs, characterized by the evolution of Hominids into modern humans.

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.

Reclamation
Returning disturbed lands to a form and productivity that will be ecologically balanced.

Reconnaissance
Preliminary examination or survey of a territory.

Recontouring
Returned a surface to or near to its original form through some type of action such as grading.

Record of Decision (ROD)
A document separate from, but associated with, an environmental impact statement that publicly and officially discloses the responsible official's decision on the proposed action.

Reference Centerline
For purposes of assessing impacts and recommending mitigation, a centerline is assigned that may be slightly adjusted during engineering design.

Region
A large tract of land generally recognized as having similar character types and physiographic types.

Residual Impact
The impact of an action remaining after application of mitigation.

Revegetation
The reestablishment and development of self-sustaining plant cover. On disturbed sites, this normally requires human assistance such as reseeding.

Right-of-way
Strip of land acquired by legal means, over which the power line and access roads would pass.

Riparian
An aquatic or terrestrial ecosystem that is associated with bodies of water, such as streams, lakes, or wetlands, or is dependent upon the existence of perennial, intermittent, or ephemeral surface or subsurface water drainage. Riparian areas are usually characterized by dense vegetation and an abundance and diversity of wildlife.

Route
A transmission route is the general path of a transmission line and associated facilities.

Sandstone
A common sedimentary rock primarily composed of sand grains, mainly quartz, that are cemented together by other minerals.

Scenic Quality Class

The designation (A, B, or C) assigned a scenic quality rating unit to indicate the visual importance or quality of a unit relative to other units within the same physiographic province (BLM designation).

Scenic Quality Rating Unit (SQRU)

A portion of the landscape that displays primarily homogeneous visual characteristics of the basic landscape features (landform, water, vegetation, and structures and modifications) which separate it from the surrounding landscape.

Sediment

Solid fragmental material, either mineral or organic, that is transported or deposited by air, water, gravity, or ice.

Seen Area

That portion of the landscape which can be viewed from one or more observer positions. The extent or area that can be viewed is normally limited by landform, vegetation, structures or distance.

Seismicity

The likelihood of an area being subject to earthquakes. The phenomenon of earth movements.

Seldom-seen Area

Areas that are either beyond the furthest extent of the background zone (of the area or travel routes) or that are seen from areas or travel routes of low use volume.

Selective Mitigation

Measures or techniques developed to reduce adverse impact on a case-by-case, or selective, basis.

Semi-arid

A climate or region characterized by little yearly rainfall and by the growth of a number of short grasses and shrubs.

Sensitivity

The state of being readily affected by the actions of external influence.

Series Compensation

Used in the design of a transmission line to electrically increase the flowability of that transmission line. Series compensation provides increased voltage support to the system when the voltage degrades due to the increased loading of the transmission line. This compensating action improves the electrical characteristics of the transmission line, thereby increasing the amount of power flow on the transmission line.

Shield Wire

(see Ground wire)

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. In general, all potential high impacts were considered to be "significant."

Simulations

The use of a computer to calculate the effect of a given physical process.

Site

In archaeology, any locale showing evidence of human activity.

Species

A group of individuals of common ancestry that closely resemble each other structurally and physiologically, and in nature interbreed producing fertile offspring.

Spring

A place where ground water flows naturally onto the land surface; often the source of a stream.

Strata

Plural of stratum—horizontal layer of sedimentary rock.

Study Area

A given geographical area delineated for specific research.

Subspecies

Any natural subdivision of a species that exhibits small, but persistent morphological variations from other subdivisions of the same species living in different geographical regions or times.

Substation

An assemblage of equipment, enclosed by fence, occurring at points along a transmission line. A facility in an electrical transmission system with the capability to route and control electrical power, and to transform power to a higher or lower voltage. Equipment includes transformers, circuit breakers, and other equipment for switching, changing, or regulating the voltage of electricity.

Substrates

Sediment that lies beneath the surface of the earth.

Talus

A pile of rock debris at the foot of a cliff or steep slope.

Tangent Structure

Typical transmission line structure. Can be one of several types, placed four to five per mile in linear position.

Taxon

A taxonomic unit or family, as a species or family.

Taxonomic

A system of arranging animals and plants into natural, related groups based on some factor common to each, such as structure or biochemistry.

Technical Report

Documentation of detailed studies summarized in the DEIS.

Terminal

(see Substation)

Tertiary

The first period in the Cenozoic Era, spanning from 65 to 1.8 million years ago.

Threatened Species (T or LT)

Any species likely to become endangered within the foreseeable future throughout all or a significant part of its range.

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.

Triassic

The first period in the Mesozoic Era, spanning from 225 to 190 million years ago and following the Permian Period of the Paleozoic Era; characterized by the appearance of many reptiles, including the dinosaurs.

Tributary

A stream or river that flows into a larger stream or river.

Uranium

A very hard, heavy, silvery, metallic, chemical element that is crucial to the research and development of atomic energy.

Use Volume

The total volume of visitor use that each segment of a travel route or use area receives.

Utility Corridor

A route used by a utility for pipelines, cables, and transmission lines.

Vanadium

A bright white soft ductile metallic element found in several minerals such as vanadinite and carnotile.

Variety Class

A designation (A, B, or C) assigned to a homogeneous area of the landscape to indicate the visual importance or quality relative to other landscape areas within the same physiographic province (FWS designation).

Vegetation Communities

Species of plants that commonly live together in the same region or ecotone.

Viewshed

Visible portion of the specific landscape seen from a specific viewpoint, normally limited by landform, vegetation, distance and existing cultural modifications.

Visual Management Objectives

The term used in this study to generally define VRM (BLM) or VQO classes (Forest Service).

Visual Management System

System of land management based upon meeting visual resource goals (Forest Service).

Visual Resource Management (VRM) classes

Classification of landscapes according to the kinds of structures and changes that are acceptable to meet established visual goals (BLM).

Visual Sensitivity Levels

The index of the relative degree of user interest in scenic quality and concern for existing or proposed changes in the landscape features of that area in relation to other areas in the study area.

Visual Quality Objectives

Classification of landscape areas according to the types of structures and changes that are acceptable to meet established visual goals (Forest Service designation).

Volcanic Field

A landscape dominated by features formed by volcanic activity, such as cinder cones, cinder covered plains, lava flows, and active or relict volcanoes.

Volts Per Meter (v/m)

A unit of measurement of an electric field.

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 waters 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.

Wetlands

Those areas that are inundated by surface or groundwater with a frequency sufficient to support vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

Wheeling

The use of the transmission facilities of one system to transmit power of and for another system. As applied to Western, the transmission of large blocks of electric power of the Western system from non-Federal hydro- and/or thermal-generating plants to points of use by utilities owning or purchasing the output of such plants.

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Eastern Area Alternatives – Shiprock to Moenkopi

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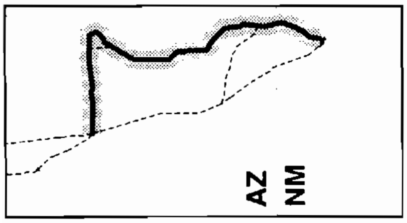

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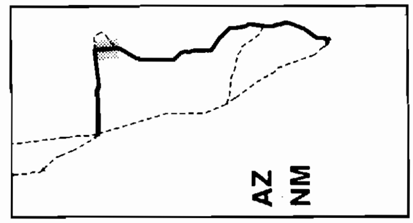

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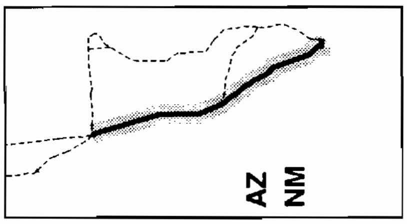

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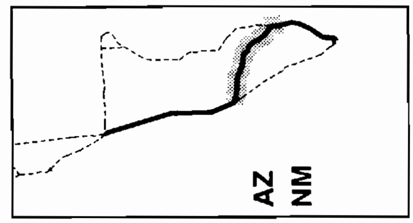

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Western Area Alternatives

Moenkopi to Marketplace

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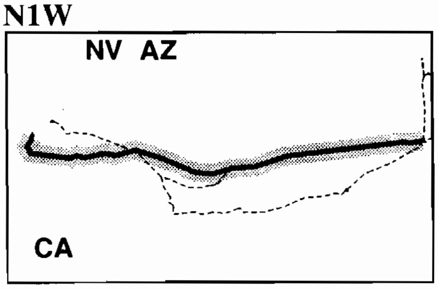

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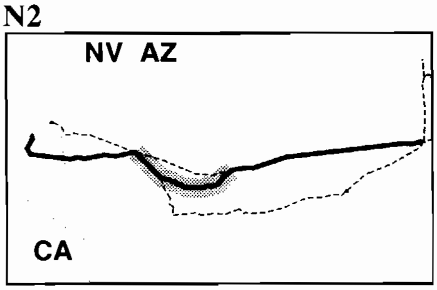

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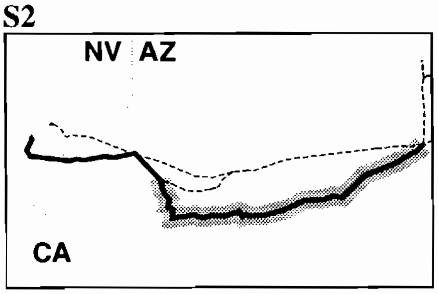

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Moenkopi to Mead

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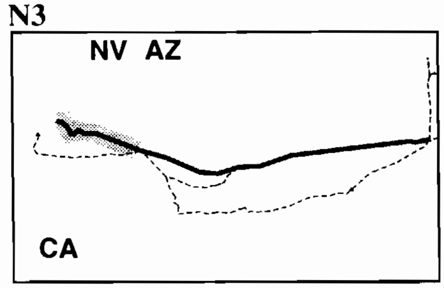

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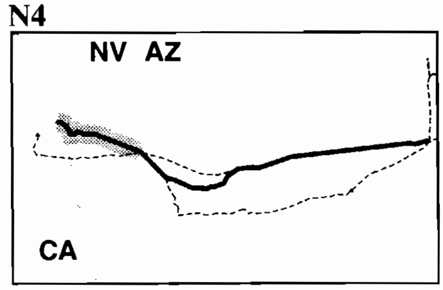

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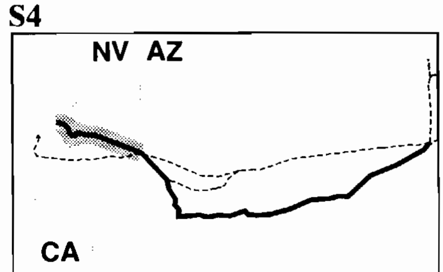

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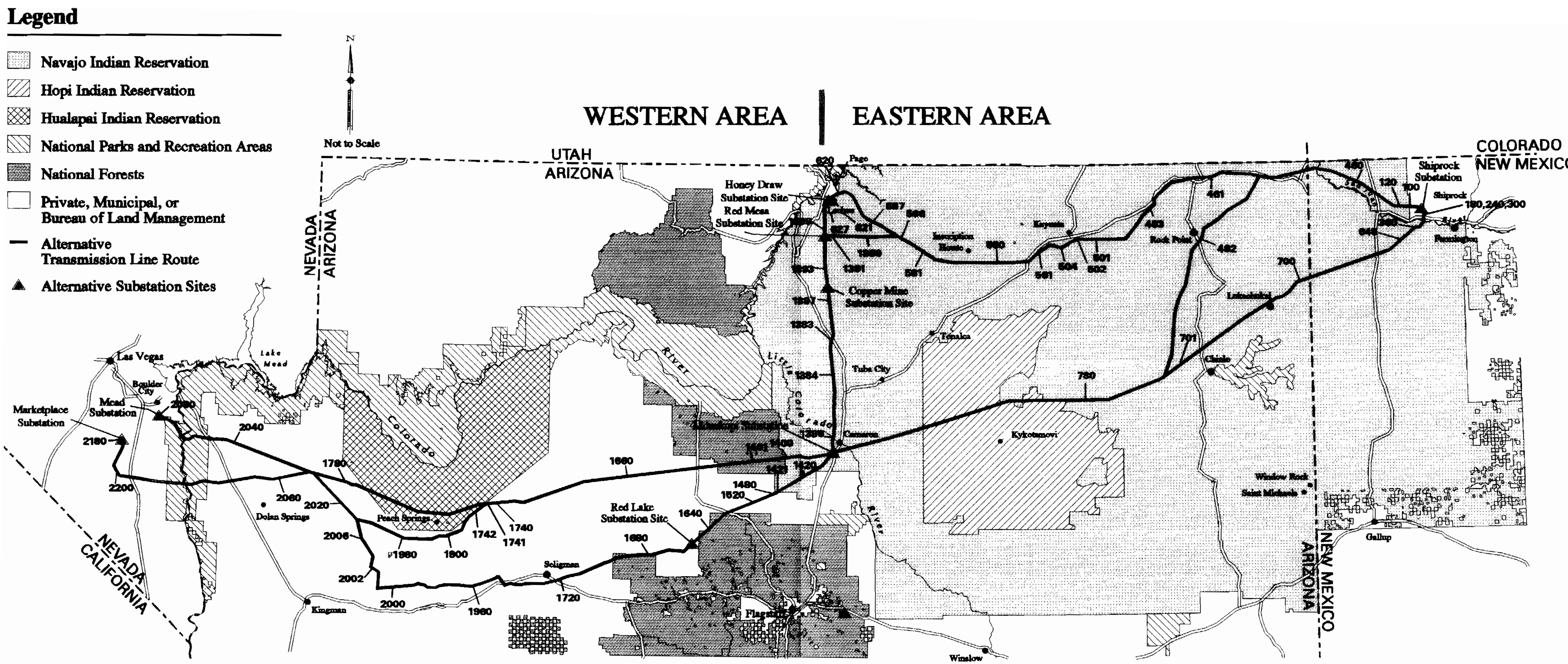
Key for Alternative Route Descriptions

Navajo Transmission Project

Fold-out Reference

Route Location

Area of Emphasis



Alternative Routes

Navajo Transmission Project

Fold-out Reference Map

APPENDIX A - ROUTE SELECTION PROCESS

INTRODUCTION

The objective of the route selection process was to identify an environmentally preferred route for the transmission line, starting at the Shiprock Substation in the Four Corners area of northwestern New Mexico and ending at either the Mead Substation or the Marketplace Substation, both of which are located in southeastern Nevada. The following sections describe the regional corridor siting study and the NEPA environmental process (shown in Figure 2-10).

REGIONAL ENVIRONMENTAL FEASIBILITY STUDY

In 1991 and 1992, DPA retained a consulting firm to complete a regional environmental feasibility study between the Four Corners area of New Mexico and southeastern Nevada to identify potential alternative corridors for initial consideration. A regional study area was defined and included approximately 38,000 square miles across portions of New Mexico, Arizona, Utah, and Nevada. Boundaries were roughly Farmington, New Mexico on the east; Las Vegas, Nevada on the west; the Arizona-Utah state border on the north; and Flagstaff, Arizona on the south. (The Grand Canyon area was excluded.) Because existing corridors are often used as alternative locations for transmission lines, corridors of existing high-voltage transmission lines (230kV and larger), interstate pipelines, and fiber optic cables were identified. In some locations, new corridors were conceptually delineated to connect existing corridors or to avoid a potentially sensitive area. About 1,800 miles of alternative study corridors were identified during the regional study.

The study relied heavily on information resulting from previous studies in the region. Federal land management plans supplemented the studies. No field review or verification was conducted for this level of study. For purposes of this study, four environmental resource disciplines were evaluated—land use, visual, biological and cultural resources. Evaluation of these resources provided (1) critical information needed to identify opportunities and constraints to routing a transmission line, and (2) parameters for more detailed studies at later stages of transmission line siting. Data gathered for the alternative study corridors were mapped and analyzed to determine resource sensitivity. The sensitivity of a resource is defined as a measure of the probable adverse response of each resource to direct and indirect impacts associated with construction, operation, and maintenance of a 500kV transmission line. Criteria considered in the sensitivity analysis included the value of the resource, protected status, and present and future use.

The study resulted in the identification of feasible alternative study corridors for further consideration and indicated areas of potential environmental concern. Potential constraints included various national parks, national monuments, wilderness and wilderness study areas, highly populated areas, and others. The feasibility study provided a substantial knowledge of the environment of the region and of the issues that would arise during later environmental investigations. The results of the study were documented in the *Navajo Transmission Project Regional Environmental Feasibility Study* (June 1992).

NEPA ENVIRONMENTAL PROCESS

In late 1992, DPA invited Western to participate in the project. As a Federal agency and project participant, Western determined that an EIS should be prepared for the project in accordance with NEPA (42 U.S.C. 4321), CEQ regulations for implementing NEPA (40 CFR 1500-1508), DOE NEPA implementing procedures (10 CFR 1021), and other applicable regulations. The intent of the NEPA environmental process is to assist in making decisions on proposed actions based on an understanding of the environmental consequences, and to ensure that Federal entities take actions to protect, restore, and enhance the environment.

SCOPING

Scoping, the first step of the NEPA environmental process, was conducted early in the project to identify the range, or scope, of issues to be addressed during the environmental studies and in the EIS (40 CFR 1501.7). The public participation program was integrated with the environmental process for NTP (refer to Figure 5-1). Western solicited comments from relevant governmental agencies and the public, organized and analyzed the comments received, and identified and summarized the issues and concerns.

The process and results are documented in the *Navajo Transmission Project Scoping Report* (January 1994) and described in Chapter 5. Generally, comments and issues identified related to need for the project, benefits, siting the alternative transmission line routes and the effects of those routes on the environment, right-of-way acquisition and use, and health and safety concerns.

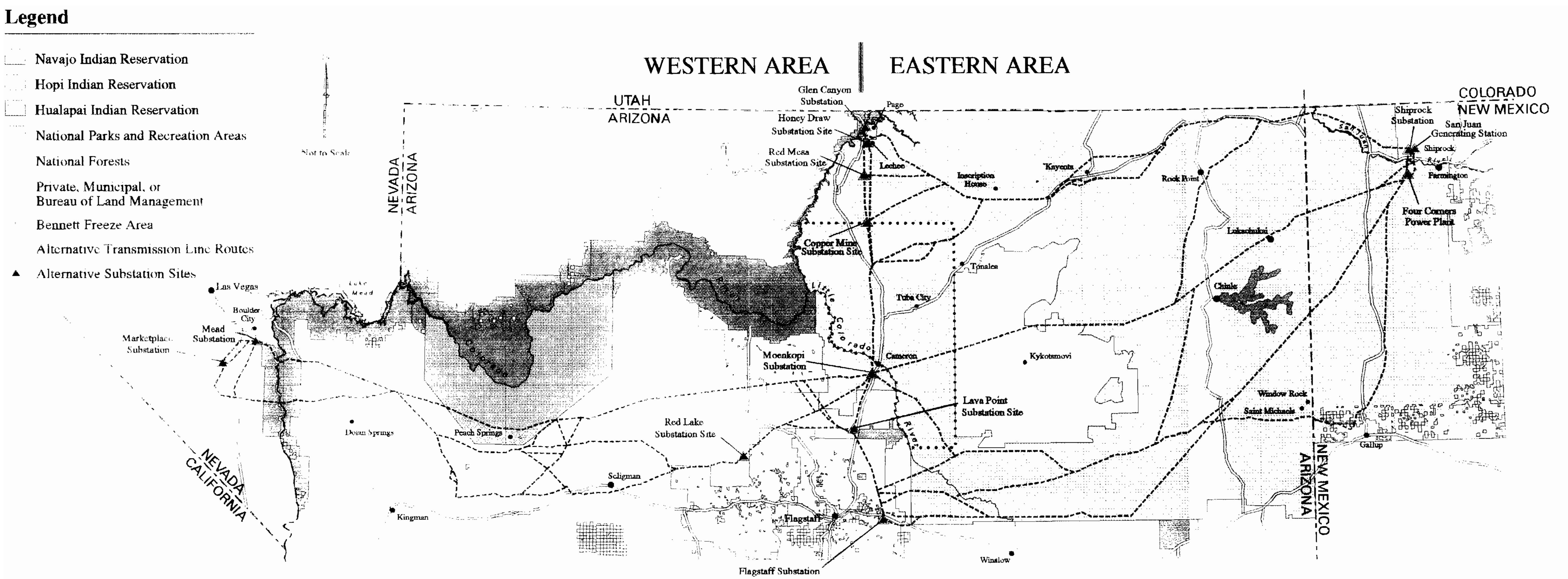
The results of the regional environmental feasibility study and scoping served as the basis to develop a work plan, which provides the approach and schedule to accomplish the environmental studies and prepare the EIS.

Alternatives Added and Eliminated as a Result of Scoping and Agency Review

The segments of alternative routes added as a result of scoping and agency review are explained and shown in Appendix B.

Also as a result of agency review and comments received from scoping, several segments of alternative routes were eliminated after each alternative had been reviewed for environmental issues, public acceptability, and/or engineering limitations.

Following scoping, the remaining alternative routes were approved for further study (Figure A-1).



Alternative Routes Studied

Navajo Transmission Project

Figure A-1

RESOURCE INVENTORY

Resource inventories (Table A-1), conducted primarily between July 1993 and June 1994, were developed within alternative study corridors in sufficient detail to assess potential impacts that could result from the proposed project. The width of the study corridor along each alternative route differed for each of the resource disciplines depending on the area that potentially could be affected. The precise location of the reference centerline will be determined through engineering surveys of the final route prior to construction. Water, earth, biological, and paleontological resources were inventoried within a one-mile-wide study corridor (0.5 mile on each side of the reference centerline). Land use, visual, and cultural resources were inventoried within a six-mile-wide study corridor (three miles on each side of the reference centerline).

TABLE A-1
ENVIRONMENTAL RESOURCES STUDIED

Natural Environment	Human Environment	Cultural Environment
Air	Land Use ■ existing land use ■ future land use ■ parks, preservation, and recreation	Archaeology and History
Water Resources ■ springs ■ streams ■ 100-year floodplains	Socioeconomics ■ demographics ■ housing ■ employment ■ taxation	Special-status Sites
Earth Resources ■ soils ■ erosion potential ■ mineral resources ■ geotechnical hazards	Visual Resources ■ scenic quality ■ views ■ viewer sensitivity ■ agency visual management objectives	Traditional Cultural Places
Biological Resources ■ vegetation ■ wildlife ■ special-status species ■ important or unique habitat ■ wetlands	Noise	
Paleontological Resources	Health and Safety	

To facilitate analysis, the alternative routes were divided into discrete segments called links, referred to throughout the DEIS. The links are numbered along a study corridor from east to west. The other resources (i.e., air, socioeconomics, and noise) are addressed regionally rather than by route. The initial efforts of the investigation consisted of gathering and reviewing published and unpublished reports documenting previous studies and projects. Existing maps of various scales and aerial photographs were reviewed and interpreted for the area within the alternative study corridors.

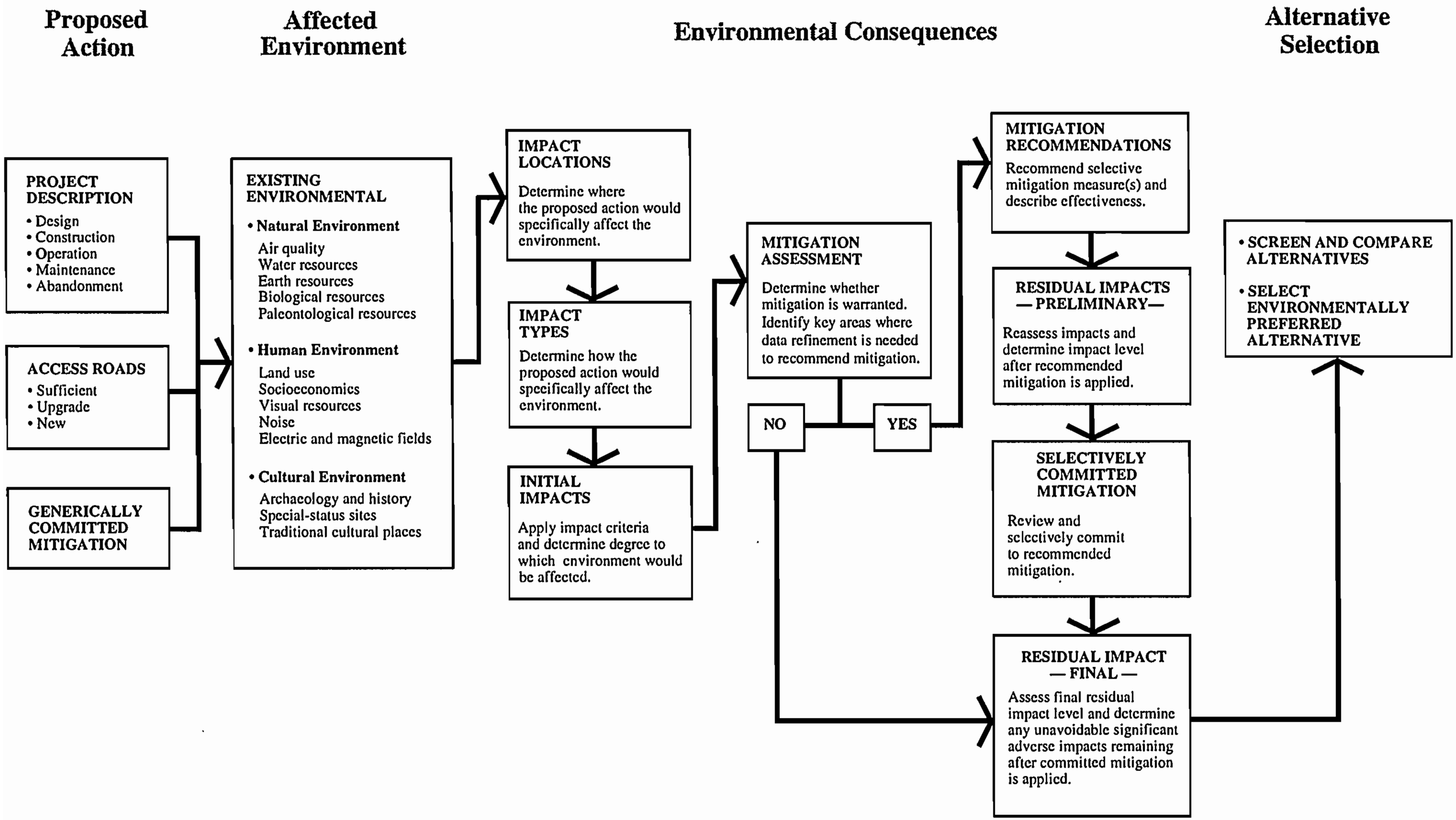
Following the initial inventory effort, relevant Federal, state, tribal, and local land and resource management agencies were contacted to update, refine, and verify information, and to solicit information regarding agency issues, concerns, policies, and regulations. Comprehensive land and resource management plans were reviewed. The data obtained were compiled and mapped on 7.5-minute and 1:100,000 scale U.S. Geological Survey (USGS) topographic maps. All data were entered (digitized) into a geographic information system (GIS) (Arc/Info version 6.1 software) used for data storage, management, and analytic and graphic output.

The preliminary results of the inventory of resources were documented by link in the resource inventory summaries. The summaries and maps (1:250,000 scale) were distributed to the cooperating agencies who provided comments on adequacy and accuracy prior to proceeding with impact assessment and mitigation planning.

IMPACT ASSESSMENT AND MITIGATION PLANNING

Potential environmental consequences from the project were determined through a systematic analysis that included assessing impacts of the project on the environment, and how the impacts could be mitigated most effectively. This impact assessment and mitigation planning process is summarized below and illustrated in Figure A-2.

Impacts to the environment can result directly or indirectly from the project action and can be permanent, long-lasting (long term) or temporary (short term). Long-term impacts are defined as those that would substantially remain for the life of the project (50 years) or beyond. Short-term impacts are defined as those changes to the environment during construction that generally would revert to preconstruction condition at or within a few years of the end of construction. Impacts can be beneficial (positive) or adverse (negative) and can vary in significance from no change or only slightly discernible change, to a full modification of the environment.



Impact Assessment and Mitigation Planning Process

Navajo Transmission Project

Figure A-2

Proposed Action—The first step was to understand the proposed action and determine the types and amount of disturbance that could occur; that is, the design and typical specifications of the project facilities, construction techniques and equipment used, extent of construction, requirements for operation of the transmission line, activities associated with routine maintenance, and activities associated with abandonment if or when the facilities are no longer needed. The majority of potential impacts that could occur would result from the activities associated with construction and include the following:

- upgrading existing roads or constructing roads for access where needed
- preparing tower sites, staging areas, batch plant sites
- assembling and erecting tower structures
- stringing conductors (e.g., wire-pulling and -splicing sites)

In addition, following construction, impacts on some resources would result from the presence of the transmission line. Also, periodic maintenance activities could cause temporary impacts.

As part of the project description, the proponents, DPA and Western, commit to undertake certain measures to protect the environment as standard practice for the entire project. These measures are referred to as "generic mitigation" and are summarized in Table 2-3.

The amount of ground that could be disturbed as a result of project activities was estimated. Six levels of ground disturbance were identified based on the extent of access road constructed or upgraded, as well as disturbance at tower sites, staging areas, batch plant sites, etc. (see Table 2-4). Where the proposed transmission line would parallel an existing linear facility such as a transmission line and/or existing access roads, new ground disturbance would be minimal, resulting in less potential impact. However, if the proposed transmission line were sited in an area where there is no or little disturbance, new ground disturbance would be greater. Refer to Figures 3-3 and 3-4 for locations of existing utility corridors along the alternative routes.

A preliminary location of the transmission line within the alternative study corridors was established by Western in 1993 and verified through aerial reconnaissance. This location was used as a "reference" centerline for purposes of assessment. Figure 3-5 shows the location of the proposed transmission line with respect to existing conditions (new corridor or parallel to existing facilities).

Initial Impacts—Given an understanding of the project description (Chapter 2) and the inventoried information reflecting the existing environment (Chapter 3), each resource specialist determined the types and amounts of impacts that could occur on their respective resources. Computer-assisted models were developed to (1) estimate the level of disturbance that could result from construction activities and (2) assess the impacts of construction on resources. Each specialist used the general methods designed for the NTP EIS studies as a guideline and tailored the methods appropriately to the specific needs and requirements of each resource study. Qualitative and quantitative variables of resource sensitivity, resource quantity, and estimated ground disturbance were considered in predicting the magnitude of impacts, which are described generally in three levels—low, moderate, and high. A low impact results when the proposed action is expected to cause slight or insignificant adverse change to the resource. A moderate impact results when the proposed project action is expected to cause some adverse change that may be substantial and mitigation may be warranted. A high impact results when the proposed action is expected to result in substantial or significant change to the resources and mitigation is warranted in most cases. These levels were defined for each resource.

Mitigation—Once "initial" impacts were identified for each resource along the reference centerlines of the alternative routes, measures to mitigate moderate or high impacts to the extent practicable were recommended. In a limited number of instances, mitigation was recommended for low impacts. Also through this process, a few key areas were identified that needed further refinement and evaluation of data in order to recommend effective mitigation. "Selective" mitigation includes those measures or techniques to which the project proponents commit on a case-by-case, or selective, basis after impacts are identified and assessed. These measures provide a planning tool for minimizing potential adverse impacts. Selective mitigation measures are shown in Table 2-7.

Once a preferred route is selected for construction of the transmission line, Western and DPA would coordinate with the applicable regulatory and/or land-managing agency to discuss how the mitigation measures would be implemented on a site- or area-specific basis. For example, in a case where road closure is recommended, Western and DPA would work with the applicable agency to refine the measure and determine the specific method of road closure most appropriate for the site or area (e.g., barricading with a locking gate, obstructing access on the road using an earthen berm or boulders, revegetating the roadbed, or obliterating the road and returning it to its natural contour and vegetation).

Mitigation planning also is addressed in the *Navajo Transmission Project Mitigation Plan*, distributed to the cooperating agencies in conjunction with this DEIS. The purpose of the *Mitigation Plan* is to clarify the mitigation planning approach and the documentation of preliminary mitigation measures recommended at this stage of the project. Table 2-9 summarizes the total number of miles for which each measure was recommended and committed along each alternative route. As the project progresses, the plan would be refined and finalized in coordination with the agencies, and the detailed mitigation would be incorporated into the COMP prior to construction.

Residual Impacts—The impacts remaining after mitigation has been applied are referred to as "residual." Potential residual impacts were reported on maps and tables that identify the locations and magnitudes of potential resource impacts along the reference centerline.

The preliminary results of impact assessment and mitigation planning were documented by link in resource technical summaries. The summaries and maps (1:250,000 scale) were distributed to the cooperating agencies to review and provide comments prior to proceeding with the comparison of alternatives and selection of the preliminary environmentally preferred route.

COMPARISON OF ALTERNATIVE ROUTES

The comparison of alternatives is based on a screening approach designed to assist in narrowing the number of alternatives, making choices, and ranking the remaining alternative routes. Individual links of the routes evaluated were combined into segments of routes and ultimately entire routes, for purposes of comparison.

The screening and comparison process was implemented through a series of meetings conducted with the interdisciplinary team of resource specialists (third-party consultant under Western's direction) representing the natural, human, and cultural resource studies under investigation for the NTP EIS. Separate meetings were held to characterize impacts and to screen, compare, and rank alternatives.

For ease of comparison and presenting results, the project area was divided into eastern and western areas. The Moenkopi Substation area represents the central point in the network of links connecting the eastern and western areas. It is the end point of the eastern alternative routes and the beginning point of the western alternative routes. Three levels of screening were completed, as illustrated on Figure B-2. Level 1 screening focused on route comparisons in localized areas, while Level 2 screening areas focused on larger subregional areas. Level 3 screening involved combining the most suitable routes from the first two levels of screening, along with connecting links, to form complete routes in the eastern and western portions of the project area. At each level of screening, impacts were characterized for each alternative, and alternatives were compared and ranked according to preference. Less preferable alternatives were eliminated from further consideration. The reasons for eliminating these alternative routes are provided in Appendix B.

The results of the screening process established the basis for (1) characterizing the impacts of remaining, complete alternative routes; (2) comparing and ranking those alternative routes; and (3) identifying the environmentally preferred alternative route(s).

Characterizing Impacts

The first step in comparing alternative routes was to characterize the impacts on resources in the areas crossed by alternative routes. Simply stated, the purpose was to assign general impact levels to routes or route segments so that the magnitude of potential impacts could be clearly distinguished. General impact levels also were assigned to the connecting links that join routes or route segments. During interdisciplinary team meetings, each resource specialist (e.g., for water, earth, paleontological, biological, land use, visual, and cultural resources) reviewed the residual impacts (particularly high and moderate impacts), baseline data, and key issues associated with the impacts. Key issues were those identified through scoping, agency and public comments, and the environmental studies (see Table 2-6). Considering the magnitude of potential impact, effectiveness of mitigation, and degree of concern associated with the issues, the data were synthesized using professional judgment into one of five general levels of potential impact for each resource (lowest to highest) on a case-by-case (area-by-area) basis. Then, considering cumulatively the magnitudes and amounts (miles) of potential adverse effects, one overall general impact level could be determined for each resource by route segments in each screening area.

Comparing Alternative Routes

Through the comparison process, alternative routes were first ranked for preference by resource and then by the interdisciplinary study team. There was no explicit numeric weighting used in the comparison process; rather, the relative importance of specific resource issues was viewed in context with other resource impacts and issues within a geographic setting. "Tradeoffs" of resource concerns were evaluated on a case-by-case basis and varied depending on the magnitude and type of localized issues, environmental setting, severity of impacts, and potential to effectively mitigate individual resource impacts and issues. For example, in one location substantial concern for an intensely sensitive traditional cultural place may outweigh adverse impacts on viewers traveling through a scenic area; while in another area, potentially adverse impacts on scenic quality due to the presence of a transmission line may outweigh adverse impacts on an archaeology site because in this instance impacts on the archaeology site can be mitigated more effectively than the impacts on scenic quality.

