ALLEN—WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

DRAFT

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

United States Department of The Interior
Bureau of Land Management

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ENVIRONMENTAL IMPACT STATEMENT

ON THE

ALLEN-WARNER VALLEY

ENERGY SYSTEM

PREPARED BY

BUREAU OF LAND MANAGEMENT

DEPARTMENT OF THE INTERIOR

Gary J. Wicks

STATE DIRECTOR, UTAH STATE OFFICE

COVER SHEET

Allen Warner Valley Energy System Environmental Impact Statement

(X) Draft ( ) Final

Lead Agency

U.S. Department of the Interior, Bureau of Land Management

Agencies Which Provided Information

Environmental Protection Agency
State of California Public Utilities Commission
U.S. Department of Agriculture
- Soil Conservation Service

U.S. Department of the Interior
- Fish and Wildlife Service
- Geological Survey
- Heritage Conservation and Recreation Service
- National Park Service
- Office of Surface Mining

U.S. Department of Transportation
- Federal Aviation Administration

Other Responsible Agencies with Jurisdiction

Federal Communication Commission
Interstate Commerce Commission
President's Advisory Council on Historic Preservation
U.S. Department of Agriculture
- Forest Service

U.S. Department of Defense
- Air Force
- Army Corps of Engineers

U.S. Department of Energy
U.S. Department of the Interior
- Bureau of Indian Affairs

U.S. Department of Transportation
- Federal Highway Administration

Western Area Power Administration

States, Counties, and Reservations that Could be Directly Affected

State of Arizona
- Mojave County

State of California
- San Bernardino County

State of Utah
- Carbon County
- Emery County
- Kane County
- Piute County
- Sanpete County
- Sevier County
- Washington County
- Wayne County

State of Nevada
- Clark County

State of Wyoming
- Lincoln County
- Sweetwater County
- Uinta County

Moapa Indian Reservation

Abstract

This statement assesses the environmental consequences of six alternatives designed to meet, at least in part, the base load energy needs of Nevada Power Company, Southern California Edison, Pacific Gas & Electric, and the city of St. George, Utah. The statement focuses on alternative coal-fired electrical generating systems, coal sources, water projects, and energy conservation in combination with other energy sources.

The major environmental topics discussed are related to air quality, hydrology, socioeconomics, threatened and endangered species, cultural resources, aesthetics, and land use. A discussion is also provided on the "need for power" question.

Questions and comments concerning this statement should be directed to:

Mr. Morgan Jensen
District Manager
Bureau of Land Management
P.O. Box 724
1579 North Main Street
Cedar City, Utah 84720

Date by Which Comments on the Statement Must be Received:

60 days after the statement is made available to the Environmental Protection Agency and the public (60 days after date below).

Date Statement Made Available to the Environmental Protection Agency and the Public:

Draft: JUN 20 1980

SUMMARY

INTRODUCTION

Four utilities and a county water conservancy district have applied to the Bureau of Land Management (BLM) for rights-of-way to utilize public lands in the development of their proposed Allen-Warner Valley (AWV) Energy System. The Nevada Power Company (NPC), Southern California Edison, (SCE), Pacific Gas and Electric (PG&E), and the city of St. George propose to construct and operate a 2,500-megawatt (MW) coal-fired steam-electric generating system in the southern areas of Utah and Nevada. A 500-MW powerplant (Warner Valley) would be located in Warner Valley, Utah, and a 2,000-MW powerplant (Harry Allen) would be located in Dry Lake, Nevada. Water to cool the Warner Valley powerplant would be supplied by the proposed Warner Valley water project. Water to cool the Harry Allen plant would be supplied from the Clark County (Nevada) Advanced Wastewater Treatment facility via a 24.5-mile long pipeline. Although several coal sources are being considered, the applicants preferred source would be the Alton coal fields of southern Utah. Approximately 11 million tons of coal would be mined annually from the Alton coal fields by surface and underground mining methods. Two coal slurry pipelines (12 and 22 inches in diameter) would transport the coal to the powerplants. An electrical transmission system and a supporting communication system would deliver power to market areas in Utah, Nevada, and California.