Ranking of the alternative routes for overall environmental preference was then completed by the interdisciplinary study team. The results of the comparison process highlighted routes with (1) the best individual resource rankings, (2) locations that best addressed local and regional key issues, and (3) the greatest opportunity for effective mitigation. As a result of the ranking, four eastern and six western preliminary alternative routes were retained and reviewed with the public and agencies during meetings in May and June 1995.

Public Review

Following the comparison of alternatives and identification of the preliminary environmentally preferred alternative routes, public meetings were held in 20 locations near the alternative routes to update area residents regarding the siting process; present the alternative routes; provide information about administrative, engineering, and environmental elements of the project; and solicit questions and comments to learn and understand the issues and concerns of the public regarding the project, particularly along the alternative routes. Presentations, questions, and answers were translated into native languages when appropriate or requested. Comments were documented, compiled, and analyzed. Although the content of the questions and comments are often interrelated, they can be summarized into general categories, similar to those from scoping. The general categories included administrative and financial, need, benefits, siting, engineering, right-of-way and access, and health and safety. These are briefly described in Chapter 5. The results of the public meetings have been used in the environmental planning process and will be used in decision making.

Further Resource Investigations

Comments from the public meetings and agencies prompted further investigation and refinement of data for resources such as biological resources, land use, and traditional cultural places, primarily in the eastern area.

In addition, the Bennett Freeze was reasserted in September 1995. The Bennett Freeze is a restriction, or "freeze," on development in an area (western portion of the 1934 reservation created by the 1934 boundary bill that defined the borders of the Navajo Nation) disputed by the Navajo and Hopi. The law associated with the land dispute does not preclude all development; rather, it prohibits development of lands *without written consent of both tribes*. The four alternative routes in the eastern portion of the project area would cross and could be affected by the Bennett Freeze. In the event that the Bennett Freeze is not lifted in the near future or results of the litigation affects development of the transmission line, Western and DPA developed an alternative to facilitate implementation of NTP. Two segments of alternative routes across Kaibito Plateau north of the Bennett Freeze area were identified and studied. Also, two potential substations sites were identified along Western's 345kV Glen Canyon-Moenkopi-Pinnacle Peak transmission lines. The proposed NTP line could connect into the preferred intermediate substation and NTP power could be "wheeled" over the existing transmission lines avoiding immediate construction in the Bennett Freeze area.

The interdisciplinary team reviewed the results of the investigations, and re-evaluated the screening and comparison of the alternatives routes in the eastern area (including the Kaibito Plateau alternatives). The alternative routes compared in this DEIS are listed in Table 2-9 and shown in Figures 2-11 and 2-12. The results of the comparison are shown by resource for each alternative route in Tables A-2 and A-3, and summarized in Tables 2-14 and 2-15. The environmentally preferred alternative route is described in Chapter 2.

TABLE A-2 COMPARISON AND RANKING OF ALTERNATIVE ROUTES EASTERN AREA				
No Action	**GLEN CANYON 1 (GC1)**	**KAIBITO 1 (K1)**	**CENTRAL 1 (C1)**	**CENTRAL 2 (C2)**
		LOCATION		
No location.	GC1 is the longest of the four alternatives, 260.6 miles which is 73.9 miles longer than the most direct alternative, C1. Approximately 19% of GC1 would be new transmission line corridor. The majority of this route, 255.1 miles (98%) crosses the Navajo Reservation.	K1 is the second longest alternative, 244.7 miles, which is 58 miles longer than the most direct alternative route, C1. Approximately 27%, or 65.9 miles of K1 would be new transmission line corridor. Almost the entire route (99%) crosses the Navajo Reservation.	C1 is the most direct alternative between Shiprock and Moenkopi. C1 is 186.7 miles long and parallels existing transmission line or pipeline corridors for approximately 94% (176 miles) of the route. Only 10.7 miles (6%) of this route would be new transmission line corridor, the least of any alternative. Alternative route C1 crosses 150.7 miles (81%) of the Navajo Reservation and 33.1 miles (18%) of the Hopi Reservation.	C2 is the second most direct route between Shiprock and Moenkopi. C2, 211 miles long, parallels existing transmission lines for 69% (145.3 miles) of the route. C2 crosses 175.9 miles (83%) of the Navajo Reservation and 33.1 miles (16%) of the Hopi Reservation.
		WATER RESOURCES		
There would be no impacts on water resources.	**Resource Preference/Ranking: 1** Impacts on water resources would be low. GC1 crosses the San Juan River, and two springs are known within 600 feet of the reference centerline. Impacts would be avoided by spanning and carefully placing the towers.	**Resource Preference/Ranking: 1** Impacts on water resources would be low. K1 crosses the San Juan River, and three springs are known within 600 feet of the reference centerline. Impacts would be avoided by spanning and carefully placing the towers.	**Resource Preference/Ranking: 1** Impacts on water resources would be low. C1 crosses the San Juan River, and has the most springs (5) within 600 feet of the reference centerline. Impacts would be avoided by spanning and carefully placing the towers.	**Resource Preference/Ranking: 1** Impacts on water resources would be low. C2 crosses the San Juan River, and two springs are known within 600 feet of the reference centerline. Impacts would be avoided by spanning and carefully placing the towers.

TABLE A-2
COMPARISON AND RANKING OF ALTERNATIVE ROUTES
EASTERN AREA

No Action	GLEN CANYON 1 (GC1)	KAIBITO 1 (K1)	CENTRAL 1 (C1)	CENTRAL 2 (C2)
		EARTH RESOURCES (SOILS)		
There would be no impacts on soils.	**Resource Preference/Ranking: 2** Impacts on soils are generally characterized as low, with moderate impacts associated with the Marsh Pass area where new corridor would be required in steep terrain. GC1 is one of the least preferred routes, because it crosses the greatest amount of soils with high/severe erosion potential, 181.5 miles (70%).	**Resource Preference/Ranking: 2** Impacts on soils are generally characterized as low, with a section of moderate along the same area described in GC1. K1 crosses the second greatest distance of soils with high/severe erosion potential, 172.6 miles (71%).	**Resource Preference/Ranking: 1** Impacts are generally characterized as low. C1 crosses 126.2 miles (68%) of soils with high/severe erosion potential. The preference is based on a combination of the least amount of ground disturbance in relation to the amount of erosive soils. The limited amount of ground disturbance is because the existing transmission line would be paralleled.	**Resource Preference/Ranking: 1** Impacts on soils are generally characterized as low. C2 crosses 116.9 miles of soils with high/severe erosion potential (55%). While C2 crosses the least amount of highly erosive soils, there would be greater amount of ground disturbance along Link 462, which would be a new corridor.
		BIOLOGICAL RESOURCES		
There would be no impacts on biological resources.	**Resource Preference/Ranking: 1** Impacts along this route are characterized as low. Special status species habitats primarily exist in three areas along GC1. Mesa Verde Cactus and the Mancos milkvetch occurs (potentially) in the area of The Hogback (Links 100 and 120). Raptor habitat exists on Black Mesa and other cliffs in the area (Links 504 and 561). Special status fish species inhabit the San Juan River. GC1 crosses 62.6 miles of big game habitat. The combination of avoiding sensitive resources associated with the Chuska Mountains, and reducing ground disturbance by paralleling existing transmission corridors resulted in ranking GC1 as first preference for biological resources.	**Resource Preference/Ranking: 1** Impacts along this route are generally characterized as low, and similar to GC1, K1 has been ranked a first preference for biological resources. Potential impacts on special status species are generally the same as GC1. This alternative crosses the Kaibito Plateau where no additional special status species or habitat have been identified. K1 crosses 62.6 miles of big game habitat.	**Resource Preference/Ranking: 2** Impacts are characterized as low. C1 is the least preferred of the eastern area alternatives for biological resources. C1 crosses the greatest amount of known special status species habitat, including Mexican spotted owl and Chuska tassle-eared squirrel in the Chuska Mountains, and Mesa Verde Cactus in The Hogback area. C1 also crosses the only area of ponderosa pine in the project area along Link 700 in the Chuska Mountains. C1 crosses 103.9 miles of big game habitat, which is the most of the eastern area alternatives.	**Resource Preference/Ranking: 1** Impacts are characterized as low. C2 was ranked as a first preference along with GC1 and K1 for biological resources. C2 minimizes potential impacts on sensitive biological resources by avoiding the Chuska Mountains (C1) and the northern portion of Black Mesa (GC1 and K1). However, using Link 462 would result in 65.7 miles of new corridor and could disturb potential habitat for Tusayan rabbitbrush, Tusayan flameflower, and Navajo sedge.

TABLE A-2
COMPARISON AND RANKING OF ALTERNATIVE ROUTES
EASTERN AREA

No Action	GLEN CANYON 1 (GC1)	KAIBITO 1 (K1)	CENTRAL 1 (C1)	CENTRAL 2 (C2)
PALEONTOLOGICAL RESOURCES				
The environment would remain as it presently exists. This alternative would forego the opportunity to develop detailed inventories of potentially important paleontological resources.	**Resource Preference/Ranking: 2** Potential impacts on paleontological resources along GC1 are generally characterized as low. GC1 crosses 196.7 miles (75% of the route) of deposits with a high potential for scientifically important fossils in New Mexico and Arizona, especially in the Chinle Formation along Links 1383 and 1384. This alternative, along with K1 has the greatest potential to encounter fossils during construction and is ranked second or least preferred.	**Resource Preference/Ranking: 2** Impacts along K1 have been generally characterized as low. Similar to GC1, K1 crosses 194.7 miles (80% of the route) of deposits with a high potential for scientifically important fossils. Similar to GC1, this alternative is ranked second or least preferred.	**Resource Preference/Ranking: 1** Impacts are generally characterized as low. C1 crosses 160.5 miles (86%of the route) of deposits with a high potential for scientifically important fossils. The preference for this route is based on the potential to minimize impacts on fossils by paralleling an existing transmission line.	**Resource Preference/Ranking: 1** Impacts are generally characterized as low. C2 crosses 170.9 miles (81% of the route) of deposits with a high potential for scientifically important fossils. Impacts are generally characterized as low. This alternative would require 65.7 miles of new corridor; however, this does not result in a substantial difference in impacts in comparison with C1, and also has been ranked as preferred.
LAND USE				
There would be no impacts on land use.	**Resource Preference/Ranking: 2** Impacts along GC1 are characterized as low-to-moderate and moderate along much of the route. Approximately 1,436 acres of potential rangeland would be disturbed short term and about 135 acres of potential rangeland would be displaced long term along the entire alternative. Twenty-one residences are located within 500 feet; however, all direct impacts on residences within the NTP right-of-way would be avoided through mitigation. GC1 crosses lands planned for open space (0.8 mile) and industrial (0.9 miles) in the city of Page. GC1 has been given a ranking of second, or least preferred due primarily to its length and planned land use in the Page and Lechee areas.	**Resource Preference/Ranking: 1** Impacts are characterized as low and moderate. Approximately 1,374 acres of potential rangeland would be disturbed short term and about 152 acres of potential rangeland would be displaced long term along the entire alternative. K1 has 19 residences within 500 feet and impacts on potential residences within the right-of-way could be mitigated. K1 was ranked as first preference along with routes C1 and C2.	**Resource Preference/Ranking: 1** Overall, impacts are characterized as low and moderate. Approximately 1,018 acres of potential rangeland would be disturbed short term and about 86 acres of potential rangeland would be displaced long term along the entire alternative. C1 crosses the most irrigated (1.6 miles) agriculture. There are 32 residences within 500 feet of the reference centerline. However, direct impacts to residences within the right-of-way could be mitigated. About 50.9 acres of lands are suitable for timber harvest. In the Chuska Mountains, impacts are characterized as low-to-moderate and moderate and C1 is ranked first preference along with routes K1 and C2.	**Resource Preference/Ranking: 1** Based on mitigation potential, impacts are characterized as low-to-moderate. Approximately 1,207 acres of potential rangeland would be disturbed short term and about 153 acres of potential rangeland would be displaced long term along the entire alternative. C2 has the least number of residences within 500 feet (10), and direct impacts to residences within the right-of-way could be mitigated. C2 is ranked as first preference with K1 and C1.

TABLE A-2
COMPARISON AND RANKING OF ALTERNATIVE ROUTES
EASTERN AREA

No Action	GLEN CANYON 1 (GC1)	KAIBITO 1 (K1)	CENTRAL 1 (C1)	CENTRAL 2 (C2)
VISUAL RESOURCES				
There would be no impact on visual resources.	**Resource Preference/Ranking: 3** The impacts along much of this route are characterized as low to moderate; moderate based on existing transmission lines paralleled. GC1 would, however, result in 14.5 miles of high impact on scenic quality in areas of new corridor at Red Point Mesa Cliffs and along the northern edge of Black Mesa near Marsh Pass. GC1 crosses the greatest amount of residential views within 0.0 to 0.5 miles (72.5 miles) resulting in high impacts for 25.8 miles in areas of new corridor. High impacts on highly sensitive roads total 1.2 miles. Based on these high impacts, GC1 has been given a ranking of third preference for visual resources.	**Resource Preference/Ranking: 3** K1 is very similar to GC1 with the exception of the crossing of the Kaibito Plateau. The impacts along most of this route is also characterized as low to moderate; moderate based on existing transmission lines paralleled. High impacts associated with K1 include 14.5 miles of high impact on scenic quality. K1 crosses the second greatest amount of views within 0.0 to 0.5 miles from residences (63.8 miles) and results in 24.4 miles of high impacts in areas of new corridor. 1.2 miles of high impact on highly sensitive roads would result. Based on the similarity to GC1, this alternative was given a ranking of third preference for visual resources.	**Resource Preference/Ranking: 1** C1 parallels existing transmission lines almost entirely (95%). Because of these existing conditions, a majority of this alternative would result in low impacts on visual resources with only limited areas of moderate and high impacts. High impacts are restricted to 0.6 miles of views from residences in a localized area of new corridor located to the west of The Hogback. The predominance of low impacts on scenic quality, and views from residences, roads, and recreation areas has resulted in ranking C1 as a first preference for visual resources.	**Resource Preference/Ranking: 2** Impacts on visual resources along C2 are generally low to moderate, with some high impacts resulting in areas of new corridor along Link 462 in the vicinity of Sweetwater, Carson Mesa and the Chinle Valley. C2 crosses 23.8 miles of high impacts on residential views in this area and also would result in 1.1 miles of high impact on moderately sensitive roads. This alternative was ranked as a second preference for visual resources.

TABLE A-2 COMPARISON AND RANKING OF ALTERNATIVE ROUTES EASTERN AREA				
No Action	**GLEN CANYON 1 (GC1)**	**KAIBITO 1 (K1)**	**CENTRAL 1 (C1)**	**CENTRAL 2 (C2)**
CULTURAL RESOURCES				
Archaeology and History				
The environment would remain as it presently exists and conflicts with heritage preservation would be avoided. This alternative would forego the opportunity to develop detailed inventories and recovery of archaeological data that might be undertaken to mitigate impacts.	**Resource Preference/Ranking: 2** Impacts on archaeological and historical sites are rated as moderate for 96.8 miles and low for 163.8 miles. These ratings are based on the use of helicopter construction techniques to avoid blading of new roads in unroaded, high sensitivity areas for about 15.4 miles along Links 504 and 561 on the northern edge of Black Mesa.	**Resource Preference/Ranking: 2** K1 is ranked the same as GC1 and has 112.3 miles of moderate impacts and 132.4 miles of low. K1 is essentially the same as GC1 except K1 would be new transmission line corridor across the Kaibito Plateau resulting in more miles of moderate impacts.	**Resource Preference/Ranking: 1** C1 is ranked as preferred, along with C2. The potential to satisfactorily mitigate impacts to archaeological and historical sites is high, and residual impacts are not projected to be significant.	**Resource Preference/Ranking: 1** Impacts on archaeological and historical sites are similar to those of C1, although C2 is somewhat longer and 14.6 more miles are rated as having moderate impacts and 9.7 more miles as low impacts.
Special Status Sites				
The environment would remain as it presently exists and conflicts with heritage preservation would be avoided.	**Resource Preference/Ranking: 1** GC1 would result in low impacts on a single special status cultural resource—the Cameron Bridge, which is listed on the National Register of Historic Places.	**Resource Preference Ranking: 1** Impacts on special status resources would be low and identical to those of GC1.	**Resource Preference Ranking: 2** Impacts on special status cultural resources are rated as moderate (Hopi Taawa tribal park) or low (Cameron Bridge, listed on the National Register of Historic Places; Pictured Cliffs site and Mitten Rock Archaeological District, both listed on the New Mexico state register).	**Resource Preference Ranking: 2** C2 and C1 are projected to have moderate impacts on Hopi Taawa tribal park and low impacts on the Cameron Bridge. C2 avoids the Pictured Cliffs site and Mitten Rock Archaeological District.

TABLE A-2 COMPARISON AND RANKING OF ALTERNATIVE ROUTES EASTERN AREA				
No Action	**GLEN CANYON 1 (GC1)**	**KAIBITO 1 (K1)**	**CENTRAL 1 (C1)**	**CENTRAL 2 (C2)**
Traditional Cultural Places				
The environment would remain as it presently exists and conflicts with heritage preservation would be avoided. This alternative would forego the opportunity to develop detailed inventories.	Navajo **Resource Preference/Ranking: 1** A special study of Navajo traditional cultural places projects that GC1 would have 9.4 miles of high impacts in the Marsh Pass area along Links 504 and 561. GC1, along with K1, are ranked as the most preferred. High impacts are in areas where the route goes through sacred areas or follows routes of travel recounted in ceremonial stories, or where new corridor would be built through moderate and high sensitivity zones.	Navajo **Resource Preference/Ranking: 1** K1 also has 9.4 miles of high impacts in the Marsh Pass area and is ranked as preferred along with GC1.	Navajo **Resource Preference/Ranking: 3** C1 is ranked as the least preferred. High impacts are projected for 74 miles. The most sensitive areas are in the Chuska Valley and Chuska Mountains (Link 700) and Black Mesa (Link 780).	Navajo **Resource Preference/Ranking: 2** C2 is projected to have 46 miles of high impacts. C2 avoids the highly sensitive areas in the Chuska Valley and Chuska Mountains crossed by C1, but does cross the sensitive areas on Black Mesa (Link 780).
The environment would remain as it presently exists and conflicts with heritage preservation would be avoided. This alternative would forego the opportunity to develop detailed inventories.	Hopi **Resource Preference/Ranking: 3** GC1, is ranked as least preferred based on impact scores determined by a special study of Hopi traditional cultural places. The GC1 impact score is 185, reflecting the presence within a six-mile-wide study corridor of 48 known ritual places, of which 12 are likely to be directly crossed, and 12 nonritual traditional use areas, of which 6 are likely to be directly crossed.	Hopi **Resource Preference/Ranking: 2** K1 along with C2 is ranked as second preference. The K1 impact score is 168 reflecting the presence of 44 ritual places, of which 12 are likely to be directly crossed, and 13 nonritual areas, of which 7 are likely to be directly crossed.	Hopi **Resource Preference/Ranking: 1** C1 is ranked as preferred. The impact score is 134, reflecting the presence within a six-mile-wide study corridor of 64 known traditional ritual places, of which one is likely to be directly crossed, and five nonritual use areas, none of which are likely to be directly crossed.	Hopi **Resource Preference/Ranking: 2** C2 has an impact score of 169, reflecting the presence within a six-mile-wide corridor of 66 known ritual places, of which one is likely to be directly crossed, and 4 nonritual traditional use areas, none of which are likely to be directly crossed.

TABLE A-3
COMPARISON AND RANKING OF ALTERNATIVE ROUTES
WESTERN AREA

	MOENKOPI TO MARKETPLACE ALTERNATIVES			MOENKOPI TO MEAD ALTERNATIVES		
NO ACTION	NORTHERN 1 WEST (N1W)	NORTHERN 2 (N2)	SOUTHERN 2 (S2)	NORTHERN 3 (N3)	NORTHERN 4 (N4)	SOUTHERN 4 (S4)
LOCATION						
No location.	N1W is 217.0 miles in length, and is the most direct route between the Moenkopi and Marketplace substations. N1W parallels existing transmission line corridors for the entire distance (100%). This route crosses several jurisdictions, including BLM (49.2 miles), Forest Service (19.1 miles), NPS (10.9 miles), Navajo Reservation (13.3 miles), Hualapai (35.1 miles), state lands (16.7 miles), and private (71.5 miles).	N2 is the second longest alternative to the Marketplace Substation at 225.1 miles. Approximately 82%, or 183.6 miles, of N2 parallels existing transmission corridors. N2 crosses several jurisdictions, including state land (20.1 miles) BLM lands (73.2 miles) Forest Service (19.1 miles), NPS (10.9 miles), and Navajo Reservation (13.3 miles). The remainder of the route would cross private lands (87.3 miles).	S2 is the longest of the three alternatives to Marketplace at 247.7 miles. This alternative parallels existing transmission or pipeline corridors for 161.4 miles, or 65%, of the route, resulting in the greatest amount of new transmission line corridor (35%) among the Marketplace alternatives. Jurisdictions crossed by S2 include state land (56.1 miles), BLM (58.2 miles), Forest Service (20.6 miles), NPS (10.9 miles), Navajo Reservation (19.5 miles). The remainder crosses private lands (81.7 miles).	N3 is the most direct alternative between Moenkopi and Mead, 199.3 miles. This alternative parallels an existing transmission line corridor for the entire distance (100%). Jurisdictions crossed by this alternative include state land (18.2 miles), BLM land (33.4 miles), Forest Service (19.1 miles), NPS (13.3 miles) Navajo Reservation (13.3 miles), and Hualapai Reservation (35.1 miles).	N4 is 207.4 miles in length and parallels existing transmission corridors for 165.9 miles, or 80%, of the route. Jurisdictions crossed by N4 include state land (21.6 miles), BLM (60.2 miles), Forest Service (19.1 miles), NPS (13.3 miles), and Navajo Reservation (13.3 miles).	S4 is the longest of the Mead alternatives (230 miles) and parallels existing transmission corridors for 143.7 miles, or 62%, of the route, which is the least of the three Mead alternatives. Jurisdictions crossed by this route include state land (57.6 miles), BLM (42.4 miles), Forest Service (20.6 miles), NPS (13.3 miles), and Navajo Reservation (19.5 miles).
WATER RESOURCES						
There would be no impacts on water resources.	**Resource Preference/Ranking-1** Impacts on water resources would be low. N1W crosses the Colorado River and in proximity to one spring. Impacts would be avoided by spanning the river and carefully placing the towers.	**Resource Preference/Ranking-1** Impacts on water resources would be low. N2 crosses the Colorado River , and no springs are known within 600 feet of the reference centerline. Impacts would be avoided by spanning the river.	**Resource Preference/Ranking-1** Impacts on water resources would be low. S2 crosses the Colorado River and no springs are known within 600 feet of the reference centerline. Impacts would be avoided by spanning the river.	**Resource Preference/Ranking-1** Impacts on water resources would be low. N3 crosses the Colorado River and one spring is known within 600 feet of the reference centerline. Impacts would be avoided by spanning the river and carefully placing the towers.	**Resource Preference/Ranking-1** Impacts on water resources would be low. N4 crosses the Colorado River and no springs are known within 600 feet of the reference centerline. Impacts would be avoided by spanning the river.	**Resource Preference/Ranking-1** Impacts on water resources would be low. S4 crosses the Colorado River and no springs are known within 600 feet of the reference centerline. Impacts would be avoided by spanning the river.
EARTH RESOURCES (SOILS)						
There would be no impacts on soils.	**Resource Preference/Ranking-1** Impacts on soils are characterized as low. Seventeen percent (37.5 miles) of N1W crosses areas of high/severe erosion potential, similar to N2. However, it parallels existing transmission lines and disturbance from construction would be minimized. N1W to Marketplace is ranked as a first preference for soils.	**Resource Preference/Ranking-2** Impacts on soils are generally characterized as low. Eighteen percent (39.6 miles) of N2 crosses areas of high/severe erosion potential. This is the second preference to Marketplace because there would be about 41.5 miles of construction in new corridor.	**Resource Preference/Ranking-3** Impacts on soils are generally characterized as low. S2 crosses the least amount of high/severe erosion potential (29.8 miles, or 12%), yet would result in the greatest amount (86.3 miles) of construction in new corridor. S2 is the least preferred of the alternative routes to Marketplace.	**Resource Preference/Ranking-1** Impacts on soils are characterized as low. N3 crosses areas subject to high/severe erosion potential for approximately 39.6 miles, or 19%, of the route. This is the preferred route to Mead because it parallels existing transmission lines and disturbance from construction would be minimized.	**Resource Preference/Ranking-2** Impacts on soils are generally characterized as low. N4 crosses areas of high/severe erosion potential for 41.7 miles, or 20%, of the route. N4 to Mead is the second preference because there would be about 41.5 miles of construction in new corridor.	**Resource Preference/Ranking-3** Impacts are generally characterized as low. S4 crosses high/severe erosion potential for 31.9 miles, or 14%, of the route. This is the least preferred route to Mead because there would be the greatest amount (86.3 miles) of construction in new corridor.

TABLE A-3
COMPARISON AND RANKING OF ALTERNATIVE ROUTES
WESTERN AREA

	MOENKOPI TO MARKETPLACE ALTERNATIVES			MOENKOPI TO MEAD ALTERNATIVES		
NO ACTION	NORTHERN 1 WEST (N1W)	NORTHERN 2 (N2)	SOUTHERN 2 (S2)	NORTHERN 3 (N3)	NORTHERN 4 (N4)	SOUTHERN 4 (S4)
BIOLOGICAL RESOURCES						
There would be no impacts on biological resources.	**Resource Preference/Ranking-1** N1W parallels existing transmission lines for the entire distance and is the preferred route for biology among the Marketplace alternatives. Impacts are characterized as low with potentially moderate impacts (0.2 mile) on Sonoran desert tortoise along Link 2060. All of the western alternatives traverse the riparian and aquatic habitats associated with the Colorado River, which support special status wildlife species. N1W crosses 2.0 miles of riparian vegetation. N1W crosses 139.4 miles of big game habitat. Each of the Marketplace alternatives cross the same amount (21.1 miles) of Mojave desert tortoise habitat and 1 mile of Sonoran desert tortoise habitat. NPS prefers Link 2060 rather than Link 2040 because Link 2060 has lower densities of Sonoran desert tortoise. Impacts on biological resources along all routes would be mitigated by paralleling existing transmission lines, using existing access roads, carefully placing towers, and preconstruction surveys to identify sensitive areas and specific mitigation . The loss of habitat as well as impacts to individual special status plants and animals would be minimized.	**Resource Preference/Ranking-3** N2 is ranked second because of the potential impacts associated with construction in new corridor (18% of route). Impacts on biological resources are characterized as low with moderate impacts (0.2 mile) associated with Sonoran desert tortoise along Link 2060 (1 mile). N2 is very similar to N1W and S2, with the exception of crossing a greater amount of sensitive species habitat (38.8 miles of known listed wildlife species and 20.1 miles of known candidate species). N2 crosses the most big game habitat (148.3 miles). Potential adverse effects on the big game habitat along Links 1742, 1800, and 1980 are of specific concern to the BLM because of the potential for increased human access.	**Resource Preference/Ranking-2** S2 is ranked second preference. Impacts are characterized as low. Impacts would result from disturbance from construction in new corridor (35% of route). S2 crosses raptor habitat along Link 2000. S2 crosses the most riparian vegetation (2.3 miles) and the least amount of big game habitat (113.3 miles) among the Marketplace alternatives.	**Resource Preference/Ranking-1** N3 parallels existing transmission line corridor for the entire distance and is the preferred route among the alternatives to Mead. Impacts are generally characterized as low. It crosses 8.3 miles of known listed wildlife species habitat and 140.4 miles of big game habitat. N3, N4, and S4 would cross 5.7 miles of Mojave desert tortoise, and 6.4 miles of Sonoran desert tortoise habitat. N3 crosses 3.3 miles of riparian vegetation.	**Resource Preference/Ranking-3** N4 is least preferred of the Mead alternatives. Impacts are characterized as low. N4 crosses the most miles (148.9) of big game habitat of the Mead alternatives.	**Resource Preference/Ranking-2** S4 is ranked second among the Mead alternatives, because of the amount of construction in new corridors (39% of the route). Impacts are characterized as low. S4 crosses 113.9 miles of big game habitat, 3.6 miles of riparian vegetation, and 8.3 miles of known habitat for listed wildlife species.

TABLE A-3 COMPARISON AND RANKING OF ALTERNATIVE ROUTES WESTERN AREA						
	MOENKOPI TO MARKETPLACE ALTERNATIVES			MOENKOPI TO MEAD ALTERNATIVES		
NO ACTION	NORTHERN 1 WEST (N1W)	NORTHERN 2 (N2)	SOUTHERN 2 (S2)	NORTHERN 3 (N3)	NORTHERN 4 (N4)	SOUTHERN 4 (S4)
PALEONTOLOGICAL RESOURCES						
The environment would remain as it presently exists. This alternative would forego the opportunity to develop detailed inventories of potentially important paleontological resources.	**Resource Preference/Ranking-1** Impacts are generally characterized as low. N1W crosses 78.5 miles (36%) of deposits with a high potential for scientifically important fossils, especially in the Chinle Formation, Kaibab Limestone, and Coconino Sandstone. This is the preferred route to Marketplace because it parallels existing transmission lines and disturbance from construction would be minimized.	**Resource Preference/Ranking-2** Impacts are generally characterized as low. N2 crosses 75.6 miles (33% of the route) of deposits with a high potential for scientifically important fossils. This is the second preference to Marketplace because there would be about 41.5 miles of construction in new corridor.	**Resource Preference/Ranking-3** Impacts are generally characterized as low. S2 crosses 62.3 miles (25% of the route) of deposits with a high potential for scientifically important fossils. S2 is the least preferred of the alternative routes to Marketplace because there would be about 86.3 miles of construction in new corridor.	**Resource Preference/Ranking-1** Impacts are generally characterized as low. N3 crosses 78.5 miles (39% of the route) of deposits with a high potential for scientifically important fossils. This is the preferred route to Mead because it parallels existing transmission lines and disturbance from construction would be minimized.	**Resource Preference/Rankig-2** Impacts are generally characterized as low. N4 crosses 75.6 miles (36% of the route) of deposits with a high potential for scientifically important fossils. This is the second preference to Marketplace because there would be about 41.5 miles of construction in new corridor.	**Resource Preference/Ranking-3** Impacts are generally characterized as low. S4 crosses 62.3 miles (27% of the route) of deposits with a high potential for scientifically important fossils. This is the least preferred route to Mead because there would be the greatest amount (86.3 miles) of construction in new corridor.
LAND USE						
There would be no impacts on land use.	**Resource Preference/Ranking-1** The primary land use concerns are potential effects on grazing and proximity to residences. Impacts on land uses are characterized as low. Approximately 1,189 acres of rangeland would be disturbed short term and 106 acres would be displaced long term. No residences have been identified within approximately 500 feet of the NTP line, or within the NTP right-of-way. N1W crosses 0.2 mile of the Lake Mohave Ranchos subdivision (undeveloped).	**Resource Preference/Ranking-2** Impacts on land uses are characterized as low. Approximately 1,279 acres of rangeland would be disturbed short term and 155 acres would be displaced long term. One residence is located within 500 feet of N2; but none are within the right-of-way. Link 1980 is not within a BLM designated utility corridor. N2 crosses the Lake Mead Ranchos, Realsite Arizona Ranchettes, and Lake Mohave Ranchos (undeveloped subdivisions) for a total distance of 1.0 mile.	**Resource Preference/Ranking-3** Impacts on land uses are characterized as low. The most short-term disturbance (1,403 acres) and long-term displacement (166 acres) of rangeland would result along S2. Also, S2 would result in the largest permanent displacement of AUMs in the western portion of the project area. There are seven residences within 500 feet of S2, but none would be within the right-of-way. S2 crosses the Sunny Highlands, Lake Mead Ranchos, Realsite Arizona Ranchettes, and Lake Mohave Ranchos undeveloped subdivisions for a distance of 1.9 miles.	**Resource Preference/Ranking-1** Impacts on land uses are characterized as low. The least short-term disturbance (1,074 acres) and long-term displacement (79 acres) of rangeland in the western portion of the project area would result along N3. N3 is the same as N1W with regard to residences.	**Resource Preference/Ranking-2** Impacts on land uses are characterized as low. Approximately 1,164 acres of rangeland would be disturbed short term and 128 acres would be displaced long term. N4 is the same as N2 with regard to residences. Link 1980 is not within a BLM designated utility corridor. N4 crosses the Lake Mead Ranchos, Realsite Arizona Ranchettes, and Lake Mohave Ranchos (undeveloped subdivision) for a distance of 0.8 mile.	**Resource Preference/Ranking-3** Impacts on land uses are characterized as low. Approximately 1,287 acres of rangeland would be disturbed short term and 139 acres would be displaced long term. S4 is the same as S2 with regard to residences. S4 crosses the Sunny Highlands, Lake Mead Ranchos, Realsite and Arizona Ranchettes (undeveloped subdivisions) for a distance of 1.7 miles.

TABLE A-3 COMPARISON AND RANKING OF ALTERNATIVE ROUTES WESTERN AREA						
	MOENKOPI TO MARKETPLACE ALTERNATIVES			MOENKOPI TO MEAD ALTERNATIVES		
NO ACTION	NORTHERN 1 WEST (N1W)	NORTHERN 2 (N2)	SOUTHERN 2 (S2)	NORTHERN 3 (N3)	NORTHERN 4 (N4)	SOUTHERN 4 (S4)
VISUAL RESOURCES						
There would be no impacts on visual resources.	**Resource Preference/Ranking-1** N1W is considered preferable for visual resources because of the opportunity to parallel an existing transmission line corridor for the entire route in visually sensitive areas, thus avoiding potentially high impacts. Impacts on visual resources are characterized as low for the majority of the route. Regarding specific visual issues, N1W crosses 15.8 miles of Class A scenery, 2.4 miles of views from residences within 0.5 mile, and 14.8 miles of views from high sensitivity roads. N1W also crosses 0.8 mile of Forest Service retention area and 13.4 miles of partial retention area (lowest among the Marketplace alternatives along with N2), and 4.9 miles of BLM Class II area.	**Resource Preference/Ranking-2** N2 is less preferable than N1W because of the amount of new transmission line corridor (18% of the route), resulting in high impacts on scenic quality, views from residences and highways (including views from Route 66). Impacts on visual resources are generally characterized as low-to-moderate and moderate for the route. Regarding specific visual issues, N2 crosses 14.3 miles of Class A scenery, 4.8 miles of views within 0.5 mile from residences, and 5.1 miles of views from high sensitivity roads. N2 crosses 13.4 miles of partial retention area (same as N1W), and 7.7 miles of BLM Class II (most among the Marketplace alternatives).	**Resource Preference/Ranking-3** S2 is the least preferable among the Marketplace alternatives because of the amount of new transmission line corridor (38% of the route), in conjunction with the highest impacts on views from residences, highways, and recreation areas. Impacts on visual resources are generally characterized as moderate and moderate-to-high, with segments of low and low-to-moderate. S2 crosses 10.8 miles of Class A scenery and 7.1 miles of views from high sensitivity roads. S2 crosses 0.2 mile of Forest Service retention area 23.5 miles of Forest Service partial retention area and 4.9 miles of BLM Class II areas. Approximately 15 miles are crossed where views from residences would be within 0.5 mile; this is the most among the Marketplace alternatives.	**Resource Preference/Ranking-1** Like alternative N1W to Marketplace, N3 is most preferable for visual resources to Mead because of the opportunity to parallel existing transmission line corridor through visually sensitive areas and avoid high visual impacts. Impacts on visual resources along N3 are characterized as generally low-to-moderate and low. Regarding specific issues, N3 crosses the most amount of Class A scenery (17.3 miles) and views from high sensitivity roads (18.6 miles) within 0-0.5 mile.	**Resource Preference/Ranking-2** N4 is less preferable than N3 because of the amount of new transmission line corridor (20% of the route), and high impacts on scenic quality and views from residences and highways. Impacts on visual resources are generally characterized as low-moderate and moderate. Regarding specific issues, N4 crosses the second least views from residences (4.6 miles) and highways (8.9 miles) within 0-0.5 mile, as well as 2.8 miles of BLM Class II area.	**Resource Preference/Ranking-3** S4 is the least preferable alternative to Mead because of the amount of new transmission line corridor (39% of the route), and the high visual impacts on views from residences and highways and recreation areas. Regarding specific issues, S4 crosses the most area (14.8 miles) of views from residences within 0-0.5 mile.
CULTURAL RESOURCES						
Archaeological and Historical Sites						
The environment would remain as it presently exists and conflicts with heritage preservation would be avoided. This alternative would forego the opportunity to develop detailed inventories and recovery of archaeological data that might be undertaken to mitigate impacts.	**Resource Preference/Ranking-1** N1W is ranked as the preferred of the alternatives to Marketplace. Because of high mitigation potential, residual impacts on archaeological and historical sites are projected to be low.	**Resource Preference/Ranking-3** N2 is ranked as least preferred. Residual impacts on archaeological and historical sites are projected on be low-to-moderate.	**Resource Preference/Ranking-2** S2 is ranked as less preferred than N1W but more preferred than N2. As with N2, residual impacts on archaeological and historical sites are projected to be low-to-moderate.	**Resource Preference/Ranking-1** N3 is similar to N1W.	**Resource Preference/Ranking-3** N4 is similar to N2.	**Resource Preference/Ranking-2** S4 is similar to S2.

TABLE A-3
COMPARISON AND RANKING OF ALTERNATIVE ROUTES
WESTERN AREA

NO ACTION	NORTHERN 1 WEST (N1W)	NORTHERN 2 (N2)	SOUTHERN 2 (S2)	NORTHERN 3 (N3)	NORTHERN 4 (N4)	SOUTHERN 4 (S4)
	MOENKOPI TO MARKETPLACE ALTERNATIVES			MOENKOPI TO MEAD ALTERNATIVES		
SPECIAL STATUS CULTURAL RESOURCES						
The environment would remain as it presently exists and conflicts with heritage preservation would be avoided.	**Resource Preference/Ranking-1** Residual impacts at a single special status cultural resource, the historic Moqui Stage Station site, are projected to be moderate.	**Resource Preference/Ranking-2** Residual impacts on special status cultural resources are expected to be high at a crossing of historic Route 66 and a crossing of the historic Beale Wagon Road, and moderate at another crossing of historic Route 66 and at the Moqui Stage Station. The moderate residual impacts reflect construction in a new corridor across the Truxton Plain (Link 1980).	**Resource Preference/Ranking-3** S2 is projected to have high residual impacts at a crossing of the historic Beale Wagon Road near the Russell Tank campsite (near junction of Links 1680 and 1720), moderate residual impacts at two crossings of historic Route 66 adjacent to pipelines or transmission lines (Links 1720 and 2006), and low impacts at two other crossings of the Beale Wagon Road where it is poorly preserved (Links 1680 and 2002), as well as on Wupatki National Monument (Link 1420).	**Resource Preference/Ranking-1** N3 is similar to N1W.	**Resource Preference/Ranking-3** N4 is similar to N2.	**Resource Preference/Ranking-2** S4 is similar to S2.
Traditional Cultural Places						
The environment would remain as it presently exists and conflicts with heritage preservation would be avoided. This alternative would forego the opportunity to develop detailed inventories.	Navajo **Resource Preference/Ranking-1** N1W is ranked as slightly preferred, along with N2. N1W is projected to have moderate impacts on Navajo traditional places for 24 miles where the route goes through sacred areas or follows routes of travel recounted in ceremonial stories. These sensitive areas are at the eastern end of the route (Link 1400).	Navajo **Resource Preference/Ranking-1** N2 is the same as N1W, N3, and N4.	Navajo **Resource Preference/Ranking-2** S2 is ranked as somewhat less preferred than N1W and N2 because S2 is projected to have moderate impacts on Navajo traditional places for about 48 miles of its length. The most sensitive areas are at the eastern end of the route (Link 1420).	Navajo **Resource Preference/Ranking-1** N3 is the same as N1W, N2, and N4.	Navajo **Resource Preference/Ranking-1** N4 is the same as N1W, N2, and N3.	Navajo **Resource Preference/Ranking-2** S4 is the same as S2.

TABLE A-3
COMPARISON AND RANKING OF ALTERNATIVE ROUTES
WESTERN AREA

	MOENKOPI TO MARKETPLACE ALTERNATIVES			MOENKOPI TO MEAD ALTERNATIVES		
NO ACTION	NORTHERN 1 WEST (N1W)	NORTHERN 2 (N2)	SOUTHERN 2 (S2)	NORTHERN 3 (N3)	NORTHERN 4 (N4)	SOUTHERN 4 (S4)
	Hopi **Resource Preference/Ranking-1** N1W is ranked as slightly preferred, along with N2. The study of traditional Hopi cultural places scored impacts as 3, reflecting the presence within a six-mile-wide study corridor of a single traditional ritual place, and a single nonritual use area, neither of which are likely to be directly crossed. These places are at the eastern end of the route Link 1400).	Hopi **Resource Preference/Ranking-1** N2 is the same as N1W, N3, and N4.	Hopi **Resource Preference/Ranking-2** S2 is ranked as somewhat less preferred than N1W and N2. The study of traditional Hopi cultural places scored impacts as 6, reflecting the presence within a six-mile-wide study corridor of 2 traditional ritual places, and 1 nonritual traditional use area, none of which are likely to be directly crossed. These places are at the eastern end of the route (Link 1420).	Hopi **Resource Preference/Ranking-1** N3 is the same as N1W, N2, and N4.	Hopi **Resource Preference/Ranking-1** N4 is the same as N1W, N2, and N3.	Hopi **Resource Preference/Ranking-2** S4 is the same as S2.
	Hualapai **Resource Preference/Ranking-1** N1W is ranked as preferred. Impacts on traditional Hualapai places are projected to be moderate for about 176 miles, reflecting traditional occupation, resource collection, and burial areas in the vicinity of the Hualapai Reservation and adjacent lands. N1W is preferred because it uses an existing corridor through traditional Hualapai territory (subject to confirmation when supplemental traditional cultural place study is completed).	Hualapai **Resource Preference/Ranking-2** N2 is projected to have high impacts on traditional Hualapai places along approximately 50 miles of the route, and is ranked as less preferred than N1W because it requires a new corridor through traditional Hualapai territory.	Hualapai **Resource Preference/Ranking-3** S2 is ranked as less preferred than N1W, and N2. S2 is projected to have high impacts on traditional Hualapai places along approximately 82 miles of the route, and is ranked as less preferred than N1W and N2 because it requires a greater distance of new corridor through traditional Hualapai territory.	Hualapai **Resource Preference/Ranking-1** N3 is the same as N1W.	Hualapai **Resource Preference/Ranking-2** N4 is the same as N2.	Hualapai **Resource Preference/Ranking-3** S4 is the same as S2.

APPENDIX B
ALTERNATIVE ROUTES ADDED AND ELIMINATED

As stated in Chapter 2 and Appendix A, a number of segments of alternative routes were added to or eliminated from the study. These alternatives have been added or eliminated as a result of (1) scoping and agency review, and (2) the environmental analysis. The purpose of this appendix is to briefly explain the reasons for adding and eliminating alternatives. (Appendix A provides an explanation of the route selection process.)

ALTERNATIVE ROUTES ADDED AS A RESULT OF SCOPING AND AGENCY REVIEW

The locations of these alternative routes, labeled A through M, are shown in blue on Figure B-1.

- ***A—Alternative across the Hualapai Indian Reservation*** This alternative route parallels the APS 500kV line across the Hualapai Reservation. This route was initially considered for detailed studies, but in mid-1993 the Hualapai Tribal Council asked Western to eliminate consideration of a new line across the reservation. However, in January 1994, the Hualapai reconsidered and requested that the route be included in NTP as an alternative.

- ***B—Alternative in the vicinity of Hackberry*** This alternative was added because of siting constraints identified by Western during the construction of the Mead-to-Phoenix 500kV transmission line through the community of Hackberry.

- ***C—Alternatives in the vicinity of Seligman and Aubrey Valley*** As a result of the mid-1993 Hualapai decision for no new line across the reservation, several alternatives were added west of Aubrey Valley for the primary purpose of providing north or south connections to initially identified routes.

- ***D—Alternatives through the Kaibab National Forest*** These routes were added to provide connections from the potential Lava Point Substation site to the northern alternative in the western portion of the project area. In addition, another route was added to the east of the existing alternative routes to respond to visual concerns expressed by the Forest Service for users of the Arizona Trail.

- ***E—Alternatives in the vicinity of Preston Mesa*** These routes near Preston Mesa were added to provide a "cut-off" along the northern route in the event that a connection with a substation in the Page area (e.g., Glen Canyon Substation) is not needed.

- ***F—Alternative in the vicinity of Kayenta*** As suggested by NPS, this route was added to diverge from the existing 230kV line to avoid locating a second transmission line through the Monument Valley Navajo Tribal Park.

- ***G—Alternative through the Chinle Valley*** This route was added to provide an alternative that avoids a crossing of the Chuska Mountains because of concern expressed by the BIA and the Navajo Nation.

- ***H—Alternatives in the vicinity of the San Juan Generating Station and the Four Corners Power Plant*** Several routes were identified paralleling existing utility corridors because of concern expressed by the BLM for The Hogback ACEC and threatened and endangered plant species in the area.

- ***I—Alternative in the vicinity of Gallup and St. Michaels*** BIA requested that this easternmost corridor be added as a means of accessing the southern corridors while minimizing impacts on the Chuska Mountains.

- ***J—Alternative in the vicinity of Dilkon*** This route was added to avoid impacts on numerous residences dispersed in the area.

- ***K—Alternatives in the vicinity of the Flagstaff Substation*** Because of input from Western, Forest Service, and NPS, several alternatives were added to provide an option for Western to access its Flagstaff Substation located south of I-40.

- ***L—Alternative in the vicinity of Tribal Route 15 southeast of Sunset Crater*** This alternative route was added as a result of input from the Forest Service to avoid crossing the Beale Wagon Road and to minimize crossings of Tribal Route 15. This alternative route parallels an existing pipeline corridor.

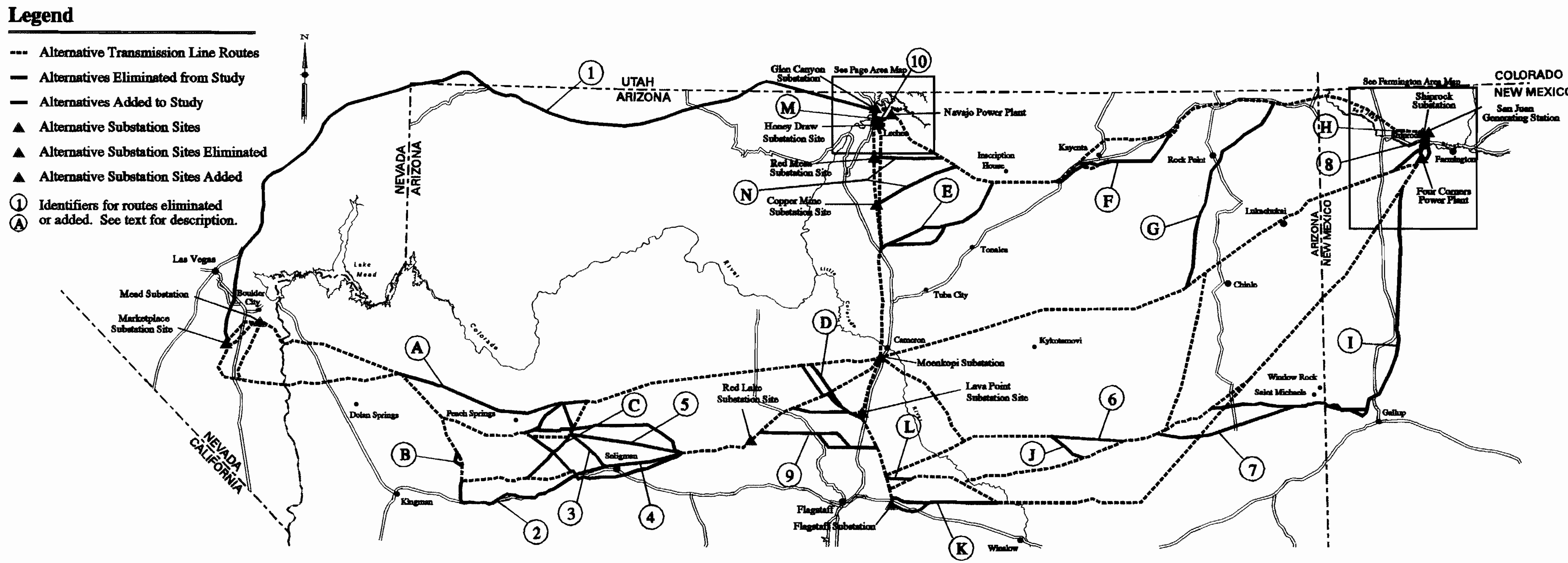
- ***M—Alternatives in the vicinity of Page*** This alternative route was added at the suggestion of the city of Page to minimize impacts on land uses in the city of Page and the Glen Canyon NRA.

- ***N—Alternatives Crossing the Kaibito Plateau*** These two alternative route segments were added as opportunities around the Bennett Freeze area, reasserted in late September 1995.

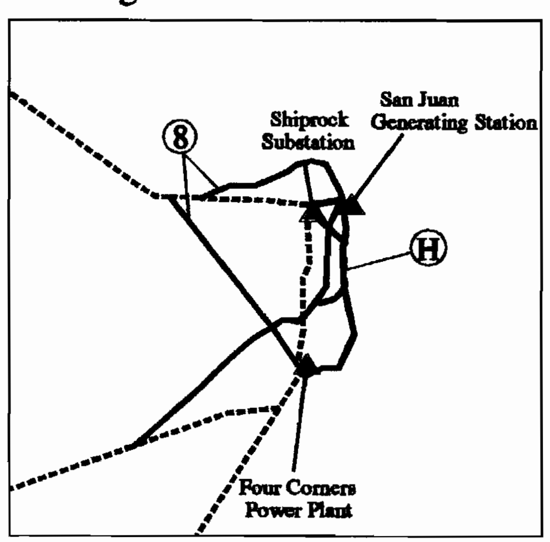
ALTERNATIVE ROUTES ELIMINATED AS A RESULT OF SCOPING AND AGENCY REVIEW

This section addresses the reasons that alternatives were eliminated as a result of scoping and agency review. The locations of these alternative routes, labeled 1 through 10, are shown in red on Figure B-1.

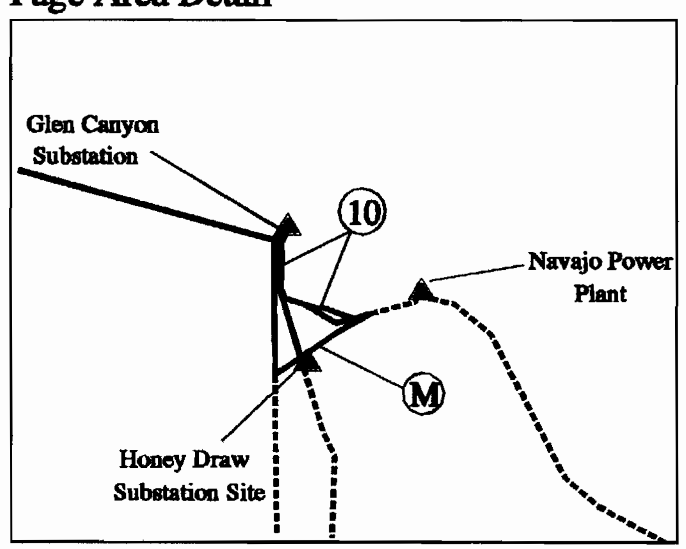
- ***1—Alternative paralleling the existing Navajo to McCullough 500kV Transmission Line*** As depicted in the Navajo Transmission Project *Regional Environmental Feasibility Study* (June 1992), this alternative was located west of the Glen Canyon dam and north of the Grand Canyon in Arizona, and then proceeded south to the Eldorado and McCullough substations southeast of Boulder City, Nevada. During initial agency meetings a number of environmental issues associated with this alternative were identified including (1) proximity to wilderness areas in Arizona and Nevada; (2) crossing the Virgin River (eligible as wild and scenic); (3) crossing the Moapa Indian Reservation; (4) desert tortoise habitat; (5) raptor habitat; (6) bighorn sheep habitat; (7) residences; (8) a proposed BLM land exchange in the Henderson area; and (9) crossing the Sunrise Mountain Instant Study Area (ISA). The Sunrise Mountain ISA protects unique geologic, biologic, and aesthetic values to be managed by BLM's WSA interim management policy, preserving the area's



Farmington Area Detail



Page Area Detail



Alternative Routes Added and Eliminated as a Result of Scoping and Agency Review

Navajo Transmission Project

Figure B-1

existing wilderness values until actual wilderness status can be determined. This management policy restricted any future development of new transmission line projects through the ISA. Because legislative action to change the current management status is pending and a resolution is uncertain, this alternative would not meet the proposed project need or in-service date. Based on these issues and concerns, BLM and Western recommended that this alternative be dropped from further consideration.

- ***2—Alternative paralleling I-40 between the communities of Seligman and Kingman south of Links 1720, 1960, and 2000*** This alternative paralleled an existing pipeline corridor from the Juniper Mountains to US 93, and then paralleled the Western 345kV Mead-to-Liberty transmission line. This corridor contains approximately five underground pipelines, which would mean potential construction and right-of-way conflicts in areas of restrictive terrain. Potentially significant impacts on viewers from I-40 and from concentrated residential development near the intersection of I-40 and US 93 resulted in Western's recommendation to eliminate this alternative from further consideration.

- ***3—Alternative paralleling historic Route 66 through the Aubrey Valley*** As depicted in the *Regional Environmental Feasibility Study,* this alternative was located near Chino Point on the south end of the Aubrey Cliffs and terminated approximately 14 miles to the northwest near the Pica railroad siding. This corridor roughly paralleled historic Route 66 and the Topeka & Santa Fe Railroad alignment. The BLM Kingman Resource Area expressed concern about the potential for high visual impacts on views from historic Route 66. The combined effect of high structure contrast, sensitive views, and a long viewing duration would result in potentially significant visual impacts, and resulted in elimination of the alternative from further consideration.

- ***4—Alternative in the vicinity of Seligman, Arizona*** Another alternative in the *Regional Environmental Feasibility Study* paralleled an AT&T fiber optic cable and El Paso Natural Gas Company (EPNG) pipeline near the community of Seligman, Arizona. The eastern portion of this route began along the fiber optic corridor approximately six miles west of the western boundary of the Kaibab National Forest and continued west to a crossing at historic Route 66 approximately three miles east of Seligman. The western portion of this route remained north of I-40 and paralleled the EPNG pipeline for approximately nine miles from the fiber optic cable crossing at historic Route 66 to a point south of Black Mountain.

  Potentially significant impacts on land uses and visual resources were identified along this route. Extensive residential development was identified five to ten miles west of Seligman and north of I-40, and the Seligman airport is oriented toward the proposed alignment. Visual impacts would result because the tower structures would dominate the foreground views from residences. Because of potentially significant land use and visual impacts along this route near the town of Seligman, Western recommended that this alternative be eliminated from further consideration.

- ***5—Alternative through the Big Boquillas Ranch*** This alternative crossed the Big Boquillas Ranch and Aubrey Cliffs to the west, approximately one mile south of Round Mountain and Trinity Mountain, then continued into the Aubrey Valley and terminated near the Pica railroad siding. Western recommended that this alternative be eliminated because of engineering constraints associated with difficult terrain located at the base of Round Mountain, the crossing at Big Chino Wash, and along the Aubrey Cliffs.

- ***6—Alternative through the Hopi Buttes*** This alternative was located approximately seven miles north of Dilkon in the distinctive landscape of lava-capped buttes and small mesas known as the Hopi Buttes. Located among the buttes and mesas are numerous residences and ranches, resulting in a high potential for direct conflicts with a transmission line and right-of-way. The area also was identified as having cultural and religious significance to the Hopi Tribe, whose reservation is located north of the Hopi Buttes. Because of the probability of significant impacts on land use and cultural resources, the eastern portion of this alternative was realigned to the south.

- ***7—Alternative paralleling the Transwestern Pipeline corridor west of Window Rock*** This alternative paralleled the existing 30-inch-diameter Transwestern pipeline corridor from the EPNG Window Rock Pumping Station southwest to the EPNG pipeline corridors approximately eight miles east of Greasewood. Western recommended that this alternative be eliminated from further consideration because of potential conflicts associated with approximately 20 residences located immediately adjacent to the existing pipelines, and a paved airstrip located within the alternative study corridor.

- ***8—Alternatives in the vicinity of the Four Corners Power Plant and the San Juan Generating Station*** Early in the project Western and DPA decided it would be most advantageous to use Western's Shiprock Substation as the eastern terminus for NTP. Therefore, several links emanating from either of the two generating stations were no longer needed and eliminated from further consideration.

- ***9—Alternatives paralleling a fiber optic cable corridor through the Coconino National Forest*** Four alternative links paralleled an underground east-west AT&T fiber optic cable and a major coaxial cable that crosses the Coconino and Kaibab national forests north of Sunset Crater National Monument and the San Francisco Peaks. Representatives from the Coconino National Forest requested that these links be eliminated from further consideration. Even though the corridor is identified in the Forest Plan map as an "Existing Communications Corridor/Potential Upgrade," the Forest Service stated that an overhead 500kV transmission line would not be a compatible use of the corridor. The transmission line, an overhead facility, would be intrusive visually in this area of the forest and the major coaxial cable could be affected by the transmission line. For these reasons and since there were other viable east-west alternative routes, the alternative was eliminated.

- ***10—Alternatives in the vicinity of the Glen Canyon Substation*** When Western determined that it would not be necessary for the transmission line to proceed into Glen Canyon Substation, several alternatives leading to the Glen Canyon Substation were eliminated from further consideration.

ALTERNATIVE ROUTES ELIMINATED AS A RESULT OF ENVIRONMENTAL ANALYSIS

All of the alternative routes studied are shown on Figure A-1. As explained in Appendix A, these alternatives were inventoried to determine the environmental resources present and assessed to identify potential impacts. Then the alternatives were systematically screened and compared to identify the most environmentally preferable alternative routes, thereby narrowing the number of alternative routes to be compared and addressed in the DEIS.

To facilitate screening and comparison, the project area was divided in two—the eastern area and western area. The alternatives in each area were then reviewed (screened) at three levels including local (Level 1), subregional (Level 2), and regional (Level 3) areas. Through the screening process, alternatives defined by individual links or combinations of different links were compared. The comparison of alternatives at these three levels resulted in the identification of preferred pathways between two common endpoints for each level of screening. Those links that were unique to alternatives that were considered less desirable were eliminated as shown on Figure B-2. This screening process resulted in the identification and initial ranking of complete alternative routes in the eastern and western areas that were presented to the public and agencies for review during the summer of 1995. Through this review, a limited number of key issues were identified. This process led to refinement of certain data, additional analysis, and identification and screening of new alternatives in selected locations in the eastern area.

A summary of the alternative links eliminated during the screening process are illustrated in Figures B-3 and B-4. An overview discussion of the alternatives eliminated as a result of screening are summarized below.

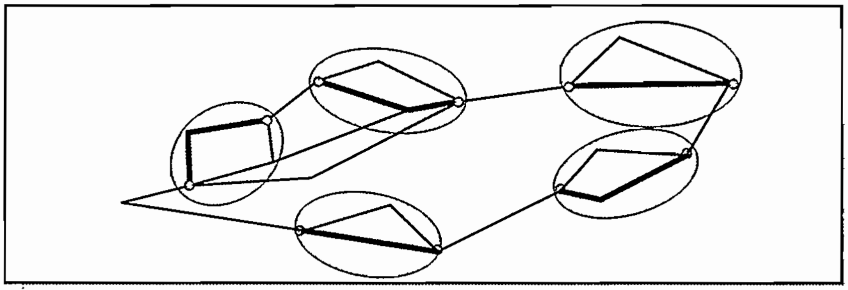
EASTERN AREA

Level 1 Screening—Local Areas

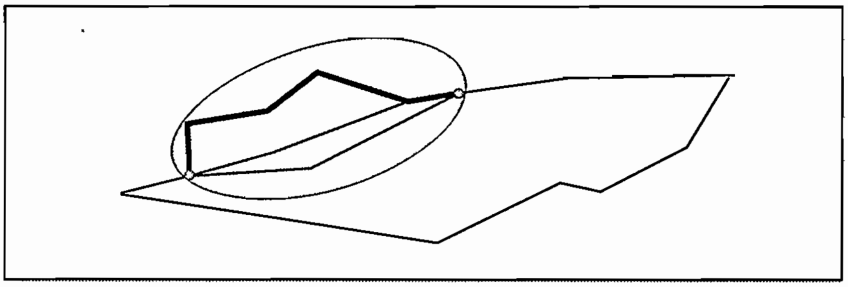
Initially, nine separate Level 1 screening areas were evaluated in the eastern portion of the project area.

- ***San Juan/Four Corners area (Links 200, 220, 260, 280, 320, and 680)*** The key factors that influenced the elimination of specific links in this area are potential impacts on residential and public land uses, scenic quality in and around The Hogback, views from residences, and two special status cultural resource sites (Pictured Cliffs and Hogback Chaco Protection Site). Potential impacts associated with the crossing of the San Juan River and agricultural lands were assumed to be mitigable. Those links in proximity to the highest density of residential development and to the Pictured Cliffs or Hogback Chaco Protection Site were eliminated.

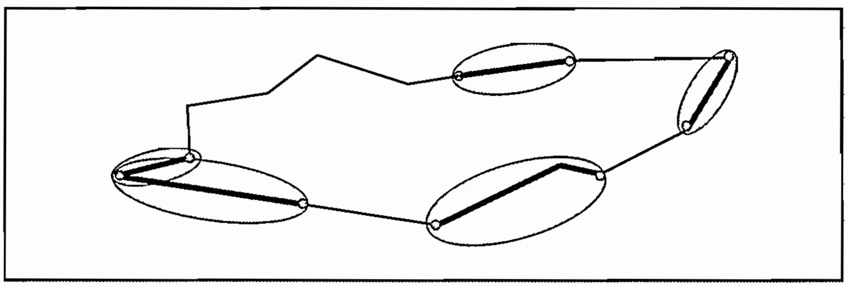
Level 1 – Compare Local Areas



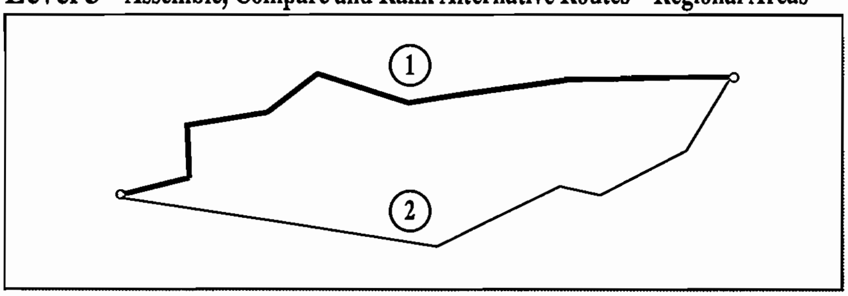
Level 2 – Compare Sub-regional Areas



Characterize Connectors



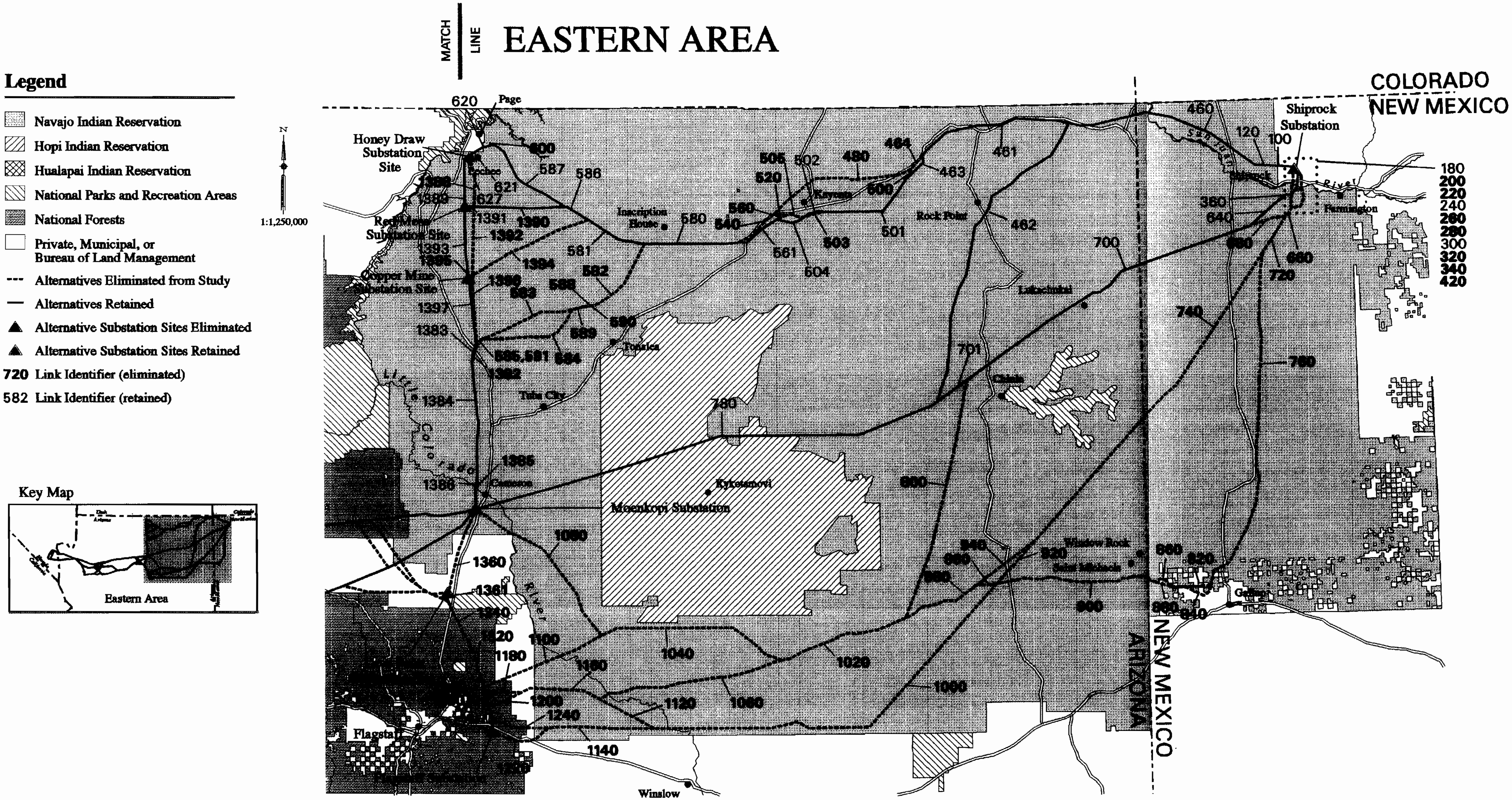
Level 3 – Assemble, Compare and Rank Alternative Routes – Regional Areas



Screening and Comparison Approach

Navajo Transmission Project

Figure B-2



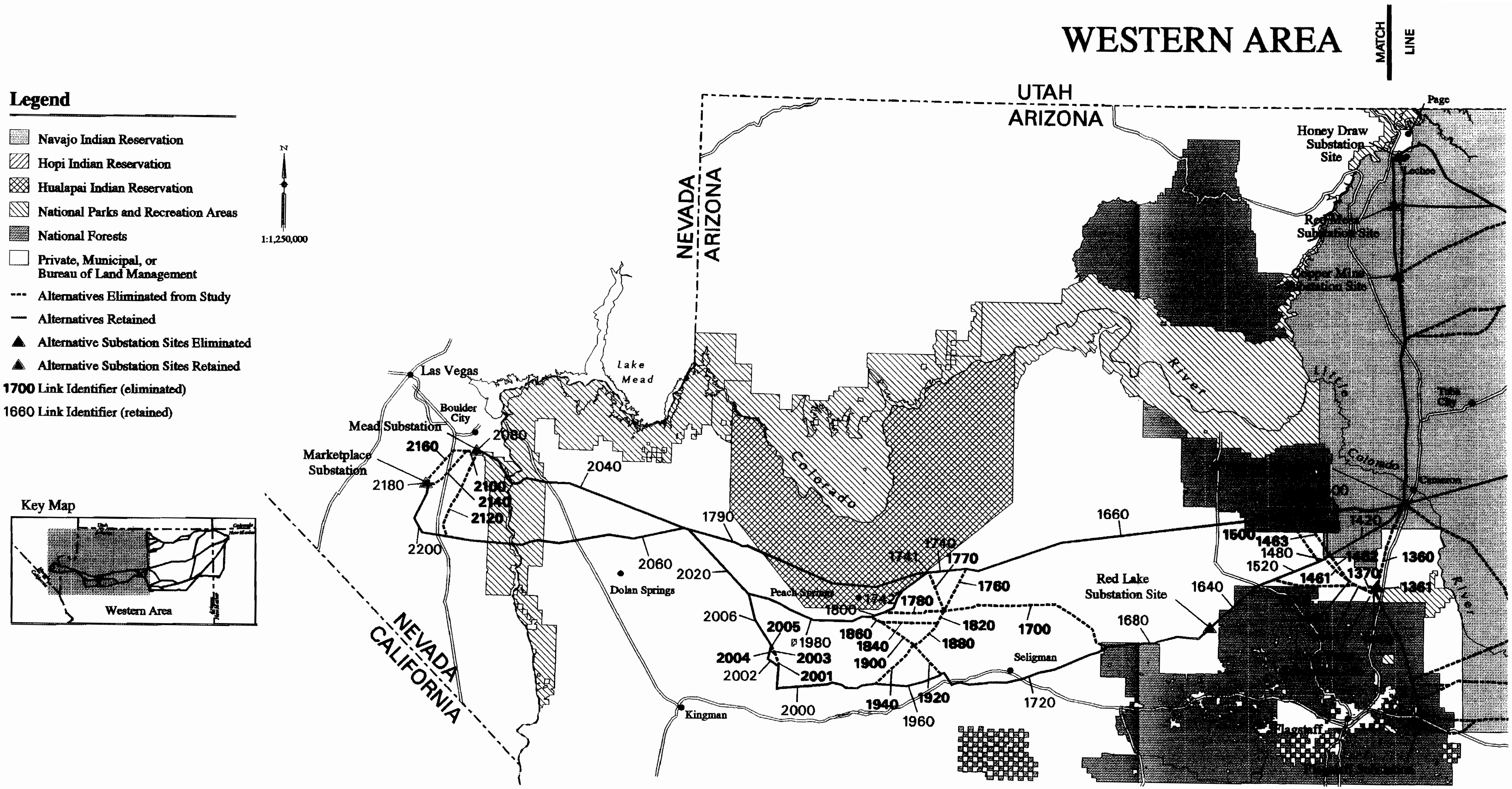
Alternative Routes Studied and Eliminated

Eastern Area

Navajo Transmission Project

Figure B-3

WESTERN AREA



Alternative Routes Studied and Eliminated

Western Area

Navajo Transmission Project

Figure B-4

- ***Monument Valley area (Links 480, 520, and 540)*** Link 480 was eliminated primarily because it crossed the Monument Valley Navajo Tribal Park for a total distance of 4.5 miles. Although the proposed transmission line could have paralleled the existing 230kV line across the Tribal Park, NPS recommended that the Tribal Park be avoided. Even through Links 520 and 540 paralleled the existing 230kV line, the links were eliminated because of potential impacts on residential development in the Marsh Pass area along U.S. Highway 160.

- ***Gallup area (Links 820 and 880)*** Links 820 and 880 paralleled a buried pipeline where there would be higher impacts on visual resources than the alternative links that follow an existing 115kV (overhead) line (Links 840 and 860). There also is a higher density of residential development along the pipeline corridor.