The initial electrical generating capacity entitlements of the participating utilities from the proposed AWV energy system in 1990 would be:

Participants	Initial Capacity Entitlement (MW)
Nevada Power Company	285
Southern California Edison Company	1,045
Pacific Gas and Electric Company	1,045
City of St. George	125

After initial operation, and throughout the remainder of the proposed project life, NPC would recapture station capacity from SCE and PG&E to supply their customer's electrical energy needs.

In support of the proposed 500-MW Warner Valley powerplant, the Washington County Water Conservancy District has proposed the construction of a 55,000 acre-foot reservoir in Warner Valley, Utah. As proposed, this water storage facility would consist of a water diversion structure on the Virgin River, 16 miles of canal pipelines, an earthen dam 224 feet high and 3,340 feet long, and a culinary water treatment facility. The reservoir would be used for cooling the Warner Valley powerplant (10,000 acre-feet), as supplementary irrigation water (8,000 acre-feet), as a source of municipal and industrial water (26,400 acre-feet), and the remainder as a powerplant reserve and for dead storage.

According to the Washington County Water Conservancy District, construction of the water project is not wholly dependent on the construction of the proposed Warner Valley powerplant since the major purpose of the water project would be to provide a municipal water source for several southern Utah communities, not to provide powerplant cooling water. However, the Warner Valley powerplant would be dependent on the water project for its water supply. Therefore, the Warner Valley water project should be considered a separate and distinct project related to but not dependent upon the AWV Energy System.

In this regard, the Warner Valley water project has been identified as a potential State sponsored project for possible construction under the State of Utah Water Conservation and Development Program (Water Bonding Fund); however, the following two qualifications exist: (1) no schedule has been assigned for State action, and (2) the project may be redesigned (scaled down) to fit the State money available (the State development program has not yet identified enough money to build the project as currently designed). Supplemental environmental analysis would be needed for a redesigned project if and when the State decided to undertake sponsorship. However, the State of Utah would rather have the water project constructed as part of the AWV Energy System (personal communication, J. Butler, Utah State Planning Office, May 15, 1980).

In accordance with the National Environmental Policy Act of 1969 (as amended) and the implementing regulations of the Council on Environmental Quality (Federal Register, Vol. 43, No. 230), the proposed project was presented to the public for comment. Several "scoping" meetings were held during July 1979 in Utah and Nevada. Participants at the meetings identified the following as being of primary concern in analyzing the applicants' proposal: hydrology, socioeconomics, air quality values (including visibility), land use, threatened and endangered species, wilderness values, aesthetic considerations, and the impacts of mining in the Alton coal fields.

In addition to establishing the major areas of concern, the scoping meeting participants also identified approximately 46 possible alternatives to the applicants' proposal. To determine which of the suggested alternatives were reasonable, a set of alternative evaluation criteria was established through a public comment and review procedure. Applying these criteria to the 46 suggested alternatives resulted in the identification of the following five reasonable alternatives to the applicants' proposal.

Construct a 2,000-MW Powerplant at the Harry Allen Site and Slurry Coal from the Alton Coal Fields

This alternative would consist of a 2,000-MW powerplant at Dry Lake, Nevada. Eight million tons of coal would be produced annually from the Alton coal fields of southern Utah. A 22-inch coal slurry pipeline would transport coal from the coal fields to the powerplant. A 345 and 500-kilovolt (kV) transmission system would be developed to provide power to the Las Vegas and southern California service areas. For analysis purposes, under this alternative it is assumed that the city of St. George would continue to purchase power from Utah Power and Light Company or would purchase layoff power from participants of the Intermountain Power Project.

Construct a 250-MW Powerplant at Warner Valley with Coal Trucked from the Alton Coal Fields, Construct the Warner Valley Water Project, and Construct a 1,000-MW Powerplant at the Harry Allen Site with Coal Railed from Central Utah or Wyoming

This alternative would consist of a 250-MW powerplant and a 55,000 acre-foot reservoir in Warner Valley, Utah, and a 1,000-MW powerplant in Dry Lake, Nevada. About 1 million tons of coal would be trucked annually from the west half of the Alton coal fields to the Warner Valley powerplant. Coal for the Harry Allen powerplant would be railed from central Utah or southwestern Wyoming (3 or 4 million tons annually). Electrical transmission facilities would be the same as the applicants' proposal, although at a smaller scale.