- ***Preston Mesa area (Link 583)*** Link 583 was eliminated because of potential impacts on Navajo traditional cultural places, crossing of a Hopi ritual place, and higher visual impacts on residential viewers.

- ***Glen Canyon area (Links 1388, 1392, and 1396)*** These links were eliminated because they crossed a Hopi ceremonial hunting area and two Hopi rock collection areas, and because they were generally adjacent to a higher-density residential development in the vicinity of Coppermine than Links 1389, 1393, and 1397.

- ***The Gap area (Link 1382)*** The comparison between Links 1382 and 1383 resulted in only a slight difference; the links are parallel and close to one another, and both parallel existing 345kV transmission lines. However, Link 1382 was eliminated because of higher level of potential ground disturbance from construction and the number of residences in proximity.

- ***Cameron area (Link 1385)*** Similar to The Gap area, Links 1385 and 1386 parallel and are generally close to one another. Link 1386 was retained as a continuation from Link 1383 as it parallels the same existing 345kV line, which would result in less construction disturbance and was a first choice preference for all resources.

- ***Flagstaff area (Link 1240)*** Link 1240 crossed the Ridge Ruin Archaeological District, a special status cultural resource listed on the National Register of Historic Places. In addition, because this link did not follow an existing utility corridor, there would be a greater potential for higher impacts on archaeological resources.

- ***Sunset Crater area (Link 1180)*** Link 1180 followed an existing pipeline corridor, but there would be higher impacts on views from residences. There also is higher density residential development along this link and impacts on Navajo traditional cultural places are higher than for Links 1200 and 1280.

Level 2 Screening—Subregional Areas

As a result of the initial Level 2 screening in the eastern portion of the project area, two links were eliminated.

- *Wupatki area (Link 1100)* Link 1100 would have been a new corridor. Alternatives including Link 1110 would be longer and would result in high impacts on archaeological resources, Navajo traditional cultural places, scenic quality, and residential views. In addition, Link 1100 followed Links 1320 and 1340 near Sunset Crater and Wupatki National Monuments.

- *Chuska area (Link 800)* Link 800 would have been a new corridor for approximately 50 miles extending south from Ventana Mesa to west of Greasewood. High impacts on scenic quality and residential views would have resulted. Also, Link 800 was located in an area of high sensitivity for Navajo and Hopi traditional cultural places. Connections with Link 800 required the crossing of the Chuska Mountains along Link 700, resulting in additional high impacts on Navajo traditional cultural places and concerns for biology and proximity to residences.

Level 3 Screening—Regional Areas

The third level of screening involved creating complete alternative routes from the remaining links, between the Shiprock and Moenkopi substations. The comparison of these alternatives focused on the elimination of the least environmentally preferable. Of the 12 alternatives (listed below), eight were eliminated from further consideration. With the elimination of these alternative transmission line routes, the Lava Point Substation and Flagstaff Substation were also eliminated.

- Glen Canyon 1 (GC1)
- Northern 1 East (N1E)
- Central 1 (C1)
- Central 2 (C2)
- South-central 1 (SC1) (eliminated)
- South-central 2 (SC2) (eliminated)
- South-central 3 (SC3) (eliminated)
- South-central 4 (SC4) (eliminated)
- Southern 1 (S1) (eliminated)
- Southern 2 (S2) (eliminated)
- Southern 3 (S3) (eliminated)
- Southern 4 (S4) (eliminated)

The links of the alternative routes eliminated include 340, 420, 660, 720, 740, 760, 840, 860, 900, 920, 940, 960, 980, 1000, 1020, 1040, 1060, 1080, 1120, 1140, 1160, 1200, 1220, 1260, 1280, 1300, 1320, 1340, 1360, 1361.

In general, the south-central (SC1 through SC4) and southern alternatives (S1 through S4) were not as environmentally desirable as the northern (GC1, N1) and central (C1, C2) alternative routes. Based on the results of the interdisciplinary comparison of these alternative(s), the northern and central options included the preferred alternative for each individual resource (water, soils, biology, paleontology, land use, visual, archaeology and history, and special status sites), with the exception of traditional cultural places (S4). However, S4 was ranked at 50 percent or lower among preferences for all other resources in the eastern area (excluding archaeology and history).

The south-central and southern alternatives were also generally longer than the northern and central options. The southern alternatives, in particular were among the longest of the eastern area alternatives ranging from approximately 263 miles (S1) to 300 miles (S3 and S4). This additional length, was in part to avoid the Chuska Mountains, which required locating alternatives farther south and east near Gallup.

The south-central and southern alternative routes paralleled segments of existing utility corridors connected by some new corridor. The utility corridors contain overhead transmission lines and/or buried pipelines for much of their lengths. For a project like NTP, it is preferable to parallel utility corridors containing transmission lines—a new transmission line introduced into an area parallel to an existing pipeline would be more intrusive than it would be paralleling an existing transmission line. Existing transmission lines were not continuous in the south-central and southern alternative routes. That is, the direction of some lines proceed into other geographic areas (e.g., two Tucson Electric Power Company 345kV lines along NTP Links 760 and 840 continue south in the vicinity west of Gallup). The amount of corridor without transmission line (e.g., new corridor or corridor with pipeline only) ranged from 65 to 139 miles, much of which was located in environmentally sensitive areas in the vicinity of the Hopi Buttes (SC1, SC2, S1, and S2) and the Painted Desert (SC1 and S1). Even where existing transmission lines would have been paralleled in the south-central and southern alternatives, the opportunities were not as environmentally preferable as in the northern and central areas (e.g., based on impacts and issues in the Chuska Mountains [SC1, SC2, SC3, and SC4], and near Sunset Crater and Wupatki National Monument [SC2, SC3, SC4, S2, S3, and S4]).

Specific resource issues and environmental impacts leading to the elimination of the south-central and southern routes included the following:

Visual Resources—The south-central and southern alternatives were the least preferred for visual resources. New transmission line corridor between Greasewood and Dilkon in the Hopi Buttes area (Link 1020), Dilkon to the Moenkopi Substation in the Painted Desert (Links 1040 and 1080), in the Rincon Basin (Link 1000) and Canyon Diablo (Link 1140) were all determined to have potentially high impacts on residential viewers and/or scenic quality. In addition, each of the south-central and southern alternatives were within view of either Wupatki National Monument and/or Sunset Crater National Monument and several of these alternatives (SC2, SC3, SC4, S2, S3, and S4) were located immediately adjacent to Wupatki National Monument.

Biological Resources—Similar to visual resources, the south-central and southern alternatives also were least preferred from a biological standpoint, particularly the south-central options (SC1, SC2, SC3, and SC4), which would require a lengthy crossing of the Chuska Mountains. The Chuska Mountain area is considered to be important habitat for big game and several listed plant and animal species in Arizona, and is of concern to the Navajo Nation. The Chuska Mountain crossing along Link 740, common to all south-central alternatives, was approximately 14 miles long and would result in a greater quantity and magnitude of potential impacts than the more northerly crossing along Link 700 (C1), which is approximately five miles in length.

Cultural Resources—A transmission line in the south-central and southern alternatives would have adversely affect the greatest number of special status sites and were considered less preferable than the northern and central options in this regard. Sixteen special status sites are located along the south-central and southern alternative routes. The greatest level of impacts would have resulted on Kinlichee Tribal Park, Beale Wagon Road, Register Rock, Sanostee Chaco Protection Site, Toh-La-Kai Chaco Protection Site, and the National Register listed Canyon Padre Bridge.

WESTERN AREA

Eight separate Level 1 screening areas were evaluated in the western portion of the project area.

Level 1 Screening—Local Areas

- ***Mesa Butte, Additional Hill, Cedar Wash, Willow Camp, and Red Mountain areas (Links 1360, 1370, 1440, 1441, 1460, 1461, 1462, 1463, 1500, and 1540)*** These alternative links were initially established as a means of connecting into the Lava Point Substation site, and all of the alternatives made up of these links would require new corridor. Several of these alternatives crossed or were located in proximity to the Arizona Trail (existing or proposed), including Links 1500, 1540, 1460, and 1461. The historic Moqui Stage Station, a historical archaeological site along the Arizona Trail, is located adjacent to Link 1500. In addition, the local alternatives that incorporated these links are not as direct as other alternative routes along existing transmission lines within the area, and/or have the potential for higher impacts on Navajo traditional cultural places and visual resources. The length of alternatives incorporating these links, amount of new corridor, impacts on cultural and visual resources, and the elimination of the Lava Point Substation from further consideration (based on the screening results for the eastern area) led to the elimination of these links.

- ***Aubrey Valley and Pica areas (Links 1760, 1780, and 1840)*** All of these links were new corridor. Link 1760 in the Aubrey Valley was eliminated because of potential impacts on a large area where a population of black-footed ferrets, designated as nonessential and experimental, are being reintroduced by the FWS. Links 1780 and 1840 were eliminated based on higher density residential development and potential impacts on residential viewers than other local alternatives.

- ***Hackberry area (Links 2001, 2003, 2004, and 2005)*** The reason for the eliminating these links was to avoid direct impacts in the vicinity of Hackberry. There are two existing transmission lines in the area adjacent to residential development as well as archaeological and historical resources. An alternative that was located to the west of Hackberry was considered preferable.

- ***Marketplace area (Link 2160)*** Link 2160 included areas of new transmission line corridor and was eliminated based on higher levels of ground disturbance and potential impacts to visual resources than for Link 2140.

Level 2 Screening—Subregional Area

As a result of Level 2 screening in the western portion of the project area, links were eliminated in three areas.

- *Chino Valley area (Links 1820 and 1880)* Links 1820 and 1880 were located in new corridor. The alternative that incorporated these links had the greatest potential for higher impacts on sensitive viewers, as well as high impacts on the historic Beale Wagon Road and Route 66.

- *Hualapai area (Link 1940)* Link 1940 would have been in new corridor. It provided a north-south access route to get from the Aubrey Valley area to the south where it intersected Link 2000. The alternative that incorporated this link was at least 23 miles longer than other options and the links that connected with 1940 to the north included potential conflicts with the black-footed ferret management area (Link 1760).

- *Mead and Marketplace areas (Links 2100, 2120, and 2140)* Two crossings of the Colorado River, between Arizona and Nevada, were evaluated to access the Marketplace or the Mead Substation. The three links listed above allowed connections to either the Mead or the Marketplace Substation regardless of the river crossing selected. However, the use of Link 2120, connecting the southern river crossing with the Mead Substation, entailed an additional 20 miles and would have resulted in higher impacts on threatened and endangered species and big game. Connections from the northern river crossing into the Marketplace Substation (Links 2100 and 2120) required approximately one mile of new corridor, and would have resulted in higher impacts on soils, vegetation, and threatened and endangered species.

Level 3 Screening—Regional Areas

Ten alternative routes were identified in the western area including five routes between the Moenkopi and Marketplace substations, and five routes between the Moenkopi and Mead substations (listed below). Of the ten, four were eliminated from further consideration.

- Moenkopi to Marketplace
  - Northern 1 West (N1W)
  - Northern 2 (N2)
  - South-central 1 (SC1) (eliminated)
  - Southern 1 (S1) (eliminated)
  - Southern 2 (S2)
- Moenkopi to Mead
  - Northern 3 (N3)
  - Northern 4 (N4)
  - South-central 2 (SC2) (eliminated)
  - Southern 3 (S3) (eliminated)
  - Southern 4 (S4)

The links of the alternative routes eliminated were 1700, 1770, 1860, 1900, and 1920.

Based on the interdisciplinary comparison, the routes retained in the western area included the preferred alternative for each individual resource (water, soils, biology, paleontology, land use, visual, archaeology and history, special status sites, and traditional cultural places). In general, these alternatives maximized the use of existing utility corridors including transmission lines and pipelines, while avoiding environmentally sensitive areas to the greatest degree possible.

The routes that were eliminated (SC1, SC2, S1, and S3) required the greatest amount of new corridor. New transmission line corridor along routes SC1 and SC2 totaled approximately 68 miles and included sensitive environmental crossings of the Aubrey Cliffs (Link 1700) and Aubrey Valley (Link 1770).

Routes S1 and S3 would have required approximately 100 miles of new corridor for each. Alternative routes N2 and N4 are identical to S1 and S3 (retained) from the intersection point of Links 1800, 1860, and 1980 into the Mead or the Marketplace Substation. The main difference is that N2 and N4 follow existing transmission line corridor for a much greater distance and would result in lower impacts on all resources. For this reason, N2 and N4 were identified as environmentally acceptable while S1 and S3 were eliminated. Specific resource issues and environmental impacts leading to the elimination of these alternatives included the following.

Biological Resources—The primary factor that influenced the elimination of the two south-central routes (SC1 and SC2) was the potential for impacts on the black-footed ferret management area. These two routes were considered the least preferable from a biological perspective due to potential conflicts with the reintroduction of ferrets in the Aubrey Valley along Link 1770 and the western portion of Link 1700. In particular, Link 1770 crossed through a substantial portion of an area in the Aubrey Valley where an experimental, nonessential population of the black-footed ferret is being reintroduced (March 1996). The presence of the ferrets would not prevent the construction of the line; however, agency biologists believe that construction of facilities including new access roads could be detrimental to the success of the program. Links 1700 and 1770 were located in areas of new corridor and would have traversed prairie dog colonies that have been surveyed and provided the basis for the Aubrey Valley as a reintroduction site.

Visual Resources—Alternatives S1 and S3 were the least preferred for visual resources. These alternatives had the greatest potential for combined high impacts to scenic quality and sensitive viewers based in part on the amount of new transmission line corridor construction, and also have the potential for high impacts on residential viewers.

Cultural Resources—Alternatives S1 and S3 had the greatest potential to adversely affect special status cultural resource sites. Each crossed the historic Beale Wagon Road three times and historic Route 66 twice.

FURTHER EVALUATION AND REVIEW

As mentioned above, the Level 3 comparison and screening of alternative routes resulted in identifying four alternative routes in the eastern area and six alternative routes in the western area to address in the DEIS. These alternative routes were initially ranked for environmental preferences and presented to the public and agencies for review during the summer of 1995. During and subsequent to this review, the three following key issues were identified in the eastern portion of the project area that prompted further evaluation:

- *Potential direct impacts on residences*—warranted refinement of land use data, identification of appropriate mitigation, and local realignments

- *Biological and cultural resources concerns*—public and agency comments prompted refinement of resource data and/or evaluation (particularly in the Chuska Mountains)

- *Reassertion of the Bennett Freeze*—led to adding and evaluating segments of alternative routes north of the Bennett Freeze area

Following the refinement of alternatives and identification of local options, the alternative route comparisons were reviewed.

Links eliminated as result of the refined land use data (Links 464, 500, 503, 505, 560, and 588) During the initial screening and comparison of alternatives, potential impacts on residences and associated land uses could not be adequately determined. Additional analysis in selected areas resulted in localized realignments of alternative routes in three locations to avoid potential conflicts (areas of Kayenta, Dennehotso, and Big Whisker Well). These localized realignments were carried forward after an interdisciplinary team review, resulting in the elimination of Links 464, 500, 503, 505, 560, and 588.

Links eliminated as a result of the addition of Kaibito Plateau alternatives (Links 582, 584, 585, 589, 590, 1394, and 1395) In September 1995, the Bennett Freeze (in the area west of the Hopi Reservation) was reasserted, potentially affecting the construction of NTP due to development restrictions. All of the eastern area alternative routes crossed the Bennett Freeze, so under the direction of Western and DPA, two new alternative routes and intermediate substations were identified that could facilitate implementation of NTP. These are located to the north of the Bennett Freeze area across the Kaibito Plateau. A Level 1 screening was conducted to compare these alternatives. As a result of the comparison, Links 1394 and 1395 were eliminated based on overall lower preference for all resources, with key concerns for impacts on views from residences and effects on Navajo traditional cultural places. Using the results from this analysis, a Level 2 analysis was conducted to evaluate the Glen Canyon, Kaibito, and Preston Mesa subroutes within the Lechee area. The Preston Mesa subroute (Links 582, 584, 585, 589, 590, and 591) was eliminated because of higher potential impacts on views from residences, views from the Great Western Trail, and effects on Navajo and Hopi traditional cultural places. As a result of the new Level 2 screening, N1E was eliminated, which included the Preston Mesa subroute. A new alternative route, Kaibito 1 (K1), was identified as environmentally preferred to N1E and replaced it as an eastern area alternative route.

APPENDIX C - DESCRIPTION OF ALTERNATIVES

This appendix contains a brief geographic description of the alternative transmission line routes for NTP. Photographs of representative scenes along the alternative routes are shown on Figure C-1 and referenced by location on Figure C-2.

EASTERN AREA - SHIPROCK TO MOENKOPI

Glen Canyon 1 (GC1)—Links 100, 120, 460, 461, 463, 501, 502, 504, 561, 580, 581, 586, 587, 620, 621, 627, 1389, 1393, 1397, 1383, 1384, 1386 (260.6 miles)

GC1 connects the Shiprock and Moenkopi substations via the Honey Draw Substation site. GC1 crosses approximately 260.6 miles and primarily follows existing transmission lines. The initial portion of the route is located in New Mexico along Links 100, 120, and a portion of 460. In New Mexico, GC1 parallels an existing 230kV transmission line that exits the Shiprock Substation and crosses The Hogback ridge (Photograph 1) and the San Juan River (Photograph 2). On the Navajo Reservation in New Mexico, GC1 crosses portions of five Navajo Chapters—Hogback, Shiprock, Cudei, Beclabito, and Teec Nos Pos. The route crosses Interstate 666 approximately five miles north of the town of Shiprock.

In Arizona, GC1 continues to parallel the same existing 230kV transmission line along Links 460 and 461. This portion of the route also generally parallels U.S. Highway 160 near the towns of Red Mesa, Mexican Water, and Tes Nez Iah. In this area, GC1 crosses the Teec Nos Pos, Red Mesa, Mexican Water, and Dennehotso chapters.

Northeast of Dennehotso the route follows Links 463, 501, 502, 504, and 561. Here the route separates from the existing line and continues southwest and west along the eastern edge of Red Point Mesa, across Church Rock Valley, south of the town of Kayenta, and across the northern edge of Black Mesa (Photographs 3 and 4). This section of the route crosses portions of the Dennehotso, Kayenta, and Chilchinbito chapters for 45.5 miles before converging again with the existing 230kV line in the Long House Valley.

From Long House Valley, GC1 continues west along Links 580 and 581 immediately north of the town of Shonto (Photograph 5) and north of Square Butte. GC1 continues northwest along Link 586, crosses Chaol Canyon (Photograph 6) at the intersection of Links 586 and 587, and continues south of Lechee Rock. Immediately south of the Navajo Power Plant, GC1 continues to parallel the existing line, but separates into a new corridor for three miles between the city of Page and town of Lechee on Link 621 (Photograph 7). The Honey Draw Substation site is located near the junction of Links 621 and 627 in the Honey Draw area, approximately one mile west of the town of Lechee (Photograph 8). Chapters crossed in this area include Shonto, Inscription House, Kaibito, and Lechee.

Link 627, which consists of 1.2 miles of new corridor, connects with an existing 345kV line. GC1 parallels the 345kV line into the Moenkopi Substation along Links 1389, 1393, 1397, 1383, 1384, and 1386 south of the Page area (Photographs 9 and 10). Chapters crossed in this area include Lechee, Copper Mine, Bodaway, and Cameron.

Kaibito 1 (K1)—Links 100, 120, 460, 461, 463, 501, 502, 504, 561, 580, 581, 586, 1390, 1391, 1393, 1397, 1383, 1384, 1386 (244.7 miles)

K1 is 244.7 miles long and is identical to GC1 until the intersection with Link 587. At this point, Link 1390 separates K1 from the existing transmission line and continues west across the Kaibito Plateau along a new corridor (see Photograph 6). The route follows this new corridor for 18.5 miles and then intersects a 345kV transmission line. K1 crosses the 345kV line, follows Link 1391 for 1.1 miles, and then intersects Link 1393, a second 345kV line. From this point south into Moenkopi, K1 is identical to GC1 as described above.

Central 1 (C1)—Links 180, 240, 300, 360, 640, 700, 701, 780 (186.7 miles)

C1 crosses 186.7 miles and primarily follows existing transmission lines. The initial portion of this route is located in New Mexico along Links 180, 240, 300, 360, 640, and a portion of 700. Along Link 700 C1 enters Arizona for the remainder of the route.

In New Mexico, C1 parallels two existing 345kV transmission lines that cross the San Juan River (Photograph 11). The route separates from these two existing lines to cross through The Hogback ridge along Link 360, which would be a new corridor, for 10.4 miles. The route then rejoins an existing 500kV transmission line for the rest of its length. On the Navajo Reservation, C1 crosses portions of four Navajo chapters—San Juan, Nenahnezad, Sanostee, and Shiprock. This portion of the route crosses Interstate 666 north of Table Mesa, and proceeds west to the south of Mitten Rock.

In Arizona, C1 crosses the Chuska Mountains in the Buffalo Pass area (Photographs 12 and 13), then proceeds just to the north of the town of Lukachukai (Photograph 14). Continuing southwest, it crosses I-191 in the Chinle Wash area (Photograph 15). This section of the route crosses portions of the Red Valley, Cove, Round Rock, Lukachukai, Many Farms, and Chinle chapters.

The route continues west along Links 701 and 780, which are located north of the town of Cottonwood. It crosses Tribal Route 4 as it enters the Hopi Reservation. At this point the route passes to the north of the town of Hard Rocks and to the south of Dinnebito, across Route 264 and south of the town of Coal Mine Mesa. The last segment of the route enters back on to the Navajo Reservation and crosses the Little Colorado River just east of Moenkopi. Navajo chapters crossed in this area include Tselani/Cottonwood, Tachee/Blue Gap, Whippoorwill Spring, Piñon, Hard Rock, Coal Mine Mesa, and Cameron. On Hopi lands, portions of Second and Third Mesa are crossed.

Central 2 (C2)—Links 100, 120, 460, 462, 780 (211.0 miles)

C2 is 211.0 miles long and is the same as GC1 from the Shiprock Substation to the junction with Link 462, which occurs east of the town of Red Mesa. At this point the line separates from the existing transmission line and continues south, following a new corridor for 65.7 miles between Sweetwater and Immanuel Mission. The route crosses I-191 south of the town of Rock Point, and continues south passing between the towns of Many Farms and Rough Rock. The chapters crossed in this area include

Sweetwater, Rock Point, Rough Rock, and Many Farms. C2 then joins an existing 500kV transmission line at Link 780, just east of Lohali Point (Photograph 16), and follows the same path as C1 into Moenkopi.

WESTERN AREA - MOENKOPI TO MARKETPLACE

Northern 1 West (N1W)—Links 1400, 1401, 1660, 1740, 1741, 1790, 2060, 2200, 2180 (217.0 miles)

N1W connects the Moenkopi and Marketplace substations across a distance of 217.0 miles, and parallels existing transmission lines along its entire route. A major portion of the route is located in Arizona along Links 1400, 1401, 1660, 1740, 1741, 1790, and a portion of 2060. The remainder is located in Nevada.

In Arizona, Links 1400 and 1401 climb west onto the Coconino Plateau paralleling an existing 500kV line (Photograph 17), and enter the Kaibab National Forest. In this area N1W crosses the Cameron Chapter along portions of Link 1400 west of the Moenkopi Substation. Proceeding west along Link 1660, N1W crosses I-180 after leaving the Forest and continues across the Boquillas Ranch. N1W continues west across the Aubrey Valley along Links 1740 and 1741 (Photograph 18).

At Link 1790, N1W enters the Hualapai Indian Reservation and continues west across Tribal Route 18 and north of the town of Peach Springs. It then crosses through the Music Mountains and down the Grand Wash Cliffs to an area immediately north of Red Lake in the Hualapai Valley (Photograph 19). At this point, Link 2060 continues west (see Photograph 24), north of Dolan Springs; crosses I-93; enters the Lake Mead NRA; and crosses the Colorado River (see Photograph 25).

In Nevada, N1W passes through the Eldorado Mountains, crosses I-95, and turns north along Links 2200 and 2180 where it parallels several transmission lines. The route then continues past the McCullough and Eldorado substations into the Marketplace Substation (see Photograph 26).

Northern 2 (N2)—Links 1400, 1401, 1660, 1740, 1741, 1742, 1800, 1980, 2020, 2060, 2200, 2180 (225.1 miles)

N2 is 225.1 miles long and parallels existing transmission lines for the majority of its length. N2 is common with N1W up to Link 1742. At this point the route enters a new corridor. It follows this new corridor for 41.5 miles, crossing Route 66 and passing to the east and south of Nelson. Along Links 1800 and 1980, N2 turns west (Photograph 20) and crosses Route 66 again southwest of the town of Truxton. N2 continues through the Music Mountains, descends the Grand Wash Cliffs, joins existing 500kV and 345kV transmission lines along Link 2020, and continues northwest to Red Lake in the Hualapai Valley (see Photograph 24). From this point N2 is identical to N1W as it continues across the Colorado River and into the Marketplace Substation (see Photographs 25 and 26).

Southern 2 (S2)—Links 1420, 1421, 1480, 1520, 1640, 1680, 1720, 1960, 2000, 2002, 2006, 2020, 2060, 2200, 2180 (247.7 miles)

S2 connects the Moenkopi and Marketplace substations across a distance of 247.7 miles, primarily along existing transmission line, pipeline, and fiber optic corridors. Portions of this route also would require new corridor.

S2 exits the Moenkopi Substation area on Link 1420 and heads southwest across the Cameron Chapter of the Navajo Nation (see Photograph 10). Link 1420 is a new corridor for 4.6 miles until it joins with two existing 500kV transmission lines northwest of Gray Mountain. Links 1421, 1480, and 1520 pass to the south of Additional Hill and cross I-180 at the boundary of the Kaibab National Forest. Continuing southwest, the route crosses State Route 64 where Link 1680 separates from the existing transmission lines to parallel a fiber optic corridor to the west for 21.7 miles. Link 1720 continues south of Seligman and across I-40 along a combined fiber optic and pipeline corridor. Continuing west, Link 1720 departs from the pipeline and fiber optic corridor in the Juniper Mountains and again crosses Interstate 40 (Photograph 21). S2 continues west on Link 1960 along an existing pipeline corridor and then joins an existing 230kV transmission line along Link 2000, continuing west until Milepost 20.7. At Milepost 20.7 along Link 2000, existing 345kV and 500kV transmission lines intersect with the 230kV line and head north towards Hackberry. S2 turns north and parallels the two lines to a point approximately four miles south of Hackberry. From here, S2 departs from the existing lines into new corridor for 5.6 miles to the west around Hackberry. Link 2000 rejoins the existing 345kV and 500kV lines north of Hackberry and continues north along Link 2006, crossing Route 66 (Photograph 22) and the Truxton Wash (Photograph 23). At this point, Link 2006 joins into Link 2020, which parallels the Grand Wash Cliffs until its intersection with other existing transmission lines north of Red Lake in the Hualapai Valley (Photograph 24). From here S2 is identical to N1W and N2 as it continues west across the Colorado River and into the Marketplace Substation (Photographs 25 and 26).

WESTERN AREA - MOENKOPI TO MEAD

Northern 3 (N3)—Links 1400, 1401, 1660, 1740, 1741, 1790, 2040, 2080 (199.3 miles)

N3 is 199.3 miles long and parallels existing transmission lines the entire length. N3 is identical to N1W up to Link 2040. Immediately north of Red Lake, N3 parallels existing 345kV and 500kV transmission lines to the northwest across the Hualapai Valley and through the White Hills (see Photograph 24). After crossing US 93, the route continues west into the Lake Mead NRA and crosses the Colorado River south of Willow Beach (Photograph 27).

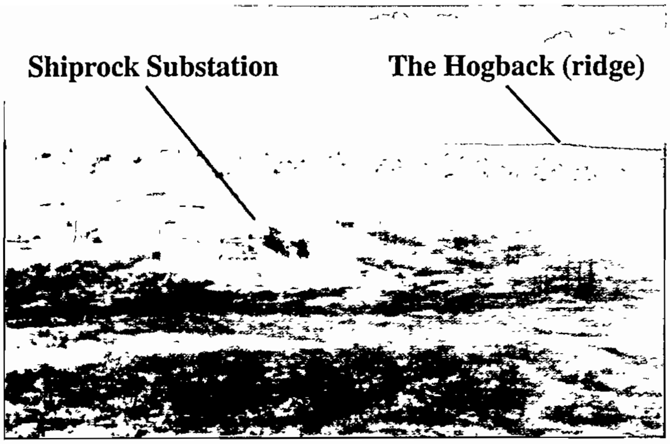
In Nevada, N3 passes through the Eldorado Mountains along Link 2040 and then turns northwest toward its termination at the Mead Substation (Photograph 28).

Northern 4 (N4)—Links 1400, 1401, 1660, 1740, 1741, 1742, 1800, 1980, 2020, 2040, 2080 (207.4 miles)

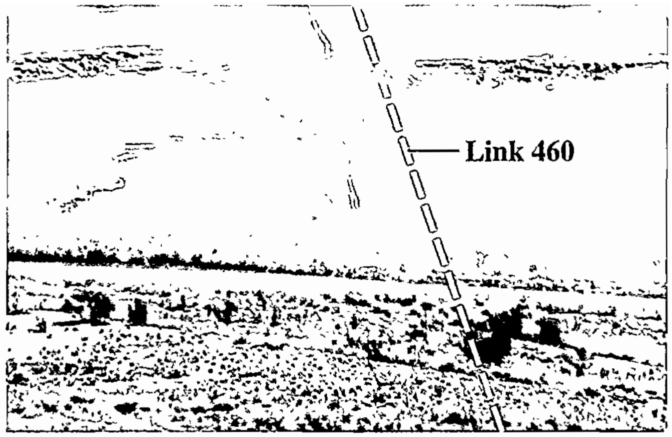
N4 is 207.4 miles long and parallels existing transmission lines for the majority of its length. This route is identical to N2 up until the intersection point north of Red Lake in the Hualapai Valley (see Photograph 24). Instead of continuing to follow the existing 500kV line to the west, this route parallels the existing 345kV and 500kV lines to the northwest through the White Hills, Detrital Valley across the Colorado River, and into the Mead Substation as described in N3 above (see Photographs 27 and 28).

Southern 4 (S4)—Links 1420, 1421, 1480, 1520, 1640, 1680, 1720, 1960, 2000, 2002, 2006, 2020, 2040, 2080 (230.0 miles)

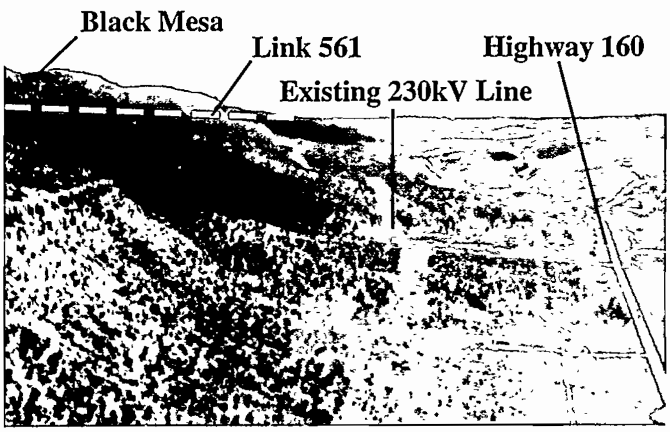
S4 connects the Moenkopi and Mead substations over a total distance of 230.0 miles. This route follows a combination of existing transmission lines, pipelines, fiber optic cables, and new corridor. S4 is identical to S2 up to the intersection point at Red Lake in the Hualapai Valley (see Photograph 24). From there, S4 follows a route identical to alternative N3 across the Colorado River and into the Mead Substation (see Photographs 27 and 28).



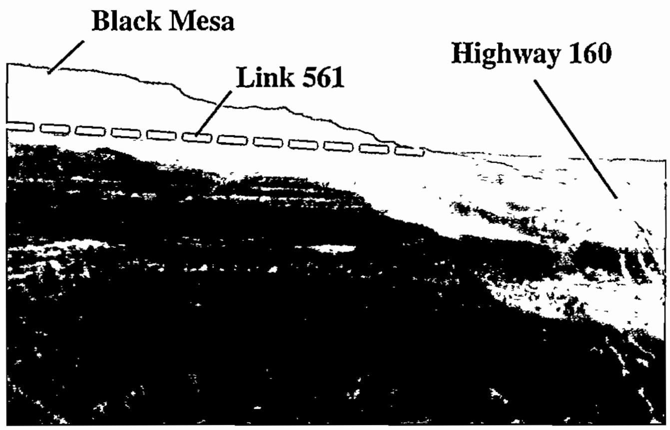
Photograph No. 1: Shiprock Substation
View Direction: West
Applicable Routes: All eastern routes (Links 100,180)
Description: The existing Shiprock Substation is visible in the foreground with The Hogback (ridge) in the background.



Photograph No. 2: Northern crossing of the San Juan River
View Direction: East
Applicable Routes: GC1, K1, C2 (Link 460)
Description: Existing 230kV line is paralleled at this location of the San Juan River crossing.



Photograph No. 3: Marsh Pass Area
View Direction: West
Applicable Routes: GC1, K1 (Link 561)
Description: Highway 160 is visible to the right; the existing 230kV line right-of-way is visible in the center. Link 561 is located on top of the bench (upper left of the photograph).



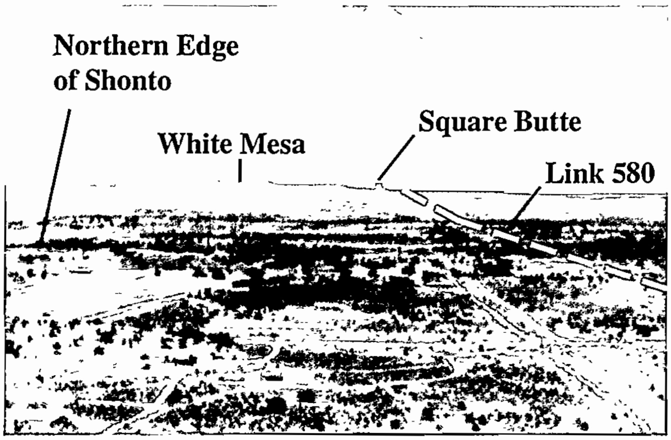
Photograph No. 4: Marsh Pass Area
View Direction: West
Applicable Routes: GC1, K1 (Link 561)
Description: View of Link 561 on top of the bench below the northern edge of Black Mesa. Highway 160 is visible (far right of the photograph).

Alternative Route Photographs

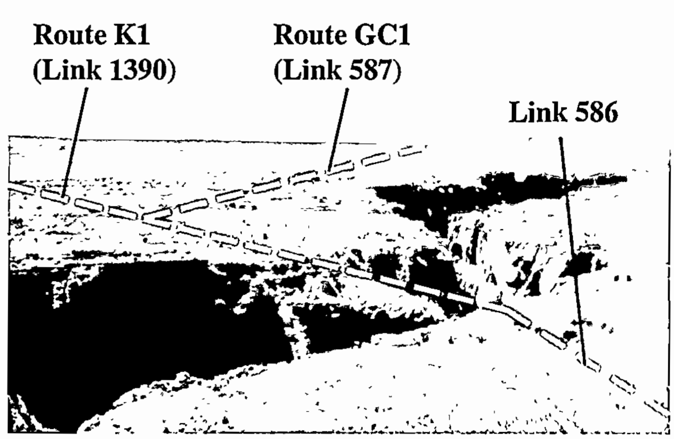
Navajo Transmission Project

Note: Route locations are approximate

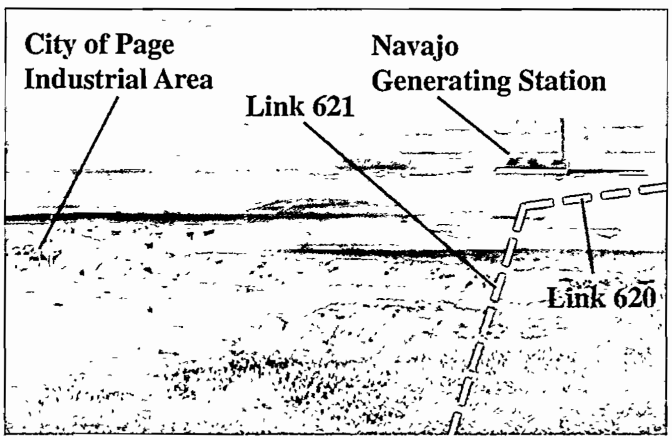
Figure C-1



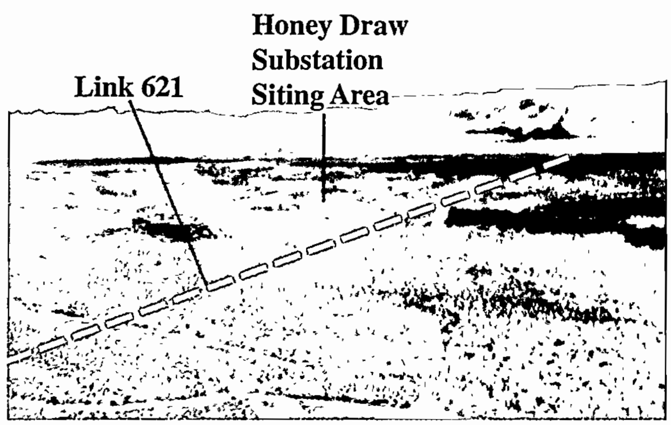
Photograph No. 5: Shonto Area
View Direction: West
Applicable Routes: GC1, K1 (Link 580)
Description: View of the area between Shonto and the existing 230kV transmission line that would be paralleled. Square Butte and White Mesa are in the distance.



Photograph No. 6: Chaol Canyon
View Direction: Northwest
Applicable Routes: GC1 (Links 586, 587), K1 (Links 586, 1390)
Description: Crossing of Chaol Canyon parallel to the existing 230kV line.



Photograph No. 7: Page Area
View Direction: Northeast
Applicable Routes: GC1 (Links 620, 621)
Description: View of the Navajo Generating Station (upper right), City of Page industrial area (center left), and Glen Canyon NRA in the background north of alternative route GC1.



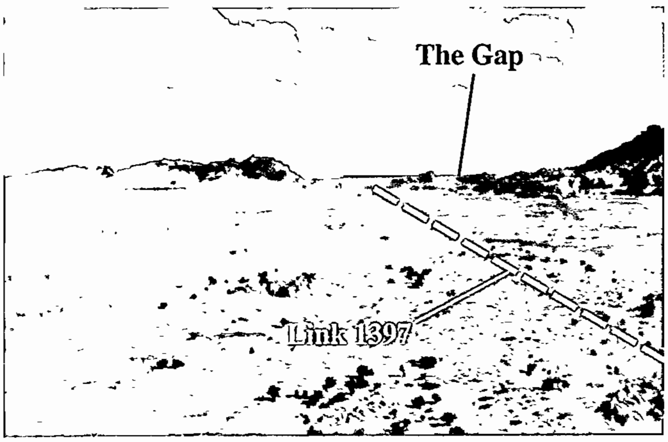
Photograph No. 8: Honey Draw Substation Site
View Direction: Southwest
Applicable Routes: GC1 (Link 621)
Description: Approximate location of Honey Draw Substation site south of Page and west of Lechee, located along Link 621.

Alternative Route Photographs

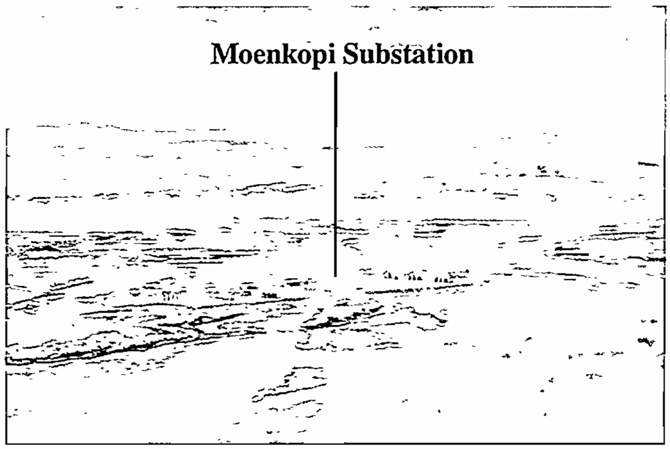
Navajo Transmission Project

Note: Route locations are approximate

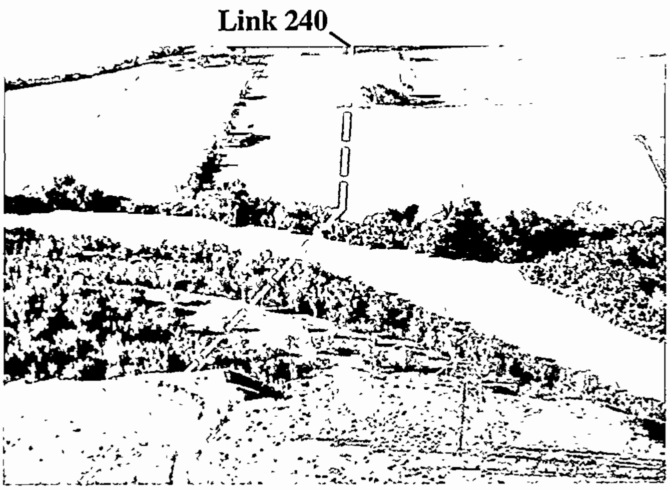
Figure C-1



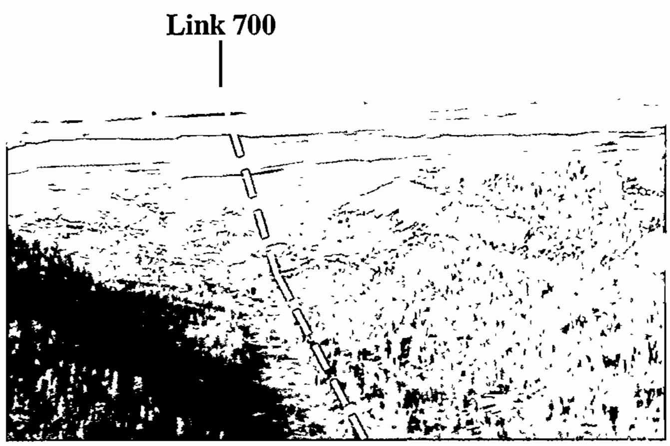
Photograph No. 9: North of The Gap
View Direction: South
Applicable Routes: K1, GC1 (Link 1397)
Description: Link 1397 parallels one of two existing 345kV lines that converge to the south at The Gap.



Photograph No. 10: Moenkopi Substation
View Direction: Southwest
Applicable Routes: All alternative routes
Description: View of the existing Moenkopi Substation with the San Francisco Peaks in the distance.



Photograph No. 11: Southern crossing of the San Juan River
View Direction: North
Applicable Routes: C1 (Link 240)
Description: Existing 345kV lines would be paralleled at this location of the San Juan River crossing.



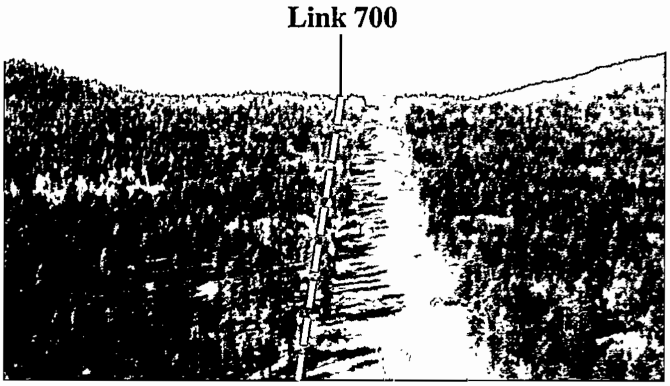
Photograph No. 12: Chuska Mountains
View Direction: Northeast
Applicable Routes: C1 (Link 700)
Description: View from the eastern side of the Chuska Mountains where Link 700 parallels the existing 500kV line.

Alternative Route Photographs

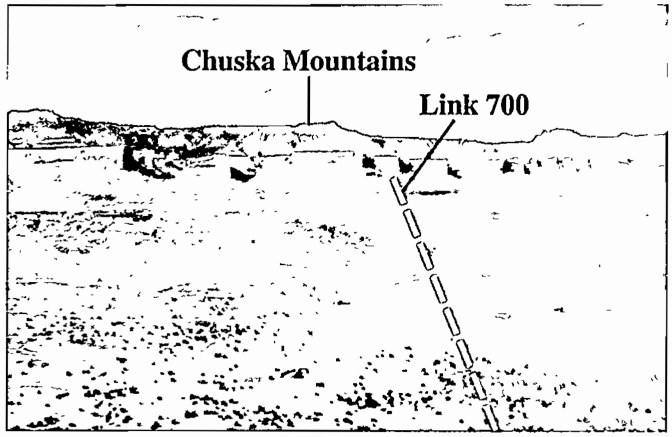
Navajo Transmission Project

Note: Route locations are approximate

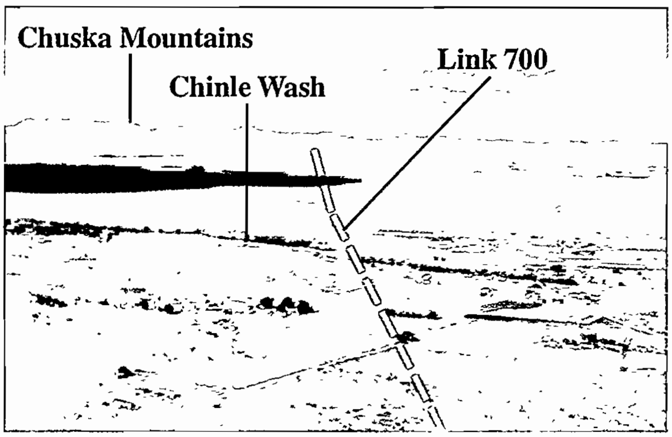
Figure C-1



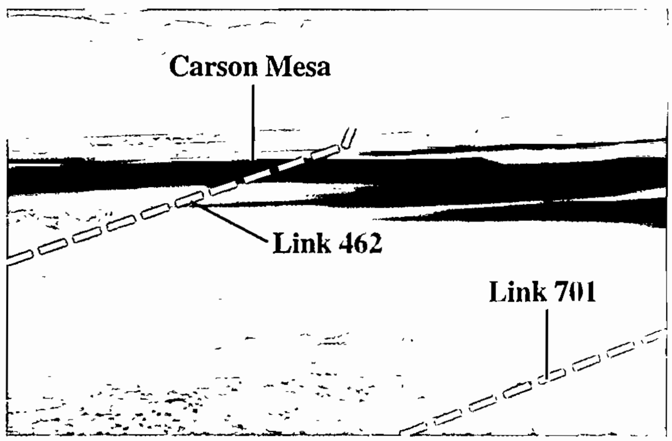
Photograph No. 13: Buffalo Pass/Chuska Mountains
View Direction: West
Applicable Routes: C1 (Link 700)
Description: Ponderosa pine forest at Buffalo Pass showing clearing for the existing 500kV line paralleled by Link 700.



Photograph No. 14: Chuska Mountains
View Direction: East
Applicable Routes: C1 (Link 700)
Description: View of the western side of the Chuska Mountains, north of Lukachukai. Link 700 parallels the existing 500kV line in this area.



Photograph No. 15: Chinle Wash
View Direction: West
Applicable Routes: C1 (Link 700)
Description: View of Chinle Wash including agricultural and residential areas. The Chuska Mountains are in the background.



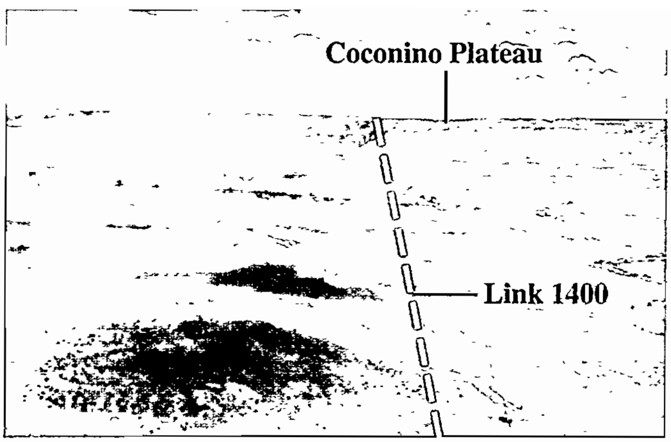
Photograph No. 16: Chinle Valley/Carson Mesa
View Direction: North
Applicable Routes: C2 (Link 462) and C1 (Link 701)
Description: View from the existing 500kV line and Link 701 towards Carson Mesa along Link 462.

Alternative Route Photographs

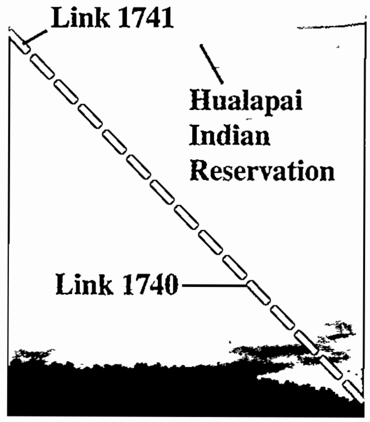
Navajo Transmission Project

Note: Route locations are approximate

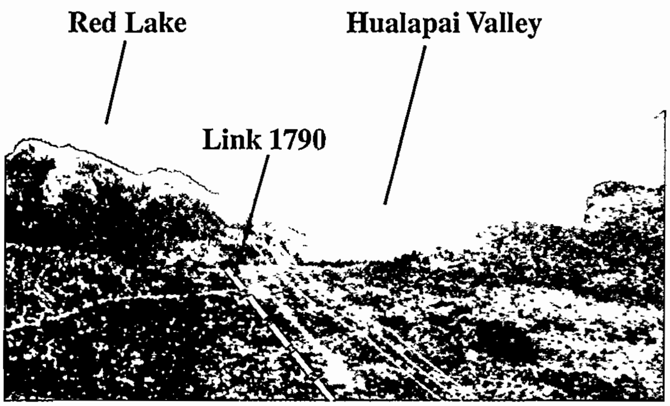
Figure C-1



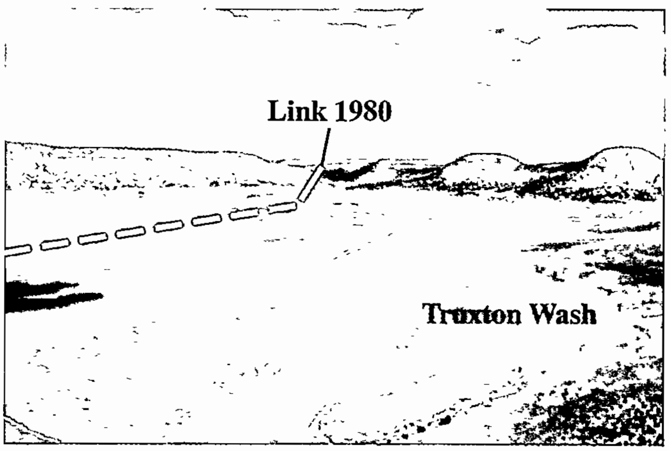
Photograph No. 17: Painted Desert
View Direction: West
Applicable Routes: N1W, N2, N3, N4 (Link 1400)
Description: View from the Moenkopi Substation toward the Coconino Plateau along the existing 500kV line paralleled by Link 1400.



Photograph No. 18: Aubrey Valley
View Direction: West
Applicable Routes: N1W, N2, N3, N4 (Links 1740, 1741)
Description: View from the top of the Aubrey Cliffs into the Aubrey Valley with the Hualapai Reservation boundary visible in the background. Links 1740 and 1741 parallel the existing 500kV line.



Photograph No. 19: Grand Wash Cliffs
View Direction: West
Applicable Routes: N1W, N3 (Link 1790)
Description: View from the top of the Grand Wash Cliffs into the Hualapai Valley and Red Lake area. Link 1790 parallels the existing 500kV line.



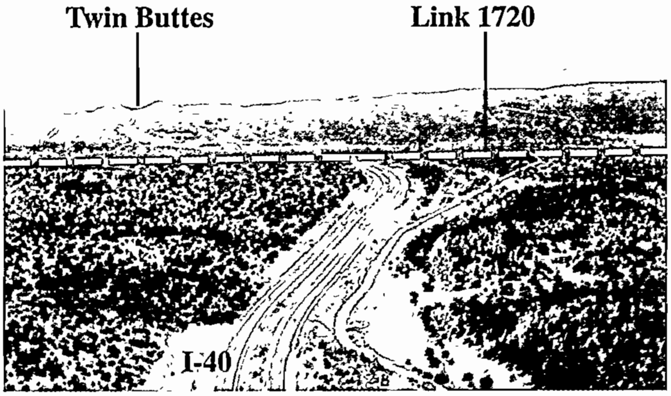
Photograph No. 20: Truxton Plains/Truxton Wash
View Direction: Northeast
Applicable Routes: N2, N4 (Link 1980)
Description: View of the Truxton Plains and Truxton Wash in the vicinity of Link 1980.

Alternative Route Photographs

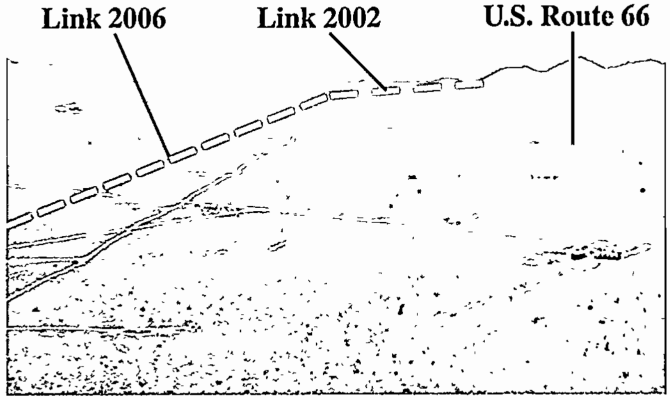
Navajo Transmission Project

Note: Route locations are approximate

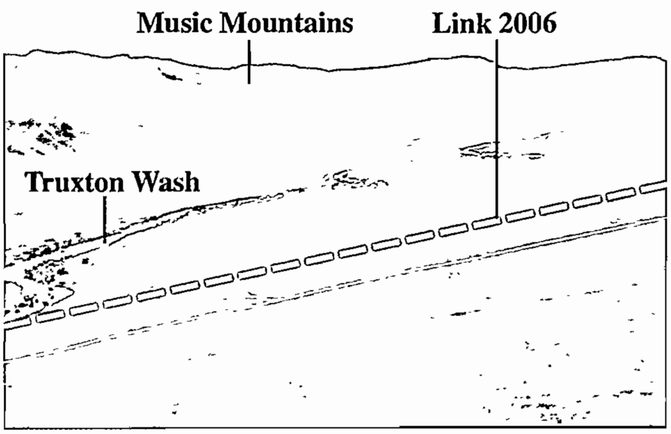
Figure C-1



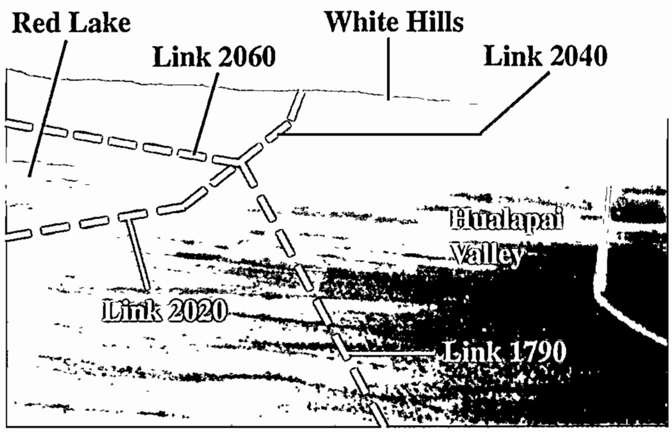
Photograph No. 21: West of Seligman
View Direction: East
Applicable Routes: S2, S4 (Link 1720)
Description: View near the crossing of Interstate 40 in the area of Link 1720.



Photograph No. 22: North of Hackberry
View Direction: South
Applicable Routes: S2, S4 (Links 2006, 2002)
Description: View of existing 345kV and 500kV lines along Link 2006 that would be paralleled. Historic U.S. Route 66 crossing and Link 2002 are visible in the background.



Photograph No. 23: Truxton Wash
View Direction: East
Applicable Routes: S2, S4 (Link 2006)
Description: Existing 345kV and 500kV lines would be paralleled near the crossing of the Truxton Wash. The Music Mountains are visible in the background.



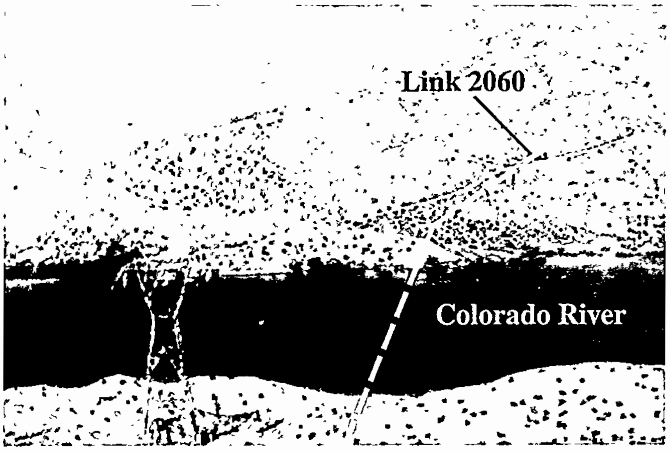
Photograph No. 24: Hualapai Valley and Red Lake
View Direction: West
Applicable Routes: N1W, N2, S2 (Links 1790, 2020, 2060) and N3, N4, S4 (Links 1790, 2020, 2040)
Description: View to the junction of Links 1790, 2020, 2060 and 2040 in the Hualapai Valley. At this point, alternative routes N1W, N2, and S2 parallel an existing 500kV transmission line west to the southern crossing of the Colorado River (Link 2060). N3, N4, and S4 diverge to the northwest parallel to existing 345kV and 500 kV lines (Link 2040) to the northern crossing of the Colorado River.

Alternative Route Photographs

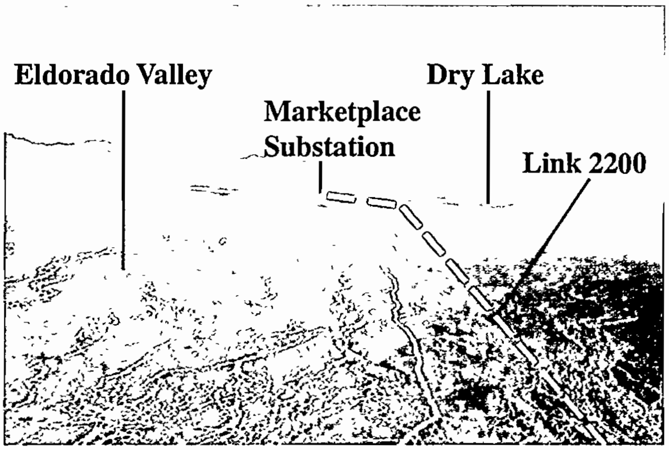
Navajo Transmission Project

Note: Route locations are approximate

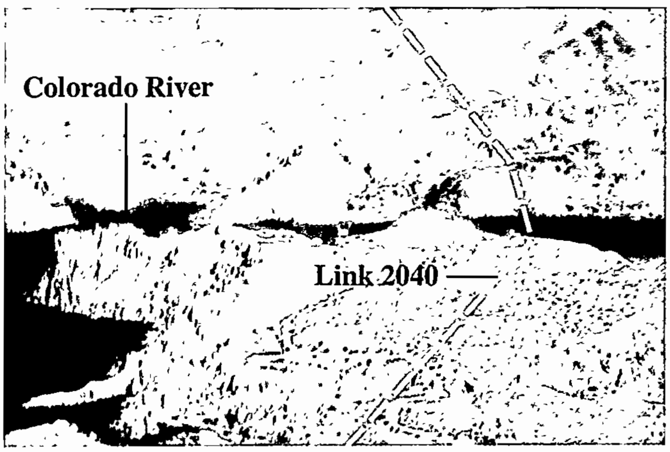
Figure C-1



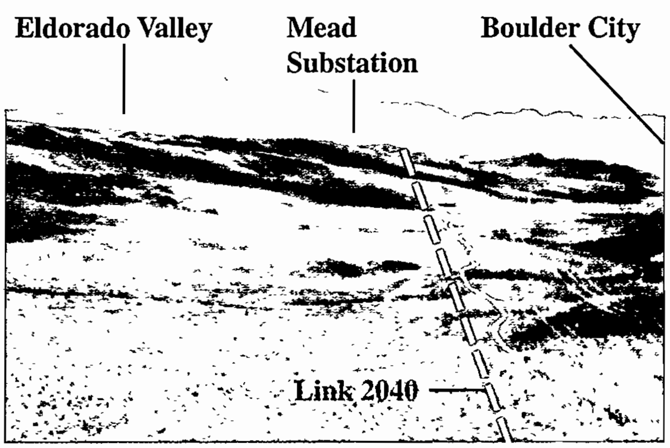
Photograph No. 25: Colorado River
View Direction: West
Applicable Routes: N1W, N2, S2 (Link 2060)
Description: View of the southern crossing of the Colorado River on the Lake Mead NRA. An existing 500kV line would be paralleled in this area.



Photograph No. 26: Marketplace Substation
View Direction: North
Applicable Routes: N1W, N2, S2 (Links 2200, 2180)
Description: View to the Marketplace Substation in the Eldorado Valley. Dry Lake is in the background. Numerous existing transmission lines would be paralleled by Link 2200 in this area.



Photograph No. 27: Colorado River
View Direction: East
Applicable Routes: N3, N4, S4 (Link 2040)
Description: View of the northern crossing of the Colorado River south of Willow Beach. Existing 345kV and 500kV lines would be paralleled. (Construction of the 500kV line has been completed since this area was photographed.)



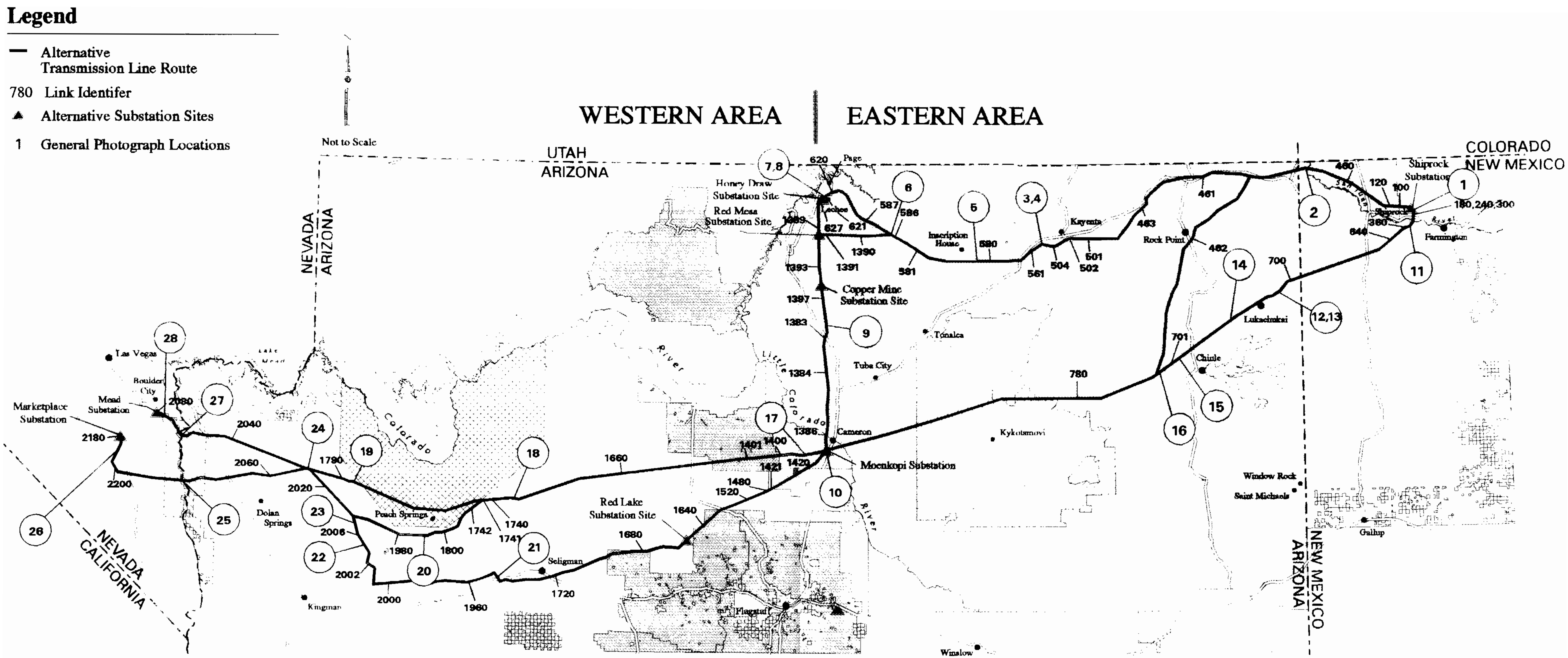
Photograph No. 28: Mead Substation
View Direction: Northwest
Applicable Routes: N3, N4, S4 (Links 2040, 2080)
Description: View to the Mead Substation south of Boulder City. Existing 345kV and 500kV lines would be paralleled in this area immediately west of the Eldorado Mountains and into the Mead Substation.

Alternative Route Photographs

Navajo Transmission Project

Note: Route locations are approximate

Figure C-1



Photograph Reference Map

Navajo Transmission Project

TABLE D-1 SPECIAL STATUS CODES	
Code	**Definition**
FEDERAL	
Fish and Wildlife Service*	
E = Endangered	Any species that is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary of the Interior to constitute a pest whose protection under this Act (ESA) wold present an overwhelming and overriding risk to man.
T = Threatened	Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
PE = Proposed endangered	Taxa already proposed for listing as endangered (a proposed rule has been published in the Federal Register)
PT = Proposed threatened	Taxa already proposed for listing as threatened (a proposed rule has been published in the Federal Register)
C1= Category 1*	Candidate species for which the FWS currently has on file substantial information on biological vulnerability and threat(s) to support the appropriateness of proposing to list the taxa as an endangered or threatened species.
C2 = Category 2*	Candidate species for which information now in possession of the FWS indicate that proposing to list the taxa as an endangered or threatened species is possibly appropriate, but for which substantial data on biological vulnerability or threat(s) are not currently known or on file to support proposed rules.
C3 = Category 3*	Taxa for which the FWS has persuasive evidence of extinction (Group 3A); taxa do not meet the Endangered Species Act's definition of a species (Group 3B); and taxa that have proven to be more abundant or widespread than previously believed and/or those that are not subject to an identifiable threat (Group 3C).
	*The definitions of candidate species were revised in a proposed rule published on February 28, 1996. These changes are not reflected in this document due to the extent of changes which would have to be done to the PDEIS and associated documents including the biological resources supporting documentation (including maps, data tables, and summary information). FWS now only maintains one group of candidate species for listing. Species previously listed as Federal candidate C2 species were either listed as threatened, endangered, proposed for such listing; remain as candidates; or were dropped from consideration. Concerns for such species remain valid and FWS prefers to see information on these species considered during the planning process whenever practicable.

TABLE D-1 SPECIAL STATUS CODES	
Code	**Definition**
	BLM
BLMS = BLM Sensitive	These species may be so designated at the discretion of the state director for any of several reasons. They may be under status review by the FWS, have typically small and widely dispersed populations, have numbers declining so rapidly that Federal listing may become necessary, or inhabit specialized or unique habitats or other ecological refugia.
	Forest Service
FSS = Forest Service Sensitive	This designation is to ensure that sensitive species and their occupied habitats will not be adversely affected without a thorough analysis of significance of such impacts. The intent of monitoring such species is to prevent any trend toward Federal or state listing.
	Birds Protected Under One or More Federal Acts
BEA = Bald and Golden Eagle Act	This statute prohibits taking, possessing, and trading bald and golden eagles. It provides for protection of the eagles, and defines criminal and civil penalties for violations.
MBTA = Migratory Bird Treaty Act	All birds, except house sparrows and starlings, are afforded protection under this statute.
	Navajo Nation
NESL = Navajo Nation Endangered Species List	This list is maintained and updated under the authority of the director of the Navajo Fish and Wildlife Department.
G1 = Group 1	Those species or subspecies that no longer occur on the Navajo Nation.
G2 = Group 2	Any species or subspecies that is in danger of being eliminated from all or a significant portion of its range on the Navajo Nation. These species are protected by tribal code.
G3 = Group 3	Any species or subspecies that is likely to become an endangered species, within the foreseeable future, throughout all or a significant portion of its range on the Navajo Nation. These species are protected by tribal code.
G4 = Group 4	Any species or subspecies for which the NFWD does not currently have sufficient information to support their being listed in Group 2 or Group 3, but has reason to consider them. The NFWD will actively seek information on these species to determine if they warrant inclusion in a different group or removal from the list. Species in Group 4 have no legal protection under 17 NTC, Section 507.

TABLE D-1 SPECIAL STATUS CODES	
Code	**Definition**
NEW MEXICO	
Plants [New Mexico Endangered Plant Species Act (9-10-10)]	
Ll = List 1	Plant species endangered in New Mexico. These are protected from unauthorized collection or take under the New Mexico Endangered Plant Species Act (9-10-10 NMSA) and attendant regulation 19 NMAC 21.2. These species are either in danger of becoming extinct or in danger of extirpation from the state of New Mexico. Taxa must meet one of the following criteria: L1A - The taxon is listed as threatened or endangered under the provisions of the Federal Endangered Species Act (16 U.S.C. Sections 1531 et seq.) or is considered proposed under the tenets of the act. L1B - The taxon is so rare across its entire range within the state and of such limited distribution and population size that unregulated collection could adversely impact it and jeopardize its survival in New Mexico.
L2 = List 2	New Mexico rare and sensitive plant species. This list contains taxa that are considered to be rare because of restricted distribution or low numerical density. They need not be endemic to New Mexico, but must be regionally endemic, rare throughout their range, or rare within threatened New Mexico habitats (wetlands). Since they are rare, these species are sensitive to long-term or cumulative land use impacts and are vulnerable to biological or climatic events that could eventually threaten them with extinction or extirpation. These species are monitored by the state of New Mexico to determine if they should ever be elevated to List 1 endangered species status. They are not protected by state statute or policy.
L3 = List 3	New Mexico rare plant review list. These are plants for which more information is needed. All are under consideration for Lists 1 or 2, but sufficient information is lacking to either list or reject them. Each species on this list will either be taxonomically questionable or poorly understood as to distribution and endangerment. They are not protected by state statute or policy. Some of these plants, however, are in need of prompt attention. Placement on the Review List should not diminish the concern for their continued survival in New Mexico and will hopefully stimulate interest in answering some of our questions.
L4 = List 4	Plant species considered but not included. This list contains all taxa occurring on the 1985 New Mexico Heritage Program Element List that were considered, but not included on Lists 1, 2, or 3. It also contains the species rejected during 1991, 1994, and 1995 interagency reviews, and taxa originally included on Lists 2 and 3 in 1992, but were later determined to be too abundant to retain.

TABLE D-1 SPECIAL STATUS CODES	
Code	**Definition**
Wildlife	
E1 = Endangered Group 1	Species whose prospects of survival or recruitment within the state are in jeopardy.
E2 = Endangered Group 2	Species whose prospects of survival or recruitment within the state are likely to become jeopardized in the foreseeable future.
ARIZONA	
Plants (Arizona Native Plant Law)	
hs = highly safeguarded	Plants whose prospects for survival are in jeopardy which are in danger of extinction throughout all or a significant portion of their range, including plants listed Federally as endangered, threatened, or Category 1 (candidate for endangered or threatened), and their seeds and fruit.
sr = salvage restricted	This category includes plants which have a high potential for theft or vandalism and focuses on the taking of the whole or live plant.
er = export restricted	This category includes plants that may be subject to over-depletion if their exportation from this state is permitted.
sa = salvage assessed	This category includes plants which have a low potential for theft, but still have enough value for salvage to be assessed at the rates of salvage restricted plants.
hr = harvest restricted	This category includes plants that have a high potential for excessive harvesting or overcutting, and focuses on the harvest of live or dead portions of the plant.
Other	
EI = economic interest	Generally species of big game and game birds which are regulated by state or tribal agencies. Revenue is obtained by these agencies through a permit system and assessing fines to violators of regulations.