Although the Warner Valley water project would be used to supply cooling water to the Warner Valley powerplant, the water project would be constructed for the primary purposes of municipal, industrial, agricultural, and interim uses such as recreation.

Construct a 2,000-MW Powerplant at the Harry Allen Site with Coal Railed from Wyoming or Central Utah

This alternative would utilize coal from the fields of central Utah or southwestern Wyoming. Coal would be delivered to the Harry Allen 2,000-MW powerplant over existing rail lines. Layoff power to St. George could be supplied by a proposed 230-kV powerline from the Intermountain Power Project generating station at Lynndyl, Utah. A system of 345 and 500-kV powerlines would provide power to the Las Vegas and California service areas.

Energy Conservation and the Development of Alternative Energy Sources

This alternative would involve the implementation of intensive conservation programs in the city of St. George and in the NPC service areas. In the service areas of PG&E and SCE in California, three major existing programs would be accelerated: the development of alternative (nonconventional) energy sources, the development of renewable energy sources (solar technology), and conservation/load management.

No Action

This is a mandatory alternative required by the National Environmental Policy Act of 1969 (as amended). Under this alternative, BLM is required to assess the environmental impacts of not developing either the applicants' proposal or the other reasonable alternatives.

PURPOSE AND NEED OF PROPOSED PROJECT

In order to determine the need for the 2,500 MW of power, the Public Service (utilities) Commissions of Utah, Nevada, and California were asked to provide an assessment of power need. The California Energy Commission was also asked to provide an assessment.

The Public Service Commission of Nevada responded that NPC would need its proposed share of 285 MW by 1990. The California Public Utilities Commission (CPUC) staff indicated that it is not ready to make an official determination regarding this particular project at this time, but will do so by July 1980.

On May 21, 1980 the California Energy Commission staff indicated that the two California utilities (SCE and PG&E) would need a total of approximately 1,543 MW by 1990, provided that preferred elements of the utilities' resource plans would be developed.

The Utah Public Service Commission declined to comment since the municipal power system in St. George is not under their jurisdiction. However, BLM assessment indicates that St. George would not need the power represented by the AWV Energy System, provided that the existing purchase power contract with Utah Power and Light Company would be continued and addended to meet future energy demand.

Based on the information received to date, a total power need of approximately 1,828 MW has been substantiated for the year 1990.

Warner Valley Water Project

Information developed by Centaur Associates, Inc. (a BLM contractor) indicates that the need for a municipal water supply to serve several southern Utah communities has been met by a separate water development: the Snow Canyon Project. There would, however, be several potential uses for the impounded water, such as agricultural or recreational uses.

MAJOR ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ALTERNATIVE ACTIONS

As specified under the Council on Environmental Quality Final Implementing Regulations of the National Environmental Policy Act of 1969 (as amended), the applicants' proposal and the five alternatives were evaluated to determine their potential major environmental impacts. The results of the evaluation are presented below.

Alternative 1: Applicants' Proposal

Preliminary air quality screening evaluations done by the Environmental Protection Agency (EPA) in Regions VIII and IX indicate that there could be violations of air quality standards with the operation of the proposed Warner Valley and Harry Allen powerplants. Emissions from the Warner Valley powerplant could cause violations of air quality Class I standards in Zion National Park. Based on EPA's screening evaluation, air quality Class II standards in the immediate areas of the Harry Allen and Warner Valley powerplants could also be exceeded. These potential impacts are being further evaluated as the EPA permit process continues.

Studies by Radian (1980) indicate that emissions from the Harry Allen powerplant could cause violations of Class I standards in Nevada's Valley of Fire State Park, a potential Class I area. Information is not presently available on possible cumulative air quality impacts from the proposed Harry

Allen powerplant and that portion of the Reid Gardner powerplant proposed for construction. Definitive conclusions regarding the extent, duration, and importance of these air quality impacts have not yet been made by the responsible Federal and State agencies because there are conflicting study results that must first be resolved. EPA has requested additional air quality data from the applicants. In response to this request, NPC submitted the results of a study done by North American Weather Consultants to EPA Region VIII on May 15, 1980, and to EPA Region IX on May 19, 1980. EPA is currently reviewing this information.