TABLE D-1 SPECIAL STATUS CODES	
Code	**Definition**
Wildlife **(Note: The state of Arizona is currently redefining these categories and may generally refer to all such species as "wildlife of concern.")**	
SE = State Endangered	Those species or subspecies (a) extirpated from Arizona since the mid-1800s and/or (b) for which extinction or extirpation is highly probably unless conservation efforts are undertaken soon.
ST = State Threatened	Those species or subspecies whose continued presence in Arizona could be in jeopardy in the near future. Serious threats have been identified and populations are (a) lower than they were historically or (b) extremely local and small.
SC = State Candidate	Those species or subspecies for which threats are known or suspected, but for which substantial population declines from historical levels have not been documented (though they appear likely to have occurred).
SX = State Extinct	Those species or subspecies that are no longer extant in the wild or in captivity, anywhere.
NEVADA	
Plants	
State of Nevada CE = Critically Endangered	Critically Endangered taxa threatened with extinction, whose survival requires assistance because of over exploitation, disease, or other factors or because their habitat is threatened with destruction, drastic modification, or severe curtailment (NRS 527.260-.300).
CE#	Recommended for listing as critically endangered, pending formal listing.
CY	Protected species of cactus and yucca in accordance with the Cactus and Yucca Law (Nevada Revised Statute 527). This law is intended to alleviate poaching and habitat destruction where healthy populations of cactus or yucca exist.
Northern Nevada Native Plant Society (NNNPS) PE = Possibly Extinct	Possibly extinct in Nevada.
E = Endangered	Endangered.
T = Threatened	Threatened.
W = Watch	Potentially vulnerable taxa in need of monitoring or further data to determine status.

TABLE D-1 SPECIAL STATUS CODES	
Code	**Definition**
Plants (continued)	
D = Delete	Deleted from consideration by NNNPS because they are presently considered secure, taxonomically indistinct, etc.
A = Absent	Absent currently and historically from Nevada, included on past lists, but not now under consideration.
Wildlife	
E = Endangered	Species or subspecies whose prospects for survival and reproduction are in immediate jeopardy throughout all or a significant portion of its range.
T = Threatened	Species or subspecies is rare if, although not presently threatened with extinction, it exists in such small numbers throughout all or a significant portion of its range that it may become endangered if its environment deteriorates.
P = Protected	Protected animals (mammals, birds, fish, reptiles, and amphibians) include those species not subject to an open season, nor may they be taken, possessed or otherwise acquired, except in some instances by a special permit.
R = Rare	A species or subspecies which, although not presently threatened with extinction, is in such small numbers throughout its range that it may be endangered if its environment deteriorates.
NB = Nongame Birds	Those protected by Federal law in accordance with the Migratory Bird Treaty Act of July 3, 1918 and the Eagle Act of June 8, 1940, and Federal regulations adopted pursuant thereto.
SC = Species of Special Concern	Those birds and mammals most in need of management, or require additional evaluation to determine their status, as they may be a candidate for endangered status.
S = Sensitive	This classification has been established for management purposes, and is designed to bring attention to those species that maintain a precarious balance within limited or vulnerable habitat and may have a need to be moved into a more restrictive classification based on further evaluation.

TABLE D-2a
SPECIAL STATUS SPECIES - NEW MEXICO
Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project
(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
MAMMALS							
Spotted Bat	*Euderma maculatum*	Variety of habitat types	C2	E2	NESL-4	no	moderate
Occult Little Brown Bat	*Myotis lucifugus occultus*	Great Basin desertscrub	C2			no	moderate

KEY:
Occurrence (determined for species not known to occur)
High = Known to be within species range, and habitat exists, but for which specific locations have not been identified
Moderate = Within species range, but little habitat exists; or migratory only
Low = Within historical range; however, no recent occurrences exist and habitat is minimal or highly degraded

Status*

Federal:
- E = Endangered
- T = Threatened
- PE = Proposed Endangered
- C1 = Category 1
- C2 = Category 2
- C3 = Category 3
  - 3A = Extinct
  - 3B = Taxonomically Invalid
  - 3C = Dropped from consideration

New Mexico: (wildlife)
- E1 = Endangered Group 1
- E2 = Endangered Group 2

New Mexico: (plants)
- L1 = List 1
  - L1A = List 1A
  - L1B = List 1B
- L2 = List 2
- L3 = List 3
- L4 = List 4
  - L41 = too common in NM
  - L42 = widespread, not endangered in NM
  - L43 = not a valid taxon

Other:
- NESL = Navajo Endangered Species List
  - 1 = Group 1
  - 2 = Group 2
  - 3 = Group 3
  - 4 = Group 4
- BLMS = BLM Sensitive
- BEA = Bald Eagle Act
- EI = Economically Important
- +MBTA = Migratory Bird Treaty Act (Note: All birds listed are protected by this act; therefore, "MBTA" is not listed in this table under status.)

TABLE D-2a
SPECIAL STATUS SPECIES - NEW MEXICO
Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project
(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Big Free-tailed Bat	*Tadarida macrotis*	Predominantly occur below 6,000 feet in piñon-juniper woodland, desert grassland, and desertscrub	C2			no	low
Long-legged Myotis	*Myotis volans*	Ponderosa pine forests and occasionally in grasslands	C2			no	moderate
Pale Townsend's Big-eared Bat	*Plecotus townsendii*	Caves, rock shelters, and mines from desertscrub to spruce-fir forests	C2			no	low
Small-footed Myotis	*Myotis leibii*	Primarily associated with Ponderosa pine but known from desertscrub to low edge of spruce fir zone	C2			no	moderate
Chuska Tassel-eared Squirrel	*Sciurus aberti chuscensis*	7,000- to 8,500-foot elevation ponderosa pine forests			NESL-4	yes	
Black-footed Ferret	*Mustela nigripes*	Associated with prairie dog towns	E		NESL-2	no	low
Mink	*Mustela vison*	Along streams and lakes			NESL-2 EI	no	moderate
Swift Fox	*Vulpes velox*	Open desert and plains	C2			no	low
Southwestern River Otter	*Lutra canadensis sonora*	Along streams and lakes; may be extinct in New Mexico	C2		NESL-1	no	low

TABLE D-2a
SPECIAL STATUS SPECIES - NEW MEXICO
Special Status Species Likely to Occur in the Habitats Traversed by
the Alternative Routes for the Navajo Transmission Project
(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Black Bear	*Ursus americanus*	Montane forests; Chuska Mountains			EI	yes	
American Pronghorn	*Antilocapra americana*	Open prairies and sagebrush plains			EI NESL-3	yes	
Mule Deer	*Odocoileus hemionus*	Coniferous forests, desert shrubs, chaparral, grassland with shrubs			EI	yes	
Mountain Lion	*Felis concolor*	Rugged mountains and forests. N. Hogback; Chuska Mountains			NESL-4	yes	
		BIRDS+					
Black-crowned Night-heron	*Nycticorax nycticorax*	Permanent or ephemeral wetlands			NESL-4	no	moderate
White-faced Ibis	*Plegadis chihi*	Permanent or ephemeral wetlands	C2	E2		no	moderate
Belted Kingfisher	*Ceryle alcyon*	Along fresh or marine water courses			NESL-4	yes	
Bald Eagle	*Haliaeetus leucocephalus*	Riparian; Little Whiskey Creek and San Juan River woodlands	E	E2	NESL-3 BEA	yes	
Golden Eagle	*Aquila chrysaetos*	Open country in prairies, tundra, and open forest. Nest on cliff ledges and in trees; Combridge, Twin Buttes, Elephant Butte, and throughout Hogback			NESL-3 BEA BLMS	yes	

TABLE D-2a
SPECIAL STATUS SPECIES - NEW MEXICO
Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project

(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Ferruginous Hawk	*Buteo regalis*	Open prairies, plains, and badlands near streams; S. Hogback, Lake Morgan	C2		NESL-3 BLMS	yes	
Swainson's Hawk	*Buteo swainsoni*	Savanna, open pine-oak woodland, cultivated areas with scattered trees	C3 (subgroup 3C)		NESL-2 BLMS	yes	
Northern Goshawk	*Accipiter gentilis*	Deciduous and coniferous forest edges, open woodland; N. Little Whiskey Creek; winter in piñon-juniper woodlands; nesting in ponderosa pine forests	C2		NESL-4	no	moderate
Northern Harrier	*Circus cyaneus*	Prairies, meadows, grasslands, and marshes; shores of E. Lake Morgan			NESL-4	no	high
American Peregrine Falcon	*Falco peregrinus anatum*	Open situations involving nesting cliffs; Little Whiskey Creek woodlands; San Juan River	E	E1	NESL-3	no	high
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	Migratory	T			no	low
Flammulated Owl	*Otus flammeolus*	Primarily ponderosa pine, montane forests; Little Whiskey Creek woodlands			NESL-4	yes	

TABLE D-2a
SPECIAL STATUS SPECIES - NEW MEXICO
Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project
(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	**Scientific Name**		**Fed**	**State**	**Other**	**Known**	**Potential**
Mexican Spotted Owl	*Strix occidentalis lucida*	Dense forest, both coniferous and hardwood, steep walled canyons; Little Whiskey Ck., Chuska Mountains	T (with critical habitat)		NESL-3	yes	
Northern Pygmy-owl	*Glaucidium gnoma*	Little Whiskey Creek woodlands			NESL-4	yes	
Western Burrowing Owl	*Athene cunicularia*	Open grasslands, nesting in mammal burrows	C2		NESL-4	no	moderate
Mountain Plover	*Charadrius montanus*	Dry upland prairies and plains, semidesert	C1		NESL-4	no	low
Black Tern	*Chlidonas niger*	Lake shores and marshes	C2			no	low
American Dipper	*Cinclus mexicanus*	Along mountain streams from 4,000 feet to timberline			NESL-3	no	moderate
Sora	*Porzana carolina*	Permanent wetlands; grain fields			NESL-4	no	moderate
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	Open woodlands, stream-side willow and alder groves	C3 (subgroup 3B)		NESL-4	no	low
Three-toed Woodpecker	*Picoides tridactylus*	Coniferous forests, especially areas burned over			NESL-4	no	low

TABLE D-2a
SPECIAL STATUS SPECIES - NEW MEXICO
Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project

(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Common Snipe	*Gallinago gallinago*	Year round range extended to Four-corners area			NESL-3	no	moderate
Blue Grouse	*Dendragapus obscurus*	Mixed coniferous forest and deciduous trees and shrubs; Chuska Mountains			NESL-3 EI	yes	
Merriam's Turkey	*Meleagris gallopavo merriami*	Montane forest and open woodland, meadows; Chuska Mountains			EI	yes	
Costa's Hummingbird	*Calypte costae*	Desert, semi desert, and chaparral		E2		no	low
Loggerhead Shrike	*Lanius ludovicianus*	Savanna, desertscrub, and less often, open woodland	C2			no	high
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Buttonbush swamps of Sonoran zones, dense willow thickets; tamarisk	E (with critical habitat)	E2	NESL-3	no	moderate
Hammond's Flycatcher	*Empidonax hammondii*	Fir forest and open woodland, 8,500 to 10,000 feet			NESL-4	no	low
Purple Martin	*Progne subis*	Near permanent water source and in suburban areas			NESL-4	no	moderate
Bell's Vireo	*Vireo belli*	Mesquite, scrub oak, chaparral, and riparian areas		E2		no	low

TABLE D-2a
SPECIAL STATUS SPECIES - NEW MEXICO
Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project
(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Gray Vireo	*Vireo vincinior*	Oak-juniper, piñon-juniper, dry chaparral, and riparian areas		E2		no	high
Yellow Warbler	*Dendroica petechia*	Open woodlands, wetlands, and orchards			NESL-4	no	moderate
Clark's Grebe	*Aechmophorus clarkii*	Broad freshwater lakes			NESL-4	no	low
Tree Swallow	*Tachycineta bicolor*	Any wooded habitat near water, esp. with abundant snags			NESL-4	no	moderate
Marsh Wren	*Cistothorus palustris*	Reedy marshes, or cattail swamps			NESL-4	no	moderate
Baird's Sparrow	*Ammodramus bairdii*	Short grass prairie with scattered low bushes	C2			no	low
REPTILES AND AMPHIBIANS							
Chorus Frog	*Pseudacris triseriata*	Aquatic			NESL-4	no	moderate
Milk Snake	*Lampropeltis triangulum*	Variety of habitats			NESL-4	no	low
Narrow-headed Garter Snake	*Thamnophis rufipunctatus*	Piñon-juniper into ponderosa pine forests along permanent or semi permanent streams	C2	E2		no	low

TABLE D-2a
SPECIAL STATUS SPECIES - NEW MEXICO
Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project

(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	**Scientific Name**		**Fed**	**State**	**Other**	**Known**	**Potential**
		FISHES					
Gila Trout	*Oncorhynchus gilae*	Aquatic	E	E2		no	low
Roundtail Chub	*Gila robusta*	Aquatic; San Juan River	C2	E2	NESL-2	yes	
Gila Chub	*Gila intermedia*	Aquatic; Gila River basin	C2	E1		no	none
Razorback Sucker	*Xyrauchen texanus*	Aquatic, San Juan River (designated critical habitat)	E		NESL-2	no	low
Flannelmouth Sucker	*Catostomus latipinnis*	Aquatic; San Juan River and Tappen Wash	C2		NESL-4	yes	
Zuni Bluehead Sucker	*Pantosteus discobolos yarrowi*	Aquatic; Little Whiskey Creek and San Juan River		E1		yes	
Little Colorado Spinedace	*Lepidomeda vittata*	Aquatic	T			no	moderate
Speckled Dace	*Rhinichthys osculus*	Aquatic; pool-and-riffle creeks	C2		NESL-4	yes	
Mottled Sculpin	*Cottus bairdi*	Aquatic; San Juan River			NESL-4	yes	
Colorado Squawfish	*Ptychocheilas lucius*	Aquatic, San Juan River (designated critical habitat)	E	E1	NESL-2	no	low

TABLE D-2a
SPECIAL STATUS SPECIES - NEW MEXICO
Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project
(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
PLANTS							
Gooding Onion	*Allium goodingii*	Mature forests, along north-trending drainage bottoms; mixed conifer and spruce-fir woodlands	C1	L1B	NESL-3	yes	
San Juan Milkweed	*Asclepias sanjuanensis*	Great Basin desertscrub	C3 (subgroup 3B)	L3		no	moderate
Zuni Milkvetch	*Astragalus accumbens*	Gravelly clay soils; piñon-juniper woodlands and sagebrush 7,500 to 7,900 elevation	C3 (subgroup 3C)	L2		no	low
Chuska Mountain Milkvetch	*Astragalus chuskanus*	Sandstone substrates in the Chuska Mountains; transition zone between ponderosa pine and Douglas-fir-white fir; 7,500-10,000 feet elevation		L2		no	high
Mancos Milkvetch	*Astragalus humillimus*	Sandstone ledges and mesas; Great Basin desertscrub	E	L1A	NESL-2	yes	
Chaco Milkvetch	*Astragalus micromerius*	Sandstone areas; piñon-juniper woodlands, Great Basin desertscrub		L2		no	moderate

TABLE D-2a
SPECIAL STATUS SPECIES - NEW MEXICO
Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project
(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Monument Valley Milkvetch	*Astragalus monumentalis var. monumentalis*	Sandstone areas; piñon-juniper woodlands, Great Basin desertscrub	C3 (subgroup 3C)	L3		yes	
Cottam's Milkvetch	*Astragalus monumentalis var. cottami*	Sandstone areas; piñon-juniper woodlands, Great Basin desertscrub	C3 (subgroup 3C)	L41		yes	
Naturita Milkvetch	*Astragalus naturitensis*	Sandstone areas; piñon-juniper woodlands	C3 (subgroup 3C)	L2	NESL-4	yes	
Arizona Leatherflower	*Clematis hirsutissima var. arizonica*	Ponderosa pine forests	C1	L3	NESL-4	no	high
Plains Pincushion Cactus	*Coryphantha (= Escobaria) missouriensis var. missouriensis*	Piñon-juniper woodlands, plains and Great Basin grasslands		L3		no	low
Handsome Cat's-eye, or Paradox Valley Cat's-eye	*Cryptantha paradoxa*	Piñon-juniper woodlands, Great Basin desertscrub	C3 (subgroup 3C)	L4		yes	
Acoma Fleabane	*Erigeron acomanus*	Sandstone areas; piñon-juniper woodlands	C2	L2	NESL-3	no	low
Rhizome, or Zuni, Fleabane	*Erigeron rhizomatus*	Seleniferous shale; piñon-juniper woodlands	T	L1A	NESL-4	no	low

TABLE D-2a
SPECIAL STATUS SPECIES - NEW MEXICO
Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project
(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	**Scientific Name**		**Fed**	**State**	**Other**	**Known**	**Potential**
Aztec, or Splendid, Gilia	*Gilia formosa*	Clay or silty soils derived from sandstone; piñon-juniper woodlands, Great Basin desertscrub	C2	L1B		no	low
Wright's Pincushion Cactus	*Mammilaria wrightii*	Gravelly, sandy hills; piñon-juniper woodlands, Great Basin and Plains grasslands		L1B		no	moderate
Eastwood Phacelia	*Phacelia splendens*	Shale; Great Basin desertscrub		L2		yes	
Mancos Saltbush	*Proatriplex pleiantha*	Shale; Great Basin desertscrub	C3 (subgroup 3C)	L2		yes	
Mesa Verde Cactus	*Sclerocactus mesae-verde*	Barren shales; Great Basin desertscrub	T	L1A	NESL-3	yes	

*Status definitions are found in text.
Sources: FWS 1993a, 1995a; Morefield and Knight 1991; NFWD, NVNHP 1993, 1995; NMNHP 1993; Sivinski and Lightfoot 1995

TABLE D-2b
SPECIAL STATUS SPECIES - ARIZONA

Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project

(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
MAMMALS							
Spotted Bat	*Euderma maculatum*	Variety of habitat types	C2	C	NESL-4	no	moderate
Red Bat	*Lasiurus borealis*	Variety of wooded habitats		C		no	moderate
California Leaf-nosed Bat	*Macrotis californicus*	Caves, mine tunnels of W. and S. Arizona deserts, Southern Nevada and NE California		C		no	moderate
Occult Little Brown Bat	*Myotis lucifugus occultus*	Great Basin and Mohave desertscrub	C2		FSS	no	moderate

KEY:

Occurrence (determined for those species not known to occur)

- High - Known to be within species range, and habitat exists, but for which known locations have not been identified.
- Moderate - Within species range, but little habitat exists, or migratory.
- Low - Within species historical range, but lacking habitat.

Status*

Federal:
- E = Endangered
- T = Threatened
- PE = Proposed Endangered
- C1 = Category 1
- C2 = Category 2
- C3 = Category 3
  - 3A = Extinct
  - 3B = Taxonomically Invalid
  - 3C = Dropped from consideration

Arizona: (wildlife)
- E = Endangered
- T = Threatened
- C = Candidate

Arizona: (plants)
- (Follow Federal categories)
- (Follow Federal)
- ANPL = Native Plant Law

Other:
- NESL = Navajo Endangered Species List
  - 1 = Group 1 3 = Group 3
  - 2 = Group 2 4 = Group 4
- FSS = Forest Service Sensitive
- BLMS = BLM Sensitive
- BEA = Bald Eagle Act
- EI = Economically Important

+MBTA = Migratory Bird Treaty Act
(Note: All birds listed are protected by this act; therefore, "MBTA" is not listed in this table under status.)

TABLE D-2b
SPECIAL STATUS SPECIES - ARIZONA

Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project

(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Allen's Big-eared Bat	*Idionycteris phyllotis*	Predominantly associated with piñon-juniper woodlands and ponderosa pine forests	C2			no	low
Small-footed Myotis	*Myotis leibii*	Desertscrub, chaparral, oak woodlands, riparian habitats with juniper and oak	C2			no	moderate
Long-eared Myotis	*Myotis evotis*	Coniferous forests on the Kaibab and Mogollon plateaus and the Chiricahua Mountains	C2			no	low
Fringed Myotis	*Myotis thysanodes*	Chaparral to ponderosa pine forests	C2			no	moderate
Cave Myotis	*Myotis velifer*	Desertscrub communities in close proximity to a permanent water source	C2			no	low
Long-legged Myotis	*Myotis volans*	Ponderosa pine and mixed conifer forests	C2			no	moderate
Big free-tailed Bat	*Tadarida macrotis*	Desertscrub, piñon-juniper woodlands, ponderosa pine forests, Douglas-fir	C2			no	low
Yuma Myotis	*Myotis yumanensis*	Present along perennial streams, such as the Colorado and Little Colorado rivers	C2			no	moderate
Pale Townsend's Big-eared Bat	*Plecotus townsendii*	Caves or mine tunnels in desertscrub, oak woodland, piñon-juniper woodland, and coniferous forests	C2			no	moderate

TABLE D-2b
SPECIAL STATUS SPECIES - ARIZONA

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Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Hualapai Southern Pocket Gopher	*Thomomys umbrinus hualpaiensis*	Montane vegetation from 4,300 to 6,200 feet	C2			no	low
Wupatki or Coconino Arizona Pocket Mouse	*Perognathus amplus cineris*	Desertscrub habitats characterized by greasewood, ephedra, shortgrass, rabbitbrush	C2		FSS	yes	
Navajo Mountain Mexican Vole	*Microtus mexicanus navaho*	Dry grassy habitats adjacent to ponderosa pine, Western Mogollon Plateau, and Navajo Mountain from 6,500 to 11,500 feet	C2	T	NESL-4	no	low
Hualapai Mexican Vole	*Microtus mexicanus hualpaiensis*	Dry grassy habitat adjacent to ponderosa pine, Hualapai Mountains, and Prospect Valley from 6,500 to 11,500 feet	E	E	FSS	no	moderate
Marble Canyon, or Houserock Valley, Chisel-toothed Kangaroo Rat	*Dipodomys microps leucotis*	Mohave desertscrub and juniper grasslands; lower elevations north of the Colorado River 3,500 to 5,400 feet	C2	C	NESL-4	no	low
New Mexico Banner-tailed Kangaroo Rat	*Dipodomys spectabilis baileyi*	Desert grasslands with catclaw, mesquite, and Opuntia, from 1,300 to 5,000 feet		E		no	moderate
Chuska Tassel-eared Squirrel	*Sciurus aberti chuscensis*	7,000 to 8,500 feet elevation yellow pine forests; Chuska and Lukachukai mountains			NESL-4	yes	
Black-footed Ferret	*Mustela nigripes*	Associated with prairie dog towns located in plains and desert grasslands	E	E	NESL-2 FSS	no	reintroduction in Aubrey Valley, March 1996

TABLE D-2b
SPECIAL STATUS SPECIES - ARIZONA

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Species		Habitat Type	Status			Occurrence	
Common Name	**Scientific Name**		**Fed**	**State**	**Other**	**Known**	**Potential**
Southwestern River Otter	*Lutra canadensis sonora*	Along streams and lakes; Lake Mead NRA	C2	E	NESL-1 FSS	no	low
Black Bear	*Ursus americanus*	Montane forests; Chuska Mountains			EI	yes	
American Pronghorn Antelope	*Antilocapra americana*	Plains and meadows of grasslands characterized by rolling or dissected hills			NESL-3	yes	
Mule Deer	*Odocoileus hemionus*	Coniferous forests, desert shrub, and chaparral; grassland with shrubs			EI	yes	
Desert Bighorn Sheep	*Ovis canadensis nelsoni*	Open areas in mountains			NESL-3	yes	
Mountain Lion	*Felis concolor*	Rugged mountains and forests (i.e., Chuska and Black mountains)			NESL-4	yes	high
BIRDS+							
American Bittern	*Botaurus lentiginosus*	Fresh water and brackish marshes; tall vegetation		C		no	low
Western Least Bittern	*Ixobrychus exilus hesperis*	Fresh water marshes; tall vegetation	C2	C		no	low
Green-backed Heron	*Butorides striatus*	Permanent or ephemeral wetlands			NESL-4	no	moderate
Black-crowned Night-heron	*Nycticorax nycticorax*	Permanent or ephemeral wetlands			NESL-4	no	moderate
Snowy Egret	*Egretta thula*	Permanent or ephemeral wetlands		T		no	moderate

TABLE D-2b
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Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
White-faced Ibis	*Plegadis chihi*	Permanent or ephemeral wetlands	C2			no	high
Belted Kingfisher	*Ceryle alcyon*	Along fresh or marine water courses			FSS NESL-4	yes	
Osprey	*Pandion haliaetus*	Riparian		T	FSS	no	high
Bald Eagle	*Haliaeetus leucocephalus*	Riparian; Little Colorado and Colorado river woodlands	E	E	NESL-3 BEA	yes	
Golden Eagle	*Aquila chrysaetos*	Open country in prairies and open forest. Nest on cliff ledges and in trees; Twin Buttes, Shonto Butte; Hopi Buttes, and Chuska Mountains			NESL-3 BEA BLMS	yes	
Ferruginous Hawk	*Buteo regalis*	Open prairies, plains, and badlands near streams; Hualapai Valley	C2	T	FSS NESL-3 BLMS	yes	
Swainson's Hawk	*Buteo swainsoni*	Savanna, open pine-oak woodland, cultivated areas with scattered trees; Hualapai Valley	C3 (sub-group 3C)		NESL-2 BLMS FSS	yes	
Northern Goshawk	*Accipiter gentilis*	Deciduous and coniferous forest edges, open woodland	C2	C	NESL-4 FSS	yes	
Northern Harrier	*Circus cyaneus*	Prairies, meadows, grasslands, and marshes			NESL-4	yes	

TABLE D-2b
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Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
American Peregrine Falcon	*Falco peregrinus anatum*	Open situations involving nesting cliffs; Grand Wash Cliffs, Music Mountains, Colorado River, Black Mesa	E	C	NESL-3 FSS	no	high
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	Migrant	T			no	low
Flammulated Owl	*Otus flammeolus*	Primarily ponderosa pine and montane forests with a well-developed understory			NESL-4 FSS	no	high
Mexican Spotted Owl	*Strix occidentalis lucida*	Dense forest, both coniferous and hardwood, steep walled canyons; Chuska Mountains	T (with critical habitat)	T	NESL-3 FSS	yes	
Northern Pygmy-owl	*Glaucidium gnoma*	Coniferous, hardwood, mixed and pine-oak associations in both dense and open forests			NESL-4	no	high
Snowy Plover	*Charadrius alexandrinus*	Barren sandy beaches and dry mud or salt flats		C		no	low
Mountain Plover	*Charadrius montanus*	Dry upland prairies and plains, plowed fields, and sandy deserts	C1		NESL-4	no	low
Black Tern	*Chlidonas niger*	Lake shores and marshes and wet meadows; migrates along Colorado River	C2			no	high
American Dipper	*Cinclus mexicanus*	Along mountain streams from 4,000 feet to timberline in the Chuska Mountains; transient along the Colorado River			NESL-3	no	moderate

TABLE D-2b
SPECIAL STATUS SPECIES - ARIZONA

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Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Sora	*Porzana carolina*	Permanent wetlands; grain fields			NESL-4	no	low
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	Open woodlands, stream-side willow and alder groves and mesquite bosques	3B	T	NESL-4	no	low
Three-toed Woodpecker	*Picoides tridactylus*	Coniferous forests, especially areas burned over; known from San Francisco Mountains			NESL-4	no	low
Common Snipe	*Gallinago gallinago*	Year-round range extended to Four Corners area			NESL-3	yes	
Scaled Quail	*Callipepla squamata*	Desert grasslands, thorn scrubland			EI	no	low
Blue Grouse	*Dendragapus obscurus*	Mixed coniferous forest and deciduous trees and shrubs; Chuska Mountains			NESL-3 EI	yes	
Merriam's Turkey	*Meleagris gallopavo merriami*	Montane forest and open woodland, meadows; Chuska Mountains			EI	yes	
Loggerhead Shrike	*Lanius ludovicianus*	Savanna, desert scrub, and less often, open woodland	C2			no	high
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Buttonbush swamps of Sonoran zones, dense willow	E (with desig-nated critical habitat)	E	NESL-3	no	low

TABLE D-2b
SPECIAL STATUS SPECIES - ARIZONA

Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project

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Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Hammond's Flycatcher	*Empidonax hammondii*	Fir forest and open woodland; 8,500 to 10,000 feet			NESL-4	no	moderate
Black-billed Magpie	*Pica pica*	Riparian and open woodland areas		C		no	low
Gray Catbird	*Dumetella carolinensis*	Dense shrub along forest edge		T		no	low
Purple Martin	*Progne subis*	Near permanent water source and in suburban areas			NESL-4	no	moderate
Yellow Warbler	*Dendroica petechia*	Open woodlands, wetlands, and orchards			NESL-4	no	high
Clark's Grebe	*Aechmophorus clarkii*	Broad freshwater lakes; known from lakes along the Colorado River			NESL-4	no	moderate
Tree Swallow	*Tachycineta bicolor*	Riparian habitat; rare in northern Arizona			NESL-4	no	low
Marsh Wren	*Cistothorus palustris*	Reedy marshes, or cattail swamps			NESL-4	no	low
California Condor	*Gymnogyps californianus*	Mountains and arid foothills	E	E		no	scheduled for reintroduction
Pine Grosbeak	*Pinicola enucleator*	Open coniferous woods and suburban areas		C		no	low

TABLE D-2b
SPECIAL STATUS SPECIES - ARIZONA

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Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
REPTILES AND AMPHIBIANS							
Northern Leopard Frog	*Rana pipiens*	Desert lowland to mountainous water sources; Tappen Springs		C	NESL-4	yes	
Lowland Leopard Frog	*Rana yavapaiensis*	Aquatic		C		no	moderate
Chorus Frog	*Pseudacris triseriata*	Aquatic			NESL-4	no	low
Arizona Toad	*Bufo microscaphus microscaphus*	Aquatic; headwaters of tributaries of the Colorado River; known from Milkweed Canyon	C2			yes	
Desert Tortoise (Sonoran Population)	*Gopherus agassizii*	Mohave desertscrub	C2	C	FSS	yes	
Chuckwalla	*Sauromalus obesus*	Mohave desertscrub, rocky areas	C2		NESL-4	yes	
Banded Gila Monster	*Heloderma suspectum circtum*	Mohave desertscrub	C2		BLMS	yes	
Milk Snake	*Lampropeltis triangulum*	Variety of habitats, drainage of Little Colorado			NESL-4	yes	
Mexican Garter Snake	*Thamnophis eques*	Pine oak forest, mesquite grassland, and desert in or near water	C2	C		no	moderate
Narrow-headed Garter Snake	*Thamnophis rufipunctatus*	Piñon-juniper, oak-pine, into ponderosa pine forests along permanent or semi- permanent streams	C2	C	FSS	no	moderate

TABLE D-2b
SPECIAL STATUS SPECIES - ARIZONA

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Species			Status			Occurrence	
Common Name	**Scientific Name**	**Habitat Type**	**Fed**	**State**	**Other**	**Known**	**Potential**
FISHES (many of the occurrences are based on historical range)							
Gila Trout	*Oncorhynchus gilae*	Aquatic	E	E		no	low
Apache Trout	*Oncorhynchus apache*	Aquatic	T	T		no	low
Roundtail Chub	*Gila robusta*	Aquatic; Colorado River	C2	T	NESL-2	yes	
Bonytail Chub	*Gila elegans*	Aquatic; Colorado River (designated critical habitat) Lake Mohave	E	E	NESL-1	no	moderate
Humpback Chub	*Gila cypha*	Aquatic; Little Colorado River; designated Colorado River (critical habitat)	E	E	NESL-2 FSS	yes	
Gila Chub	*Gila intermedia*	Aquatic; Gila River basin	C2	T		no	none
Razorback Sucker	*Xyrauchen texanus*	Aquatic, Colorado River (designated critical habitat) Lake Mohave	E	E	NESL-2 FSS	yes	
Flannelmouth Sucker	*Catostomus lattipinnis*	Aquatic; Little Colorado and Tappen Wash	C2		NESL-4	yes	
Zuni Bluehead Sucker	*Pantosteus discobolos yarrowi*	Aquatic		C		yes	
Little Colorado Spinedace	*Lepidomeda vittata*	Aquatic	T	T		no	moderate
Speckled Dace	*Rhinichthys osculus*	Aquatic; pool-and-riffle creeks; generally above 3,500 feet elevation	C2		NESL-4	yes	
Mottled Sculpin	*Cottus bairdi*	Aquatic			NESL-4	yes	

TABLE D-2b
SPECIAL STATUS SPECIES - ARIZONA

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Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Colorado Squawfish	*Ptychocheilas lucius*	Aquatic; Colorado River (designated critical habitat)	E	E	NESL-2	no	low
INVERTEBRATES							
Arizona Giant Sand Treader Cricket	*Daihinibaenetes arizonensis*	Sandy washes, dunes	C2			no	low
Blue-black Silverspot Butterfly	*Speyeria nokomis nigrocaerulea*	Streamside meadows	C3 (sub-group 3B)		NESL-4	no	low
Navajo Jerusalem Cricket	*Stenopelmatus navajo*	Sandy washes, dunes	C2			no	low
PLANTS							
Goodding Onion	*Allium gooddingii*	Mature forests along north-trending drainage bottoms; mixed conifer and spruce-fir woodlands	C1	C1 ANPL	FSS NESL-3	no	moderate
Roaring Springs Prickle Poppy	*Argemone arizonica*	Steep slopes; pine forests, 3,300 to 6,500 feet elevation	C2	C2	FSS	no	moderate
Welsh's Milkweed	*Asclepias welshii*	Semi-stabilized and actively shifting sand dunes; open, sparsely vegetated	T	T ANPL	NESL-4	no	moderate
Freckled Milkvetch	*Astragalus lentiginosus var. ambiguus*	Limestone or granite on open hillsides	C2	C2		no	high

TABLE D-2b
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Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Gladiator Milkvetch	*Astragalus xiphoides*	Gypsum or gypsiferous sand near the Chinle Formation	C2	C2	NESL-4	yes	
Atwood's Camissonia	*Camissonia atwoodii*	Salt desertshrub community	C2		NESL-4	no	low
Primrose	*Camissonia specuicola ssp. hesperia*	Havasu and Hualapai Canyons, Separation to Spencer Canyon; 2,300 to 3,500 feet	C2	C2		no	low
Navajo Sedge	*Carex specuicola*	Vertical cliffs of Navajo pink sandstone; seep-springs	T (with critical habitat)	T ANPL	NESL-3	yes	
Tusayan or disturbed Rabbitbrush	*Chrysothamnus molestus*	Calcareous deposits piñon-juniper woodlands or Great Basin grasslands	C2	C2	NESL-4	yes	
Arizona Leatherflower	*Clematis hirsutissima var. arizonica*	Kaibab limestone; piñon-juniper woodlands/ponderosa pine transition zone	C1	C1 ANPL	FSS NESL-4	no	high
Cameron Water-parsley, or Bighead Water Parsnip	*Cymopterus megacephalus*	Moenkopi shale near Little Colorado River	C2	C2		no	moderate
Ripley Wild Buckwheat	*Eriogonum ripleyi*	Tertiary lake bed deposits	C2	C2		no	low
Flagstaff Pennyroyal	*Hedeoma diffusum*	Outcrops of dolomitic upper Kaibab limestone, level open spots; ponderosa pine forests, 6,000 to 7,000 feet elevation	C3 (sub-group 3C)		FSS NESL-4	no	low

TABLE D-2b
SPECIAL STATUS SPECIES - ARIZONA

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Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Brady Pincusion Cactus	*Pediocactus bradyi*	Kaibab limestone overlying soils derived from Moenkopi shale and sandstone outcrops; Great Basin desertscrub	E	E ANPL	NESL-2	no	moderate
Fickeisen Plains Cactus	*Pediocactus peeblesianus var. fickeiseniae*	Kaibab limestone; Great Basin desert, Great Plains grasslands	C1	C1 ANPL	FSS NESL-3	no	high
Peebles Navajo Cactus	*Pediocactus peeblesianus var. peeblesianus*	Gravelly soils of the Shinarump conglomerate of the Chinle formation; sparsely scattered shrubs, 5,400 to 5,600 feet elevation	E	E ANPL		no	low
Rosy Twotone Beardtongue	*Penstemon bicolor ssp. roseus*	Gravelly soils, washes; Mohave desertscrub	C2			no	high
Sunset Crater Beardtongue	*Penstemon clutei*	Cinder cones; ponderosa pine parklands	C2	C2		yes	
Nipple Beach Phacelia	*Phacelia mammilarensis*	Salt and mixed desertscrub communities	C3 (sub-group 3C)			yes	
Cinder Phacelia	*Phacelia serrata*	Volcanic cinder substrate	C2	C2		yes	
Welsh Phacelia	*Phacelia welshii*	Gravelly washes, Moenkopi formation; Great Basin desertscrub	C2	C2	NESL-4	no	moderate
Arizona Cinquefoil	*Potentilla multifoliolata*	Gravelly washes; 6,000 to 7,500 feet elevation	C3 (sub-group 3C)	3C	FSS	no	low

TABLE D-2b
SPECIAL STATUS SPECIES - ARIZONA

Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project

(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Whiting Indigo Bush	*Psorothamnus thompsoniae var. whitingii*	Sandy clays; Great Basin desertscrub	C2	C2	NESL-4	no	high
Parish Alkali Grass	*Puccinellia parishii*	Moist, saline soils; variety of habitats	PE	PE ANPL	NESL-2	no	moderate
Arizona Cliffrose	*Purshia subintegra*	Tertiary limestone lakebed deposits	E	E ANPL		no	low
Grand Canyon Rose	*Rosa stellata ssp. abyssa*	Limestone derived soils	C2	C2	FSS	no	low
San Francisco Peaks Groundsel	*Senecio franciscanus*	Talus slopes; spruce-fir or bristlecone forests	T	T ANPL		no	none
Tusayan Flame Flower	*Talinum validulum*	Shallow, rocky soils; piñon-juniper woodlands, ponderosa pine forests	C2	C2		yes	

* Status definitions are found in text.
Sources: AGFD 1994; FWS 1993 a,b,c, 1995; Kearney and Peebles 1960; Morefield and Knight 1991; NFWD, NHP 1993; Rutman 1992; Welsh et al. 1987

TABLE D-2c
SPECIAL STATUS SPECIES - NEVADA

Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project

(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
MAMMALS							
Spotted Bat	*Euderma maculatum*	Variety of habitat types	C2	R		no	moderate
Greater Western Mastiff Bat	*Eumops perotis*	Crevices and shallow caves in desertscrub communities	C2			no	low
Allen's Big-eared Bat	*Idionycteris phyllotis*	Mountainous forested habitats	C2			no	low

KEY:

Occurrence (determined for those species not known to occur)

High = known to be within species range, and habitat exists, but for which known locations have not been identified.
Moderate = within species range but little habitat exists, or migrating only.
Low = within species range but lacking habitat.

Status*

Federal:
- E = Endangered
- T = Threatened
- PE = Proposed Endangered
- C1 = Category 1
- C2 = Category 2
- C3 - Category 3
  - 3A = Extinct
  - 3B = Taxonomically Invalid
  - 3C = Dropped from consideration

Nevada: (wildlife)
- P = Protected
- E = Endangered
- R = Rare
- SC = Species of Special Concern
- S = Sensitive

Nevada: (plants)
- CE = critically endangered
- CE# = recommended for listing as CE
- CY = Cactus and Yucca Law
- NNNPS = Northern Nevada Native Plant Society
- E = Endangered
- T = Threatened
- W = Watch
- D = Delete

Other:
- BEA = Bald Eagle Act
- BLMS = BLM Sensitive
- EI = Economic Importance
- +MBTA = Migratory Bird Treaty Act (Note: All birds listed are protected by this act; therefore, "MBTA" is not listed under status.)

TABLE D-2c
SPECIAL STATUS SPECIES - NEVADA

Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project
(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	**Scientific Name**		**Fed**	**State**	**Other**	**Known**	**Potential**
California Leaf-nosed Bat	*Macrotis californicus*	Caves and mines in desertscrub habitat	C2			no	moderate
Small-footed Myotis	*Myotis leibii*	Variety habitats in the vicinity of water	C2			no	moderate
Long-eared Myotis	*Myotis evotis*	Piñon-juniper woodlands	C2			no	low
Fringed Myotis	*Myotis thysanodes*	Primarily inhabit oak-piñon woodlands but are found from desertscrub to fir forests	C2			no	moderate
Cave Myotis	*Myotis velifer*	Desertscrub communities in close proximity to water	C2			no	moderate
Long-legged Myotis	*Myotis volans*	Primarily inhabit conifer forests but may occur in desertscrub habitats near water	C2			no	moderate
Yuma Myotis	*Myotis yumanensis*	Desertscrub and grasslands with a permanent water source nearby	C2			no	high
Pale Townsend's Big-eared Bat	*Plecotus townsendii*	Ponderosa pine forests, deciduous forests, and piñon-juniper woodlands	C2			no	low
Southwestern River Otter	*Lutra canadensis sonora*	Along streams and lakes; Lake Mead NRA	C2			no	low
Desert Bighorn Sheep	*Ovis canadensis*	Open areas near broken escape country			EI	yes	
BIRDS+							
Western Least Bittern	*Ixobrychus exilus hesperis*	Fresh water marshes; tall vegetation	C2			no	moderate

TABLE D-2c
SPECIAL STATUS SPECIES - NEVADA

Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project

(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
White-faced Ibis	*Plegadis chihi*	Permanent or ephemeral wetlands	C2	P		no	moderate
Belted Kingfisher	*Ceryle alcyon*	Along fresh water courses		P		yes	
Osprey	*Pandion haliaetus*	Riparian; along Lower Colorado River		P		no	high
Bald Eagle	*Haliaeetus leucocephalus*	Riparian; Colorado River woodlands.	E	E	BEA	yes	
Golden Eagle	*Aquila chrysaetos*	Open country in prairies, tundra, and open forest; nest on cliff ledges and in trees		P	BEA BLMS	yes	
Ferruginous Hawk	*Buteo regalis*	Open prairies, plains, and badlands near streams	C2	P	BLMS	yes	
Southwestern Willow Flycatcher	*Empidonax traillii extimis*	Dense multistory riparian habitats; cottonwood-willow or tamarisk	E			no	moderate
Northern Harrier	*Circus cyaneus*	Prairies, meadows, grasslands, and marshes		P		no	moderate
American Peregrine Falcon	*Falco peregrinus anatum*	Open grassland areas for foraging with adjacent cliffs for nesting	E	E	NESL-3	yes	
Burrowing Owl	*Athene cunicularia*	Prairie, plains, and savanna		P		no	high
Barn Owl	*Tyto alba*	Variety of habitat types		P		yes	

TABLE D-2c
SPECIAL STATUS SPECIES - NEVADA

Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project

(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	**Scientific Name**		**Fed**	**State**	**Other**	**Known**	**Potential**
Mountain Plover	*Charadrius montanus*	Dry upland prairies and plains, semidesert, plowed fields, and sandy deserts	C1			no	low
Black Tern	*Chlidonas niger*	Lake shores and marshes	C2			no	high
Loggerhead Shrike	*Lanius ludovicianus*	Savanna, desert scrub, and less often, open woodland	C2			yes	
REPTILES AND AMPHIBIANS							
Desert Tortoise (Mojave population)	*Gopherus agassizii*	Mohave desertscrub	T	P		yes	
Chuckwalla	*Sauromalus obesus*	Mohave desertscrub	C2		NESL-4	yes	
Banded Gila Monster	*Heloderma suspectum circtum*	Mohave desertscrub	C2	P	BLMS	yes	
FISHES							
Roundtail Chub	*Gila robusta*	Aquatic; Colorado River	C2	P,R		yes	
Bonytail Chub	*Gila elegans*	Lake Mohave	E	P		no	moderate
Humpback Chub	*Gila cypha*	Aquatic; Colorado River (designated critical habitat); Little Colorado River	E			yes	
Razorback Sucker	*Xyrauchen texanus*	Lake Mohave	E	P		yes	

TABLE D-2c
SPECIAL STATUS SPECIES - NEVADA

Special Status Species Likely to Occur in the Habitats Traversed by the Alternative Routes for the Navajo Transmission Project
(Note: This includes species identified as occurring or potentially occurring along all alternative routes inventoried in the data supporting this DEIS.)

Species		Habitat Type	Status			Occurrence	
Common Name	Scientific Name		Fed	State	Other	Known	Potential
Flannelmouth Sucker	*Catostomus lattipinnis*	Aquatic; Colorado River	C2			yes	
Colorado Squawfish	*Ptychocheilas lucius*	Aquatic, Colorado River (designated critical habitat)	E	E		yes	
PLANTS							
White Bear Desert Poppy	*Arctomecon merriami*	Rocky slopes, barren limestone outcroppings; creosotebush and blackbrush series	C2		NNNPS-W	no	moderate
Curve-podded Mojave Milkvetch	*Astragalus mohavensis var. hemigyrus*	Limestone ledges and gravelly hillsides; associated with creosotebush and junipers, elevations range from 4,065 to 6,070 feet	C2	CE#	NNNPS-E	no	low
Yellow Twotone Beardtongue	*Penstemon bicolor ssp. bicolor*	Gravelly soils, washes; Mohave desertscrub	C2		NNNPS-W	no	high
Rosy Twotone Beardtongue	*Penstemon bicolor ssp. roseus*	Gravelly soils, washes; Mohave desertscrub	C2		NNNPS-D	no	high

* Status definitions are found in text. Sources: FWS 1993a,b,c; NFWD, NNHP 1993

TABLE D-3 UNIQUE HABITATS			
Feature	**Associated Species***	**Other Attributes**	**Links**
	New Mexico		
The Hogback (BLM-within The Hogback ACEC; Navajo Nation)	Endangered: Mancos milkvetch Threatened: Mesa Verde cactus Other: pronghorn, mule deer, mountain lion, Cottam's milkvetch, Monument Valley milkvetch, handsome cat's-eye, splendid phacelia, Eastwood phacelia	The Hogback is a unique geologic outcropping, which occurs where several biogeographical provinces meet.	100, 240, 640
San Juan River (BLM, Navajo Nation)	Endangered: Aquatic habitat is designated critical habitat for Colorado squawfish and razorback sucker. Riparian habitat supports wintering bald eagles and (potentially) southwestern willow flycatcher. Candidate C2: roundtail chub, flannelmouth sucker, white-faced ibis Other: Zuni bluehead sucker, mottled sculpin	peregrine falcon may inhabit adjacent cliffs; three transmission lines cross the river	240, 460
Beautiful Mountain (part of the Chuska Mountains) (Navajo Nation)	Threatened: Mexican spotted owl (designated critical habitat) Candidate C1: Goodding onion, Arizona leatherflower Candidate C2: Northern goshawk Other: Chuska Mountains milkvetch, Chuska Mountains tassel-eared squirrel	Ponderosa pine and mixed conifer forests are present in the project area only here; big game (mule deer, elk, bear, and wild turkey); most biologically diverse area in project area	700
	Arizona		
Chuska Mountains (Navajo Nation)	Threatened: Mexican spotted owl (designated critical habitat) Candidate C1: Goodding onion, Arizona leatherflower Other: Chuska Mountains milkvetch Chuska Mountains tassel-eared squirrel	Ponderosa pine and mixed conifer forests occur in the project area only here; big game (mule deer, elk, bear, and wild turkey); most biologically diverse area in project area	700
Aubrey Valley (BLM, state, private, Navajo Nation)	Endangered: management area for reintroduction of black-footed ferret population designated as "nonessential, experimental"	extensive habitat for pronghorn	1740, 1741, 1742, 1790
Hualapai Valley (BLM, Hualapai Tribe, private)	Candidate C2: ferruginous hawk, loggerhead shrike Other: Swainson's hawk	nesting areas for raptors exist	2020, 2040, 2060

TABLE D-3 UNIQUE HABITATS			
Feature	**Associated Species***	**Other Attributes**	**Links**
Black Mountains (BLM, NPS)	Candidate C2: desert tortoise (Sonoran population), chuckwallas, banded Gila monster	habitat and lambing grounds for bighorn sheep	2040, 2060
Arizona and Nevada			
Colorado River (NPS Lake Mead NRA, state)	Endangered: Aquatic habitat is designated critical habitat for bonytail chub and razorback sucker. Riparian habitat supports wintering bald eagles and (potentially) southwestern willow flycatcher. Peregrine falcon may inhabit adjacent cliffs Candidate C2: flannelmouth sucker, southwestern river otter	Game species that occur in Lake Mohave include largemouth bass, striped bass, channel catfish, rainbow trout, black crappie, bluegill, and green sunfish. Nongame species include carp and threadfin shad.	2040, 2060
Nevada			
Eldorado Mountains (BLM, state, private)	Threatened: desert tortoise (Mojave population) designated critical habitat Candidate C2: chuckwalla, rosy and yellow twotone beardtongues, banded Gila monster	habitat and lambing grounds for bighorn sheep	2040, 2060
Eldorado Valley (BLM, state, private)	Threatened: desert tortoise (Mojave population) designated critical habitat Candidate C2: chuckwalla, rosy and yellow twotone beardtongues, banded Gila monster	The proposed Paiute-Eldorado Desert Wildlife Management Area encompasses a portion of the western edge of the project area.	2040, 2080, 2200, 2180
Colorado River (NPS Lake Mead NRA, state)	Endangered: Aquatic habitat is designated critical habitat for bonytail chub and razorback sucker; Riparian habitat supports wintering bald eagles and (potentially) southwestern willow flycatcher. Peregrine falcon may inhabit adjacent cliffs Candidate C2: roundtail chub and flannelmouth sucker; black tern, western least bittern, white-faced ibis	Game species that occur in Lake Mohave include largemouth bass, striped bass, channel catfish, rainbow trout, black crappie, bluegill, and green sunfish. Nongame species include carp and threadfin shad.	2040, 2060
*Includes species for which habitat occurs along an alternative route, but for which specific locations have not been identified.			

TABLE D-4
BIOLOGICAL RESOURCES SENSITIVITY LEVELS

Low	Moderate	High
Vegetation Types		
Great Basin/Plains Grassland Mohave Desertscrub Great Basin Desertscrub	Piñon-Juniper Woodland Ponderosa Pine Forest	Sand Dune Scrub Mixed Conifer Forest Riparian Areas Wetlands
Special Status Plants		
Monument Valley Milkvetch Gladiator Milkvetch Disturbed Rabbitbrush Handsome Cat's-eye Rosy Twotone Beardtongue Yellow Twotone Beardtongue Eastwood Phacelia Cottam's Milkvetch Mancos Saltbush	Roaring Springs Prickly Poppy Chuska Mountain Milkvetch Naturita Milkvetch Cameron Water-parsley Fickeisen Plains Cactus Sunset Crater Beardtongue* Cinder Phacelia* Welsh Phacelia Whiting Indigobush Tusayan Flame Flower Freckled Milkvetch Arizona Leatherflower	Goodding Onion Mancos Milkvetch Navajo Sedge Welsh's Milkweed Parish Alkali Grass Mesa Verde Cactus
Special Status Wildlife		
Northern Harrier Flammulated Owl* Ferruginous Hawk Long-billed Curlew* Lowland Leopard Frog Chorus Frog Chuckwalla Roundtail Chub Flannelmouth Sucker Speckled Dace	Osprey Swainson's Hawk Barn Owl Pygmy Owl* Chuska Tassel-eared Squirrel Southwestern River Otter Northern Goshawk Bald Eagle Southwestern Willow Flycatcher Arizona Toad Northern Leopard Frog Desert Tortoise (Sonoran Population) Blue-black Silverspot Butterfly* Humpback Chub Zuni Bluehead Sucker*	Coconino Arizona Pocket Mouse Hualapai Mexican Vole Black-footed Ferret Golden Eagle Peregrine Falcon Mexican Spotted Owl Desert Tortoise (Mojave Population) Gila Monster Bonytail Chub Little Colorado River Spinedace Colorado Squawfish Razorback Sucker
Big Game		
Black Bear Mule Deer Elk Mountain Lion Wild Turkey	Pronghorn Antelope	Desert Bighorn

This table includes all species for the project area. Several species listed above (marked with an *) occur only along links that were eliminated from further consideration in the DEIS.

TABLE D-5 SUMMARY OF POTENTIAL IMPACTS ON VEGETATION						
Alternative Route	Impact	Vegetation Type	Miles of Impacts			Total
			NM	AZ	NV	
EASTERN AREA ALTERNATIVES						
GC1	L	Great Basin Desertscrub	26.1	151.8	—	177.9
GC1	L	Great Basin/Plains Grassland	8.0	40.2	—	48.2
GC1	L	Piñon-Juniper Woodland	0.4	30.3	—	30.7
GC1	M	Piñon-Juniper Woodland	—	0.3	—	0.3
GC1	L	Riparian/Salt Cedar/Greasewood	0.3	3.1	—	3.4
GC1	L	Wetlands/Aquatic	0.1	—	—	0.1
K1	L	Great Basin Desertscrub	26.1	138.6	—	164.7
K1	L	Great Basin/Plains Grassland	8.0	35.8	—	43.8
K1	L	Piñon-Juniper Woodland	0.4	32.1	—	32.5
K1	M	Piñon-Juniper Woodland	—	0.3	—	0.3
K1	L	Riparian/Salt Cedar/Greasewood	0.3	3.0	—	3.3
K1	L	Wetlands/Aquatic	0.1	—	—	0.1
C1	L	Bare Rock	0.9	—	—	0.9
C1	L	Great Basin Desertscrub	23.9	26.8	—	50.7
C1	L	Great Basin/Plains Grassland	13.6	86.3	—	99.9
C1	L	Piñon-Juniper Woodland	1.3	25.2	—	26.5
C1	L	Ponderosa Pine Woodland		6.8	—	6.8
C1	L	Riparian/Salt Cedar/Greasewood	0.4	1.4	—	1.8
C1	L	Wetlands/Aquatic	0.1	—	—	0.1
C2	L	Great Basin Desertscrub	26.1	73.6	—	99.7
C2	L	Great Basin/Plains Grassland	8.0	83.2	—	91.2
C2	L	Piñon-Juniper Woodland	0.4	18.0	—	18.4
C2	L	Riparian/Salt Cedar/Greasewood	0.3	1.3	—	1.6
C2	L	Wetlands/Aquatic	0.1	—	—	0.1

TABLE D-5 SUMMARY OF POTENTIAL IMPACTS ON VEGETATION						
Alternative Route	Impact	Vegetation Type	Miles of Impacts			Total
			NM	AZ	NV	
WESTERN AREA ALTERNATIVES						
Moenkopi to Marketplace						
N1W	L	Great Basin Desertscrub	—	5.1	—	5.1
N1W	L	Great Basin/Plains Grassland	—	86.2	—	86.2
N1W	L	Mohave Desertscrub	—	44.7	29.5	74.2
N1W	L	Piñon-Juniper Woodland	—	49.3	—	49.3
N1W	L	Riparian/Salt Cedar/Greasewood	—	0.6	0.4	1.0
N1W	L	Sand Dune Scrub/Bare Sand	—	0.2	—	0.2
N1W	L	Wetlands/Aquatic	—	0.9	0.1	1.0
N2	L	Bare Rock	—	1.7	—	1.7
N2	L	Great Basin Desertscrub	—	5.1	—	5.1
N2	L	Great Basin/Plains Grassland	—	95.7	—	95.7
N2	L	Mohave Desertscrub	—	58.7	29.5	88.2
N2	L	Piñon-Juniper Woodland	—	32.2	—	32.2
N2	L	Riparian/Salt Cedar/Greasewood	—	0.6	0.4	1.0
N2	L	Sand Dune Scrub/Bare Sand	—	0.2	—	0.2
N2	L	Wetlands/Aquatic	—	0.9	0.1	1.0
S2	L	Bare Rock	—	1.1	—	1.1
S2	L	Great Basin Desertscrub	—	4.2	—	4.2
S2	L	Great Basin/Plains Grassland	—	92.0	—	92.0
S2	L	Mohave Desertscrub	—	55.1	29.5	84.6
S2	L	Piñon-Juniper Woodland	—	58.9	—	58.9
S2	L	Riparian/Salt Cedar/Greasewood	—	1.8	0.4	2.2
S2	L	Sand Dune Scrub/Bare Sand	—	4.6	—	4.6
S2	L	Wetlands/Aquatic	—		0.1	0.1

TABLE D-5 SUMMARY OF POTENTIAL IMPACTS ON VEGETATION						
Alternative Route	Impact	Vegetation Type	Miles of Impacts			Total
			NM	AZ	NV	
Moenkopi to Mead						
N3	L	Great Basin Desertscrub	—	5.1	—	5.1
N3	L	Great Basin/Plains Grassland	—	86.2	—	86.2
N3	L	Mohave Desertscrub	—	46.1	9.1	55.2
N3	L	Piñon-Juniper Woodland	—	49.3	—	49.3
N3	L	Riparian/Salt Cedar/Greasewood	—	0.5	1.8	2.3
N3	L	Sand Dune Scrub/Bare Sand	—	0.2	—	0.2
N3	L	Wetlands/Aquatic	—	1.0	—	1.0
N4	L	Bare Rock	—	1.7	—	1.7
N4	L	Great Basin Desertscrub	—	5.1	—	5.1
N4	L	Great Basin/Plains Grassland	—	95.7	—	95.7
N4	L	Mohave Desertscrub	—	60.1	9.1	69.2
N4	L	Piñon-Juniper Woodland	—	32.2	—	32.2
N4	L	Riparian/Salt Cedar/Greasewood	—	0.5	1.8	2.3
N4	L	Sand Dune Scrub/Bare Sand	—	0.2	—	0.2
N4	L	Wetlands/Aquatic	—	1.0	—	1.0
S4	L	Bare Rock	—	1.1	—	1.1
S4	L	Great Basin Desertscrub	—	4.2	—	4.2
S4	L	Great Basin/Plains Grassland	—	92.0	—	92.0
S4	L	Mohave Desertscrub	—	56.5	9.1	65.6
S4	L	Piñon-Juniper Woodland	—	58.9	—	58.9
S4	L	Riparian/Salt Cedar/Greasewood	—	1.7	1.8	3.5
S4	L	Sand Dune Scrub/Bare Sand	—	4.6	—	4.6
S4	L	Wetlands/Aquatic	—	0.1	—	0.1

TABLE D-6 SUMMARY OF POTENTIAL IMPACTS ON KNOWN HABITAT OF SPECIAL STATUS PLANTS							
Alternative Route	Impact	Special Status Plants	Federal Status	Miles of Impacts			Total
				NM	AZ	NV	
EASTERN AREA ALTERNATIVES							
GC1	L	Mancos Milkvetch	E	2.7	—	—	2.7
GC1	L	Mesa Verde Cactus	T	1.7	—	—	1.7
GC1	L	Monument Valley Milkvetch	C2	1.6	—	—	1.6
GC1	L	Eastwood Phacelia	O	1.0	—	—	1.0
K1	L	Mancos Milkvetch	E	2.7	—	—	2.7
K1	L	Mesa Verde Cactus	T	1.7	—	—	1.7
K1	L	Monument Valley Milkvetch	C2	1.6	—	—	1.6
K1	L	Eastwood Phacelia	O	1.0	—	—	1.0
C1	M	Mancos Milkvetch	E	0.1	—	—	0.1
C1	L	Mancos Milkvetch	E	0.8	—	—	0.8
C1	L	Mesa Verde Cactus	T	1.2	—	—	1.2
C1	L	Monument Valley Milkvetch	C2	0.2	—	—	0.2
C1	L	Eastwood Phacelia	O	1.4	—	—	1.4
C2	L	Mancos Milkvetch	E	2.7	—	—	2.7
C2	L	Mesa Verde Cactus	T	1.7	—	—	1.7
C2	L	Monument Valley Milkvetch	O	1.6	—	—	1.6
C2	L	Eastwood Phacelia	O	1.0	—	—	1.0
WESTERN AREA ALTERNATIVES							
Moenkopi to Marketplace							
N1W	L	Tusayan Flame Flower	C2	—	0.8	—	0.8
N1W	L	Tusayan Rabbitbrush	C2	—	1.9	—	1.9
N2	L	Tusayan Flame Flower	C2	—	0.8	—	0.8
N2	L	Tusayan Rabbitbrush	C2	—	1.9	—	1.9

TABLE D-6 SUMMARY OF POTENTIAL IMPACTS ON KNOWN HABITAT OF SPECIAL STATUS PLANTS							
Alternative Route	**Impact**	**Special Status Plants**	**Federal Status**	**Miles of Impacts**			**Total**
				NM	**AZ**	**NV**	
S2	L	Tusayan Rabbitbrush	C2	—	6.8	—	6.8
Moenkopi to Mead							
N3	L	Tusayan Flame Flower	C2	—	0.8	—	0.8
N3	L	Tusayan Rabbitbrush	C2	—	1.9	—	1.9
N4	L	Tusayan Flame Flower	C2	—	0.8	—	0.8
N4	L	Tusayan Rabbitbrush	C2	—	1.9	—	1.9
S4	L	Tusayan Rabbitbrush	C2	—	6.8	—	6.8

TABLE D-7 SUMMARY OF POTENTIAL IMPACTS ON POTENTIAL HABITAT OF SPECIAL STATUS PLANTS							
Alternative Route	Impact	Special Status Plants	Federal Status	Miles of Impacts			Total
				NM	AZ	NV	
EASTERN AREA ALTERNATIVES							
GC1	L	Meas Verde Cactus	T	23.4	—	—	23.4
GC1	M	Navajo Sedge	T	—	0.5	—	0.5
GC1	L	Navajo Sedge	T	—	2.0	—	2.0
GC1	L	Fickeisen Plains Cactus	C1	—	2.2	—	2.2
GC1	L	Cameron Water-parsley	C2	—	2.6	—	2.6
GC1	L	Monument Valley Milkvetch	C2	0.5	—	—	0.5
GC1	L	Nipple Beach Phacelia	C2	—	0.2	—	0.2
GC1	L	Roaring Springs Prickly Poppy	C2	—	1.0	—	1.0
GC1	L	Tusayan Flame Flower	C2	—	6.9	—	6.9
GC1	L	Welsh Phacelia	C2	—	2.8	—	2.8
GC1	L	Cottam's Milkvetch	O	0.5	—	—	0.5
GC1	L	Eastwood Phacelia	O	24.1	—	—	24.1
GC1	L	Mancos Saltbrush	O	1.4	—	—	1.4
K1	L	Mesa Verde Cactus	T	23.4	—	—	23.4
K1	M	Navajo Sedge	T	—	0.5	—	0.5
K1	L	Navajo Sedge	T	—	2.0	—	2.0
K1	L	Fickeisen Plains Cactus	C1	—	2.2	—	2.2
K1	L	Cameron Water-parsley	C2	—	2.6	—	2.6
K1	L	Monument Valley Milkvetch	C2	0.5	—	—	0.5
K1	L	Roaring Springs Prickly Poppy	C2	—	1.0	—	1.0
K1	L	Tusayan Flame Flower	C2	—	6.9	—	6.9
K1	L	Welsh Phacelia	C2	—	2.8	—	2.8
K1	L	Cottam's Milkvetch	O	0.5	—	—	0.5

TABLE D-7 SUMMARY OF POTENTIAL IMPACTS ON POTENTIAL HABITAT OF SPECIAL STATUS PLANTS							
Alternative Route	Impact	Special Status Plants	Federal Status	Miles of Impacts			Total
				NM	AZ	NV	
K1	L	Eastwood Phacelia	O	24.1	—	—	24.1
K1	L	Mancos Saltbrush	O	1.4	—	—	1.4
C1	M	Mancos Milkvetch	E	0.3	—	—	0.3
C1	M	Mesa Verde Cactus	T	8.1	—	—	8.1
C1	L	Mesa Verde Cactus	T	8.7	—	—	8.7
C1	L	Gladiator Milkvetch	C2	—	0.1	—	0.1
C1	L	Monument Valley Milkvetch	C2	0.1	—	—	0.1
C1	L	Tusayan Flame Flower	C2	—	5.0	—	5.0
C1	L	Tusayan Rabbitbrush	C2	—	12.3	—	12.3
C1	L	Chuska Mountain Milkvetch	O	—	4.6	—	4.6
C1	L	Cottam's Milkvetch	O	0.2	—	—	0.2
C1	L	Eastwood Phacelia	O	17.7	—	—	17.7
C1	L	Mancos Saltbush	O	3.9	—	—	3.9
C1	L	Naturita Milkvetch	O	—	15.0	—	15.0
C2	M	Navajo Sedge	T	—	3.5	—	3.5
C2	L	Mesa Verde Cactus	T	23.4	—	—	23.4
C2	L	Monument Valley Milkvetch	C2	0.5	—	—	0.5
C2	L	Tusayan Flame Flower	C2	—	5.0	—	5.0
C2	L	Tusayan Rabbitbrush	C2	—	15.7	—	15.7
C1	L	Cottam's Milkvetch	O	0.5	—	—	0.5
C1	L	Eastwood Phacelia	O	24.1	—	—	24.1
C1	L	Mancos Saltbush	O	1.4	—	—	1.4
C1	L	Naturita Milkvetch	O	—	15.0	—	15.0

TABLE D-7 SUMMARY OF POTENTIAL IMPACTS ON POTENTIAL HABITAT OF SPECIAL STATUS PLANTS							
Alternative Route	**Impact**	**Special Status Plants**	**Federal Status**	**Miles of Impacts**			**Total**
				NM	**AZ**	**NV**	
WESTERN AREA ALTERNATIVES							
Moenkopi to Marketplace							
N1W	L	Fickeisen Plains Cactus	C1	—	0.8	—	0.8
N1W	L	Cameron Water-parsley	C2	—	4.0	—	4.0
N1W	L	Rosy Twotone Beardtongue	C2	—	—	18.1	18.1
N1W	M	Tusayan Flame Flower	C2	—	1.6	—	1.6
N1W	L	Tusayan Flame Flower	C2	—	14.9	—	14.9
N1W	L	Tusayan Rabbitbrush	C2	—	10.0	—	10.0
N1W	L	Welsh Phacelia	C2	—	3.9	—	3.9
N1W	L	Yellow Twotone Beardtongue	C2	—	—	17.4	17.4
N2	L	Fickeisen Plains Cactus	C1	—	0.8	—	0.8
N2	L	Cameron Water-parsley	C2	—	4.0	—	4.0
N2	L	Freckled Milkvetch	C2	—	0.8	—	0.8
N2	L	Roaring Springs Prickly Poppy	C2	—	6.8	—	6.8
N2	L	Rosy Twotone Beardtongue	C2	—	—	18.1	18.1
N2	M	Tusayan Flame Flower	C2	—	1.6	—	1.6
N2	L	Tusayan Flame Flower	C2	—	16.0	—	16.0
N2	L	Tusayan Rabbitbrush	C2	—	10.8	—	10.8
N2	L	Welsh Phacelia	C2	—	3.9	—	3.9
N2	L	Yellow Twotone Beardtongue	C2	—	—	17.4	17.4
S2	M	Fickeisen Plains Cactus	C1	—	0.2	—	0.2
S2	L	Fickeisen Plains Cactus	C1	—	1.6	—	1.6
S2	L	Cameron Water-parsley	C2	—	4.2	—	4.2
S2	L	Freckled Milkvetch	C2	—	0.1	—	0.1

TABLE D-7 SUMMARY OF POTENTIAL IMPACTS ON POTENTIAL HABITAT OF SPECIAL STATUS PLANTS							
Alternative Route	Impact	Special Status Plants	Federal Status	Miles of Impacts			Total
				NM	AZ	NV	
S2	L	Roaring Springs Prickly Poppy	C2	—	7.7	—	7.7
S2	L	Rosy Twotone Beardtongue	C2	—	—	18.1	18.1
S2	L	Tusayan Flame Flower	C2	—	25.6	—	25.6
S2	L	Tusayan Rabbitbrush	C2	—	1.0	—	1.0
S2	L	Welsh Phacelia	C2	—	2.2	—	2.2
S2	L	Yellow Twotone Beardtongue	C2	—	—	17.4	17.4
Moenkopi to Mead							
N3	L	Fickeisen Plains Cactus	C1	—	0.8	—	0.8
N3	L	Cameron Water-parsley	C2	—	4.0	—	4.0
N3	L	Rosy Twotone Beardtongue	C2	—	—	3.5	3.5
N3	M	Tusayan Flame Flower	C2	—	1.6	—	1.6
N3	L	Tusayan Flame Flower	C2	—	14.9	—	14.9
N3	L	Tusayan Rabbitbrush	C2	—	10.0	—	10.0
N3	L	Welsh Phacelia	C2	—	3.9	—	3.9
N3	L	Yellow Twotone Beardtongue	C2	—	—	3.1	3.1
N4	L	Fickeisen Plains Cactus	C2	—	0.8	—	0.8
N4	L	Cameron Water-parsley	C2	—	4.0	—	4.0
N4	L	Freckled Milkvetch	C1	—	0.8	—	0.8
N4	L	Roaring Springs Prickly Poppy	C2	—	6.8	—	6.8
N4	L	Rosy Twotone Beardtongue	C2	—	—	3.5	3.5
N4	M	Tusayan Flame Flower	C2	—	1.6	—	1.6
N4	L	Tusayan Flame Flower	C2	—	16.0	—	16.0
N4	L	Tusayan Rabbitbrush	C2	—	10.8	—	10.8
N4	L	Welsh Phacelia	C2	—	3.9	—	3.9

TABLE D-7
SUMMARY OF POTENTIAL IMPACTS ON POTENTIAL HABITAT OF SPECIAL STATUS PLANTS

Alternative Route	Impact	Special Status Plants	Federal Status	Miles of Impacts			Total
				NM	AZ	NV	
N4	L	Yellow Twotone Beardtongue	C2	—	—	3.1	3.1
S4	M	Fickeisen Plains Cactus	C1	—	0.2	—	0.2
S4	L	Fickeisen Plains Cactus	C1	—	1.6	—	1.6
S4	L	Cameron Water-parsley	C2	—	4.2	—	4.2
S4	L	Freckled Milkvetch	C2	—	0.1	—	0.1
S4	L	Roaring Springs Prickly Poppy	C2	—	7.7	—	7.7
S4	L	Rosy Twotone Beardtongue	C2	—	—	3.5	3.5
S4	L	Tusayan Flame Flower	C2	—	25.6	—	25.6
S4	L	Tusayan Rabbitbrush	C2	—	1.0	—	1.0
S4	L	Welsh Phacelia	C2	—	2.2	—	2.2
S4	L	Yellow Twotone Beardtongue	C2	—	—	3.1	3.1

TABLE D-8 SUMMARY OF POTENTIAL IMPACTS ON HABITAT OF SPECIAL STATUS WILDLIFE							
Alternative Route	Impact	Special Status Wildlife	Federal Status	Miles of Impacts			Total
				NM	AZ	NV	
EASTERN AREA ALTERNATIVES							
GC1	L	Colorado Squawfish (CH)	E	0.1	—	—	0.1
GC1	L	Raptor Habitat	E	0.3	6.0	—	6.3
GC1	L	Razorback Sucker (CH)	E	0.1	—	—	0.1
GC1	L	Coconino Arizona Pocket Mouse	C2	—	7.1	—	7.1
GC1	L	Flannelmouth Sucker	C2	0.1	—	—	0.1
GC1	L	Roundtail Chub	C2	0.1	—	—	0.1
GC1	L	Golden Eagle	O	—	2.4	—	2.4
GC1	L	Mottled Sculpin	O	0.1	—	—	0.1
GC1	L	Rough-legged Hawk	O	0.3	—	—	0.3
K1	L	Colorado Squawfish (CH)	E	0.1	—	—	0.1
K1	L	Raptor Habitat	E	0.3	6.0	—	6.3
K1	L	Razorback Sucker (CH)	E	0.1	—	—	0.1
K1	L	Coconino Arizona Pocket Mouse	C2	—	7.2	—	7.2
K1	L	Flannelmouth Sucker	C2	0.1	—	—	0.1
K1	L	Roundtail Chub	C2	0.1	—	—	0.1
K1	L	Golden Eagle	O	—	2.4	—	2.4
K1	L	Mottled Sculpin	O	0.1	—	—	0.1
K1	L	Rough-legged Hawk	O	0.3	—	—	0.3
C1	L	Colorado Squawfish (CH)	E	0.1	—	—	0.1
C1	L	Humpback Chub	E	—	0.2	—	0.2
C1	L	Raptor Habitat	E	1.0	—	—	1.0
C1	L	Razorback Sucker	E	0.1	0.2	—	0.3
C1	L	Mexican Spotted Owl (CH)	T	—	5.9	—	5.9
C1	L	Coconino Arizona Pocket Mouse	C2	—	4.2	—	4.2
C1	L	Flannelmouth Sucker	C2	0.1	0.2	—	0.3

TABLE D-8 SUMMARY OF POTENTIAL IMPACTS ON HABITAT OF SPECIAL STATUS WILDLIFE							
Alternative Route	Impact	Special Status Wildlife	Federal Status	Miles of Impacts			Total
				NM	AZ	NV	
C1	L	Roundtail Chub	C2	0.1	—	—	0.1
C1	L	Chuska Tassel-eared Squirrel	O	—	5.9	—	5.9
C1	L	Mottled Sculpin	O	0.1	—	—	0.1
C1	L	Zuni Bluehead Sucker	O	0.1	0.2	—	0.3
C2	L	Colorado Squawfish	E	0.1	—	—	0.1
C2	L	Humpback Chub	E	—	0.2	—	0.2
C2	L	Raptor Habitat	E	0.3	—	—	0.3
C2	L	Razorback Sucker	E	0.1	0.2	—	0.3
C2	L	Coconino Arizona Pocket Mouse	C2	—	4.2	—	4.2
C2	L	Flannelmouth Sucker	C2	0.1	0.2	—	0.3
C2	L	Roundtail Chub	C2	0.1	—	—	0.1
C2	L	Golden Eagle	O	—	0.8	—	0.8
C2	L	Mottled Sculpin	O	0.1	—	—	0.1
C2	L	Rough-legged Hawk	O	0.3	—	—	0.3
C2	L	Zuni Bluehead Sucker	O	—	0.2	—	0.2
WESTERN AREA ALTERNATIVES							
Moenkopi to Marketplace							
N1W	L	Bonytail Chub (CH)	E	—	—	0.1	0.1
N1W	L	Raptor habitat	E	—	1.9	—	1.9
N1W	L	Razorback Sucker (CH)	E	—	—	0.1	0.1
N1W	L	Black-footed Ferret	E*	—	8.4	—	8.4
N1W	L	Desert Tortoise (M) (CH)	T	—	—	21.1	21.1
N1W	L	Arizona Toad	C2	—	2.5	—	2.5
N1W	L	Chuckwalla	C2	—	1.2	—	1.2
N1W	L	Coconino Arizona Pocket Mouse	C2	—	6.0	—	6.0
N1W	M	Desert Tortoise (S)	C2	—	0.1	—	0.1

TABLE D-8
SUMMARY OF POTENTIAL IMPACTS ON HABITAT OF SPECIAL STATUS WILDLIFE

Alternative Route	Impact	Special Status Wildlife	Federal Status	Miles of Impacts			Total
				NM	AZ	NV	
N1W	L	Desert Tortoise (S)	C2	—	0.9	—	0.9
N1W	L	Southwestern River Otter	C2	—	0.1	—	0.1
N1W	L	Cooper's Hawk	O	—	3.0	—	3.0
N1W	L	Gila Monster	·O	—	1.2	—	1.2
N2	L	Bonytail Chub (CH)	E	—	—	0.1	0.1
N2	L	Raptor Habitat	E	—	2.0	—	2.0
N2	L	Razorback Sucker (CH)	E	—	—	0.1	0.1
N2	L	Black-footed Ferret	E*	—	15.5	—	15.5
N2	L	Desert Tortoise (M) (CH)	T	—	—	21.1	21.1
N2	L	Chuckwalla	C2	—	0.7	—	0.7
N2	L	Coconino Arizona Pocket Mouse	C2	—	6.0	—	6.0
N2	M	Desert Tortoise (S)	C2	—	0.1	—	0.1
N2	L	Desert Tortoise (S)	C2	—	0.9	—	0.9
N2	L	Ferruginous Hawk	C2	—	3.0	—	3.0
N2	L	Southwestern River Otter	C2	—	0.1	—	0.1
S2	L	Bonytail Chub (CH)	E	—	—	0.1	0.1
S2	L	Raptor Habitat	E	—	1.9	—	1.9
S2	L	Razorback Sucker (CH)	E	—	—	0.1	0.1
S2	L	Desert Tortoise (M) (CH)	T	—	—	21.1	21.1
S2	L	Chuckwalla	C2	—	0.7	—	0.7
S2	L	Coconino Arizona Pocket Mouse	C2	—	4.2	—	4.2
S2	M	Desert Tortoise (S)	C2	—	0.1	—	0.1
S2	L	Desert Tortoise (S)	C2	—	0.9	—	0.9
S2	L	Ferruginous Hawk	C2	—	3.0	—	3.0
S2	L	Southwestern River Otter	C2	—	0.1	—	0.1

TABLE D-8
SUMMARY OF POTENTIAL IMPACTS ON HABITAT OF SPECIAL STATUS WILDLIFE

Alternative Route	Impact	Special Status Wildlife	Federal Status	Miles of Impacts			Total
				NM	AZ	NV	
Moenkopi to Mead							
N3	L	Bonytail Chub (CH)	E	—	0.1	—	0.1
N3	L	Raptor Habitat	E	—	2.4	—	2.4
N3	L	Razorback Sucker (CH)	E	—	0.1	—	0.1
N3	L	Black-footed Ferret	E*	—	8.4	—	8.4
N3	L	Desert Tortoise (M) (CH)	T	—	—	5.7	5.7
N3	L	Arizona Toad	C2	—	2.5	—	2.5
N3	L	Chuckwalla	C2	—	0.8	—	0.8
N3	L	Coconino Arizona Pocket Mouse	C2	—	6.0	—	6.0
N3	L	Desert Tortoise (S)	C2	—	6.4	—	6.4
N3	L	Southwestern River Otter	C2	—	0.1	—	0.1
N3	L	Cooper's Hawk	O	—	3.0	—	3.0
N3	L	Gila Monster	O	—	0.8	—	0.8
N3	L	Osprey	O	—	0.5	—	0.5
N4	L	Bonytail Chub (CH)	E	—	0.1	—	0.1
N4	L	Raptor Habitat	E	—	2.5	—	2.5
N4	L	Razorback Sucker (CH)	E	—	0.1	—	0.1
N4	L	Black-footed Ferret	E*	—	15.5	—	15.5
N4	L	Desert Tortoise (M) (CH)	T	—	—	5.7	5.7
N4	L	Chuckwalla	C2	—	0.3	—	0.3
N4	L	Coconino Arizona Pocket Mouse	C2	—	6.0	—	6.0
N4	L	Desert Tortoise (S)	C2	—	6.4	—	6.4
N4	L	Ferruginous Hawk	C2	—	3.0	—	3.0
N4	L	Southwestern River Otter	C2	—	0.1	—	0.1
N4	L	Gila Monster	O	—	0.3	—	0.3
N4	L	Osprey	O	—	0.5	—	0.5

TABLE D-8
SUMMARY OF POTENTIAL IMPACTS ON HABITAT OF SPECIAL STATUS WILDLIFE

Alternative Route	Impact	Special Status Wildlife	Federal Status	Miles of Impacts			Total
				NM	AZ	NV	
N4	L	Swainson's Hawk	O	—	8.6	—	8.6
S4	L	Bonytail Chub (CH)	E	—	0.1	—	0.1
S4	L	Raptor Habitat	E	—	2.4	—	2.4
S4	L	Razorback Sucker (CH)	E	—	0.1	—	0.1
S4	L	Desert Tortoise (M) (CH)	T	—	—	5.7	5.7
S4	L	Chuckwalla	C2	—	0.3	—	0.3
S4	L	Coconino Arizona Pocket Mouse	C2	—	4.2	—	4.2
S4	L	Desert Tortoise (S)	C2	—	6.4	—	6.4
S4	L	Ferruginous Hawk	C2	—	3.0	—	3.0
S4	L	Southwestern River Otter	C2	—	0.1	—	0.1
S4	L	Gila Monster	O	—	0.3	—	0.3
S4	L	Osprey	O	—	0.5	—	0.5
S4	L	Swainson's Hawk	O	—	12.8	—	12.8

CH = Critical habitat M - Mojave population S = Sonoran population

TABLE D-9 SUMMARY OF POTENTIAL IMPACTS ON BIG GAME*						
Alternative Route	Impact	Special Status Wildlife	Miles of Impacts			Total
			NM	AZ	NV	
EASTERN AREA ALTERNATIVES						
GC1	L	American Pronghorn Antelope	3.4	26.4	—	29.8
GC1	L	American Pronghorn Antelope, Mule Deer	—	9.0	—	9.0
GC1	L	American Pronghorn Antelope, Mule Deer (w, m)	0.4	—	—	0.4
GC1	L	Mule Deer	—	14.9	—	14.9
GC1	L	Mule Deer (w, m)	8.5	—	—	8.5
K1	L	American Pronghorn Antelope	3.4	26.4	—	29.8
K1	L	American Pronghorn Antelope, Mule Deer	—	9.0	—	9.0
K1	L	American Pronghorn Antelope, Mule Deer (w, m)	0.4	—	—	0.4
K1	L	Mule Deer	—	14.9	—	14.9
K1	L	Mule Deer (w, m)	8.5	—	—	8.5
C1	L	American Pronghorn Antelope	1.9	51.3	—	53.2
C1	L	American Pronghorn Antelope, Mule Deer	0.1	9.7	—	9.8
C1	L	American Pronghorn Antelope, Mule Deer (w), Merriam's Turkey	—	10.1	—	10.1
C1	L	American Pronghorn Antelope, Mule Deer, Merriam's Turkey	1.5	7.9	—	9.4
C1	L	American Pronghorn Antelope, Mule Deer, Merriam's Turkey (s,w)	0.5	—	—	0.5
C1	L	Black Bear, Mule Deer (s)	—	1.0	—	1.0
C1	L	Black Bear, Mule Deer (s), Merriam's Turkey	—	2.1	—	2.1
C1	L	Black Bear, Mule Deer (s), Merriam's Turkey (s,w)	—	2.1	—	2.1
C1	L	Merriam's Turkey, Mule Deer, Mountain Lion	—	1.2	—	1.2
C1	L	Mountain Lion, Mule Deer	2.8	—	—	2.8
C1	L	Mule Deer	1.1	—	—	1.1

TABLE D-9 SUMMARY OF POTENTIAL IMPACTS ON BIG GAME*						
Alternative Route	Impact	Special Status Wildlife	Miles of Impacts			Total
			NM	AZ	NV	
C1	L	Mule Deer (c,w), Merriam's Turkey (s,w), Mountain Lion	—	4.9	—	4.9
C1	L	Mule Deer, Merriam's Turkey (s,w), Mountain Lion	4.6	1.1	—	5.7
C2	L	American Pronghorn Antelope	3.4	65.5	—	68.9
C2	L	American Pronghorn Antelope, Mule Deer	—	9.7	—	9.7
C2	L	American Pronghorn Antelope, Mule Deer (w,m)	0.4	—	—	0.4
C2	L	Mule Deer	8.5	—	—	8.5
WESTERN AREA ALTERNATIVES						
Moenkopi to Marketplace						
N1W	L	American Pronghorn Antelope	—	25.5	—	25.5
N1W	L	American Pronghorn Antelope, Elk, Mule Deer	—	3.8	—	3.8
N1W	L	American Pronghorn Antelope, Mountain Lion, Mule Deer	—	6.0	—	6.0
N1W	L	American Pronghorn, Antelope, Mule Deer	—	2.5	—	2.5
N1W	L	Bighorn Sheep	—	—	3.3	3.3
N1W	L	Bighorn Sheep (s)	—	—	6.2	6.2
N1W	L	Bighorn Sheep, Mountain Lion, Mule Deer	—	10.4	—	10.4
N1W	L	Mountain Lion, Mule Deer	—	22.0	—	22.0
N1W	L	Mule Deer	—	60.1	—	60.1
N2	L	American Pronghorn Antelope	—	60.0	—	60.0
N2	L	American Pronghorn Antelope (yr,mc)	—	2.0	—	2.0
N2	L	American Pronghorn Antelope, Elk, Mule Deer	—	3.8	—	3.8
N2	L	American Pronghorn Antelope, Mule Deer	—	2.5	—	2.5
N2	L	Bighorn Sheep	—	—	3.3	3.3
N2	L	Bighorn Sheep (s)	—	—	6.2	6.2

TABLE D-9 SUMMARY OF POTENTIAL IMPACTS ON BIG GAME*						
Alternative Route	Impact	Special Status Wildlife	Miles of Impacts			Total
			NM	AZ	NV	
N2	L	Bighorn Sheep, Mountain Lion, Mule Deer	—	10.4	—	10.4
N2	L	Mule Deer	—	60.1	—	60.1
S2	L	American Pronghorn Antelope	—	49.5	—	49.5
S2	L	American Pronghorn Antelope, Mule Deer	—	28.1	—	28.1
S2	L	Bighorn Sheep	—	—	3.3	3.3
S2	L	Bighorn Sheep (s)	—	—	6.2	6.2
S2	L	Bighorn Sheep, Mountain Lion, Mule Deer	—	10.4	—	10.4
S2	L	Mule Deer	—	15.8	—	15.8
Moenkopi to Mead						
N3	L	American Pronghorn Antelope	—	31.8	—	31.8
N3	L	American Pronghorn Antelope, Elk, Mule Deer	—	3.8	—	3.8
N3	L	American Pronghorn Antelope, Mountain Lion, Mule Deer	—	6.0	—	6.0
N3	L	American Pronghorn Antelope, Mule Deer	—	2.5	—	2.5
N3	L	Bighorn Sheep	—	—	2.7	2.7
N3	L	Bighorn Sheep (s)	—	—	5.5	5.5
N3	L	Bighorn Sheep, Mountain Lion, Mule Deer	—	3.0	—	3.0
N3	L	Mountain Lion, Mule Deer	—	22.0	—	22.0
N3	L	Mountain Lion, Mule Deer, Bighorn Sheep (l)	—	3.0	—	3.0
N3	L	Mule Deer	—	60.1	—	60.1
N4	L	American Pronghorn Antelope	—	66.3	—	66.3
N4	L	American Pronghorn Antelope (yr, m)	—	2.0	—	2.0
N4	L	American Pronghorn Antelope, Elk, Mule Deer	—	3.8	—	3.8
N4	L	American Pronghorn Antelope, Mule Deer	—	2.5	—	2.5
N4	L	Bighorn Sheep	—	—	2.7	2.7
N4	L	Bighorn Sheep (s)	—	—	5.5	5.5

TABLE D-9 SUMMARY OF POTENTIAL IMPACTS ON BIG GAME*						
Alternative Route	Impact	Special Status Wildlife	Miles of Impacts			Total
			NM	AZ	NV	
N4	L	Bighorn Sheep, Mountain Lion, Mule Deer	—	3.0	—	3.0
N4	L	Mountain Lion, Mule Deer, Bighorn Sheep (l)	—	3.0	—	3.0
N4	L	Mule Deer	—	60.1	—	60.1
S4	L	American Pronghorn Antelope	—	55.8	—	55.8
S4	L	American Pronghorn Antelope, Mule Deer	—	28.1	—	28.1
S4	L	Bighorn Sheep	—	—	2.7	2.7
S4	L	Bighorn Sheep (s)	—	—	5.5	5.5
S4	L	Bighorn Sheep, Mountain Lion, Mule Deer	—	3.0	—	3.0
S4	L	Mountain Lion, Mule Deer, Bighorn Sheep (1)	—	3.0	—	3.0
S4	L	Mule Deer	—	15.8	—	15.8

*These data reflect impacts on habitat, whether occupied or not, for each species listed.

m = migration corridor
cw = critical winter range
w = winter range
yr = year-long range
s = summer range
l = lambing grounds

TABLE E-1 MAJOR UTILITIES PARALLELED AND CROSSED				
Link No.	**Utility Description**	**Condition**	**Begin and End Mileposts Crossing Location**	**Total Mileage**
100	two 230kV lines (Western)	parallel	0.0-5.7	5.7
120	two 230kV lines (Western)	parallel	0.0-1.3	1.3
120	345kV (PacifiCorp)	crossed	1.3	—
180	115kV (COF)	parallel	0.0-1.1	1.1
240	two 345kV (TEP)	parallel	0.0-3.9	3.9
300	two 345kV (TEP)	parallel	0.0-0.9	0.9
300	500kV	crossed	0.9	—
360	two 345kV (TEP)	parallel	0.0-0.3	0.3
360	pipeline (Texas-New Mexico oil)	parallel	0.3-1.8	1.5
360	pipeline (Texas-New Mexico oil)	crossed	1.1	—
360	345kV (PacifiCorp)	crossed	1.8	—
460	two 230kV lines (Western)	parallel	0.0-5.2	5.2
460	230kV line (Western)	parallel	5.2-41.8	36.6
460	pipeline (Texas-New Mexico oil)	crossed	15.0	—
460	16" pipeline (Western gas)	parallel	28.7-29.7	1.0
460	two pipelines (Western gas 16" and Meridian Oil 6")	crossed	23.0	—
460	16" pipeline (Western gas)	crossed	29.0	—
460	12" pipeline (Four Corners oil)	crossed	37.5	—
461	230kV	parallel	0.0-31.9	31.9
461	230kV (Western)	crossed*	3.7	—
461	230kV (Western)	crossed*	5.7	—
561	16" pipeline (Four Corners oil)	crossed	8.1	—
561	230kV (Western)	crossed*	9.4	—
580	230kV (Western)	parallel	0.0-19.1	19.1

TABLE E-1 MAJOR UTILITIES PARALLELED AND CROSSED				
Link No.	**Utility Description**	**Condition**	**Begin and End Mileposts Crossing Location**	**Total Mileage**
581	230kV (Western)	parallel	0.0-12.5	12.5
586	230kV (Western)	parallel	0.0-5.4	5.4
586	230kV (Western)	crossed	0.0	—
587	230kV (Western)	crossed*	11.0	—
587	two 500kV (APS)	crossed	20.5	—
620	500kV (NPC/DWP)	parallel	0.0-2.1	2.1
621	345kV (Western)	crossed	3.0	—
627	345kV (Western)	crossed	1.2	—
640	12" pipeline (Four Corners oil)	crossed	4.5	—
700	500kV (APS)	parallel	0.0-66.0	66.0
700	two pipelines (Continental oil)	crossed	3.7-3.8	—
700	500kV (APS)	crossed*	21.0	—
701	500kV (APS)	parallel	0.0-7.6	7.6
780	500kV (APS)	parallel	0.0-96.5	96.5
780	500kV (APS)	crossed*	19.5	—
780	500kV (APS)	crossed*	21.5	—
780	18" coal slurry pipeline (Black Mesa)	crossed	94.3	—
780	two 500kV (APS)	crossed	95.1	—
780	16" pipeline (Four Corners oil)	crossed	95.1	—
1383	two 345kV (Western)	parallel	0.0-3.8	3.8
1383	345kV (Western)	crossed*	3.8	—
1384	two 345kV (Western)	parallel	0.0-1.0	1.0
1384	two 345kV (Western) and two 500kV (APS)	parallel	1.0-12.5	11.5
1384	two 345kV (Western)	parallel	12.5-22.3	9.8

TABLE E-1 MAJOR UTILITIES PARALLELED AND CROSSED				
Link No.	**Utility Description**	**Condition**	**Begin and End Mileposts Crossing Location**	**Total Mileage**
1386	two 345kV (Western)	parallel	0.0-1.0	1.0
1386	345kV (Western)	parallel	1.0-4.0	3.0
1386	two 345kV (Western)	parallel	4.0-7.2	3.2
1389	345kV (Western)	parallel	0.0-9.5	9.5
1390	two 500kV (APS)	crossed	10.3	—
1390	69kV (APS)	crossed	12.0	—
1390	345kV (Western)	crossed	18.5	—
1391	345kV (Western)	crossed	1.9	—
1393	345kV (Western)	parallel	0.0-14.4	14.4
1397	345kV (Western)	parallel	0.0-13.5	13.5
1397	345kV (Western)	crossed*	13.5	—
1400	500kV (APS)	parallel	0.0-21.5	21.5
1401	500kV (APS)	parallel	0.0-2.9	2.9
1420	two 500kV (APS)	parallel	4.6-18.7	14.1
1420	16" pipeline (Four Corners oil)	parallel	14.5-18.7	4.3
1421	two 500kV (APS)	parallel	0.0-1.3	1.3
1421	16" pipeline (Four Corners oil)	parallel	0.0-1.3	1.3
1480	two 500kV (APS)	parallel	0.0-1.5	1.5
1480	16" pipeline (Four Corners oil)	parallel	0.0-1.5	1.5
1520	two 500kV (APS)	parallel	0.0-9.9	9.9
1520	16" pipeline (Four Corners oil)	parallel	0.0-0.6	—
1520	two pipelines (Four Corners oil 16") and Black Mesa coal slurry 18")	parallel	0.6-9.9	9.9
1640	two 500kV (APS)	parallel	0.0-17.0	17.0
1640	two pipelines (Four Corners oil 16" and Black Mesa coal slurry 18")	parallel	0.0-3.7	3.7

TABLE E-1 MAJOR UTILITIES PARALLELED AND CROSSED				
Link No.	**Utility Description**	**Condition**	**Begin and End Mileposts Crossing Location**	**Total Mileage**
1640	two pipelines (Four Corners oil 16" and Black Mesa coal slurry 18")	crossed	3.7	—
1660	500kV (APS)	parallel	0.0-66.7	66.7
1680	two 500kV (APS)	parallel	0.0-2.7	2.7
1680	fiber optic cable (AT&T)	crossed	2.2	—
1680	fiber optic cable (AT&T)	crossed	3.0	—
1680	fiber optic cable (AT&T)	parallel	2.7-21.7	19.0
1720	fiber optic cable (AT&T)	parallel	0.0-5.0	5.0
1720	16" pipeline (Four Corners oil)	crossed	4.9	—
1720	fiber optic cable (AT&T)	crossed	4.9	—
1720	16" pipeline (Four Corners)	parallel	5.0-15.0	10.0
1720	16" pipeline (Four Corners oil)	parallel	18.0-21.6	3.6
1720	230kV (APS)	crossed	20.2	—
1720	two pipelines (EPNG gas and Four Corners oil 16")	parallel	21.6-25.5	3.9
1720	two pipelines EPNG gas and Four Corners oil 16"	crossed	25.5	—
1720	pipeline (TW)	parallel	25.9-33.3	7.4
1720	two pipelines (EPNG gas and Four Corners oil 16")	crossed	34.2	—
1720	230kV (APS)	crossed	34.6	—
1720	18" pipeline (Black Mesa coal slurry)	crossed	35.6	—
1720	18" pipeline (Black Mesa coal slurry)	parallel	35.6-36.9	1.3
1740	500kV (APS)	parallel	0.0-7.6	7.6
1741	500kV (APS)	parallel	0.0-0.4	0.4
1742	fiber optic cable (AT&T)	crossed	6.5	—

TABLE E-1 MAJOR UTILITIES PARALLELED AND CROSSED				
Link No.	**Utility Description**	**Condition**	**Begin and End Mileposts Crossing Location**	**Total Mileage**
1790	500kV	parallel	0.0-52.2	52.2
1790	345kV and 500kV (Western, SRP)	crossed	52.2	—
1960	18" pipeline (Black Mesa coal slurry)	parallel	0.0-13.9	13.9
1980	fiber optic cable (Citizens Utilities and AT&T)	crossed	13.0-13.3	—
2000	18" pipeline (Black Mesa coal slurry)	parallel	0.0-6.3	6.3
2000	18" pipeline (Black Mesa coal slurry)	crossed	5.0-6.3	—
2000	230kV (Western)	parallel	6.3-20.6	14.3
2000	230kV and 500kV (Western, SRP)	crossed	20.6	—
2000	345kV and 500kV (Western, APS)	parallel	20.6-25.2	4.6
2002	345kV and 500kV (Western, APS)	crossed*	5.6	—
2006	345kV and 500kV (Western, SRP)	parallel	0.0-11.5	11.5
2006	fiber optic cable (AT&T)	crossed	2.5	—
2020	345kV and 500kV (Western, SRP)	parallel	0.0-18.8	18.8
2020	345kV and 500kV (Western, SRP)	crossed*	18.8	—
2040	500kV (APS)	crossed	0.0	—
2040	345kV and 500kV (Western, SRP)	parallel	0.0-47.7	47.7
2040	fiber optic cable (Citizens Utilities)	crossed	5.3	—
2040	fiber optic cable (Citizens Utilities)	crossed	29.5	—
2040	three 230kVs (Western, MWD)	crossed	47.3	—
2060	500kV (APS)	crossed	0.0	—
2060	500kV (APS)	parallel	0.0-49.0	49.0
2060	fiber optic cable (Citizens Utilities)	crossed	6.2	—
2060	fiber optic cable (Citizens Utilities)	crossed	22.4	—
2060	230kV (Western)	crossed	49.0	—

TABLE E-1 MAJOR UTILITIES PARALLELED AND CROSSED				
Link No.	**Utility Description**	**Condition**	**Begin and End Mileposts Crossing Location**	**Total Mileage**
2200	two 230kV (MWD)	crossed	0.9	—
2200	fiber optic cable (AT&T)	crossed	2.0	—
2200	500kV (SCE, APS)	parallel	0.0-5.2	5.2
2200	one 230kV and two 500kV (Western, SCE, APS).	parallel	5.2-8.5	3.3
2200	three 230kV and three 500kV (Western, SCE, APS)	parallel	8.5-14.0	5.5
2200	230kV (SCE)	crossed	14.0	—
2200	two 230kV and three 500kV (Western, SCE, APS)	parallel	15.0-16.2	1.0
2200	two 230kV (SCE)	parallel	15.0-16.2	1.2
2200	three 287.5kV (LADWP)	crossed	15.4	—
2200	two 230kV (SCE)	crossed	16.2	—

*NTP transmission line alignment was shifted to opposite side of existing line(s) to mitigate impacts.

TABLE E-2
DESIGNATED UTILITY CORRIDORS ON FEDERAL LANDS

Agency	Agency ID	Corridor Description	NTP Alternative	Links
BLM				
Farmington District, NM	--	No formal designation of utility corridors; lands are open to the location of rights-of-way on a case-by-case basis with environmental review.	GC1, K1, C2 C1	100, 120 180, 240, 300, 360, 640
Kingman Resource Area, AZ	Four Corners-El Dorado	Designated one-mile-wide utility corridor centered on Four Corners to El Dorado 500kV transmission line.	N1W, N2, S2	1790, 2060
	Mead-Phoenix	Designated two-mile-wide utility corridor centered on Mead-Liberty 345kV transmission line.	N2, N4, S2, S4	2000, 2006, 2020, 2040
Stateline Resource Area, NV	--	Planning corridor of unspecified width centered on the Four Corners-El Dorado 500kV transmission line.	N1W, N2, S2	2060
Forest Service				
Kaibab National Forest	--	Designated utility corridor; no specified width.	N1W, N2, N3, N4 S2, S4	1400, 1401, 1660 1640
NPS				
Lake Mead NRA	Mead-Liberty	Designated 1,660-foot-wide corridor centered on Mead-Liberty 345kV transmission line.	N3, N4, S4	2040
	Aztec	Designated 1,660-foot-wide corridor centered on Four Corners-El Dorado 500kV transmission line.	N1W, N2, S2	2060

TABLE E-3 LAND JURISDICTIONS CROSSED					
Alternative Route	Jurisdiction	Miles			Total
		NM	AZ	NV	
EASTERN AREA ALTERNATIVES					
GC1	Navajo Reservation	31.3	223.8	—	255.1
GC1	BLM	3.4	—	—	3.4
GC1	Private	—	1.9	—	1.9
GC1	State	0.2	—	—	0.2
K1	Navajo Reservation	31.3	209.8	—	241.1
K1	BLM	3.4	—	—	3.4
K1	Private	—	—	—	—
K1	State	0.2	—	—	0.2
C1	Hopi Reservation	—	32.2	—	32.2
C1	Navajo Reservation	36.4	114.3	—	150.7
C1	BLM	2.1	—	—	2.1
C1	Private	1.7	—	—	1.7
C2	Hopi Reservation	—	32.2	—	32.2
C2	Navajo Reservation	31.3	143.9	—	175.2
C2	BLM	3.4	—	—	3.4
C2	Private	—	—	—	—
C2	State	0.2	—	—	0.2
WESTERN AREA ALTERNATIVES					
Moenkopi to Marketplace					
N1W	Hualapai Reservation	—	35.1	—	35.1
N1W	Navajo Reservation	—	13.3	—	13.3
N1W	Navajo Individual Allotment	—	0.5	—	0.5
N1W	Private	—	62.9	8.6	71.5

TABLE E-3 LAND JURISDICTIONS CROSSED					
Alternative Route	Jurisdiction	Miles			Total
		NM	AZ	NV	
N1W	State	—	16.7	—	16.7
N1W	Forest Service	—	19.1	—	19.1
N1W	Army COE	—	0.1	0.2	0.3
N1W	BLM	—	32.8	16.4	49.2
N1W	NPS	—	6.5	4.4	10.9
N1W	BOR Withdrawal	—	—	0.4	0.4
N2	Navajo Reservation	—	13.3	—	13.3
N2	Navajo Individual Allotment	—	0.5	—	0.5
N2	Private	—	78.7	8.6	87.3
N2	State	—	20.1	—	20.1
N2	Forest Service	—	19.1	—	19.1
N2	Army COE	—	0.1	0.2	0.3
N2	BLM	—	56.8	16.4	73.2
N2	NPS	—	6.5	4.4	10.9
N2	BOR Withdrawal	—	—	0.4	0.4
S2	Navajo Reservation	—	19.5	—	19.5
S2	Private	—	73.1	8.6	81.7
S2	State	—	56.1	—	56.1
S2	Forest Service	—	20.6	—	20.6
S2	Army COE	—	0.1	0.2	0.3
S2	BLM	—	41.8	16.4	58.2
S2	NPS	—	6.5	4.4	10.9
S2	BOR Withdrawal	—	—	0.4	0.4

TABLE E-3 LAND JURISDICTIONS CROSSED					
Alternative Route	**Jurisdiction**	**Miles**			**Total**
		NM	**AZ**	**NV**	
Moenkopi to Mead					
N3	BLM	—	33.4	—	33.4
N3	Hualapai Reservation	—	35.1	—	35.1
N3	Navajo Reservation	—	13.3	—	13.3
N3	Navajo Individual Allotment	—	0.5	—	0.5
N3	Private	—	61.6	—	61.6
N3	State	—	18.2	—	18.2
N3	Forest Service	—	19.1	—	19.1
N3	Army COE	—	0.1	0.1	0.2
N3	BOR	—	—	1.8	1.8
N3	BOR Withdrawal	—	—	2.8	2.8
N3	NPS	—	7.1	6.2	13.3
N4	BLM	—	57.4	—	57.4
N4	Navajo Reservation	—	13.3	—	13.3
N4	Navajo Individual Allotment	—	0.5	—	0.5
N4	Private	—	77.4	—	77.4
N4	State	—	21.6	—	21.6
N4	Forest Service	—	19.1	—	19.1
N4	Army COE	—	0.1	0.1	0.2
N4	BOR	—	—	1.8	1.8
N4	BOR Withdrawal	—	—	2.8	2.8
N4	NPS	—	7.1	6.2	13.3
S4	BLM	—	42.4	—	42.4
S4	Navajo Reservation	—	19.5	—	19.5

TABLE E-3 LAND JURISDICTIONS CROSSED					
Alternative Route	Jurisdiction	Miles			Total
		NM	AZ	NV	
S4	Private	—	71.8	—	71.8
S4	State	—	57.6	—	57.6
S4	Forest Service	—	20.6	—	20.6
S4	Army COE	—	0.1	0.1	0.2
S4	BOR	—	—	1.8	1.8
S4	BOR Withdrawal	—	—	2.8	2.8
S4	NPS	—	7.1	6.2	13.3

TABLE E-4 NAVAJO AGENCIES AND CHAPTERS CROSSED BY NTP ALTERNATIVE ROUTES			
Alternative	**Agency**	**Chapter**	**Approximate Miles**
GC1	Shiprock	The Hogback	6.0
		Shiprock	2.5
		Cudei	18.6
		Beclahbito	1.9
		Teec Nos Pos	20.0
		Red Mesa	10.8
		Mexican Water	10.8
GC1	Tuba City	Dennehotso	24.9
		Kayenta	26.4
		Chilchinbito	0.9
		Shonto	12.4
		Inscription House	10.7
		Kaibito	14.3
		Lechee	31.5
		Copper Mine	29.7
		Tuba City	1.7
		Bodaway	27.7
		Cameron	5.0
GC1 Total			255.8
K1	Shiprock	The Hogback	6.0
		Shiprock	2.5
		Cudei	18.6
		Beclahbito	1.9
		Teec Nos Pos	20.0
		Red Mesa	10.8
		Mexican Water	10.8
K1	Tuba City	Copper Mine	28.7
		Dennehotso	24.9
		Kayenta	26.4
		Kaibito	14.3
		Chilchinbito	0.9
		Shonto	12.4
		Lechee	18.5
		Inscription House	10.7
		Tuba City	1.7
		Bodaway	27.7
		Cameron	5.0
K1 Total			241.8

TABLE E-4 NAVAJO AGENCIES AND CHAPTERS CROSSED BY NTP ALTERNATIVE ROUTES			
Alternative	**Agency**	**Chapter**	**Approximate Miles**
C1	Shiprock	San Juan and Nenahnezad Sanostee Shiprock Red Valley Cove	4.3 14.1 3.2 17.9 4.0
C1	Tuba City	Coalmine Mesa Cameron	21.4 4.9
C1	Hopi	Hopi Indian Reservation	33.1
C1	Chinle	Round Rock Luckachukai Many Farms Chinle Tselani/Cottonwood Tachee/Blue Gap Whippoorwill Spring Piñon Hardrock	5.6 9.5 10.2 4.7 22.8 4.5 6.9 11.5 4.3
C1 Total			182.9
C2	Shiprock	The Hogback Shiprock Cudei Beclahbito Teec Nos Pos Sweetwater Rock Point	6.2 2.5 18.5 1.9 19.6 15.4 22.2
C2	Chinle	Rough Rock Many Farms Tselani/Cottonwood Tachee/Blue Gap Whippoorwill Spring Piñon Hardrock	5.3 12.3 17.6 4.5 6.9 11.5 4.3
C2	Hopi	Hopi Indian Reservation	33.1
C2	Tuba City	Cameron Coalmine Mesa	4.9 21.4
C2 Total			208.1
N1W	Tuba City	Cameron	13.8

TABLE E-4 NAVAJO AGENCIES AND CHAPTERS CROSSED BY NTP ALTERNATIVE ROUTES			
Alternative	**Agency**	**Chapter**	**Approximate Miles**
N2	Tuba City	Cameron	13.8
S2	Tuba City	Cameron	19.5
N3	Tuba City	Cameron	13.8
N4	Tuba City	Cameron	13.8
S4	Tuba City	Cameron	19.5