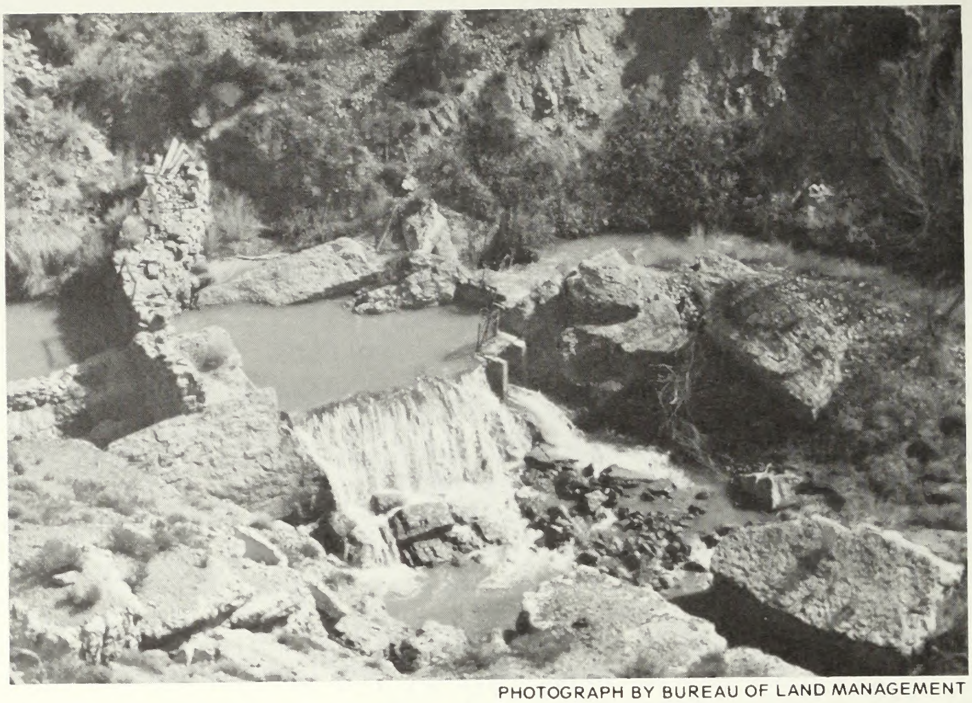
In accordance with the Clean Air Act (as amended, 1977), visibility has been identified by the National Park Service as an important air quality related value in Bryce Canyon and Zion National Parks. Several studies are currently being conducted to address possible visibility impacts to these two National Parks. It is anticipated that the studies will be completed in June 1980. The National Park Service (NPS) has prepared several photographic simulations that show possible visual impacts to Zion National Park. These simulations indicate perceivable visibility reductions. Preliminary information indicates that surface coal mining at the Alton coal fields would reduce visibility in Bryce Canyon National Park by 2.3 percent at the full production level (11 million tons per year). However, other studies indicate significantly higher visibility reductions.

Operation of the proposed powerplants would utilize a portion of the appropriate Prevention of Significant Deterioration (PSD) increment within Warner Valley, Utah and Dry Lake, Nevada. Utilization of this increment would impose a restriction on future industrial growth in the area (i.e., future development would have to accommodate itself within whatever remained of the allowable Class I or II increments). The extent of this restriction will not be known until EPA completes its PSD permit review process.

The pumping of 10,000 acre-feet of ground water per year from the Navajo Sandstone Formation near Alton, Utah could adversely affect nearby springs. The extent and severity of the possible impacts cannot be determined until an intensive program of test drilling and pumping is conducted. According to the State of Utah Department of Natural Resources, Division of Water Rights "approval [of the Alton well field] could not be made if there is known or even suspected interference possible [with approved water rights]."

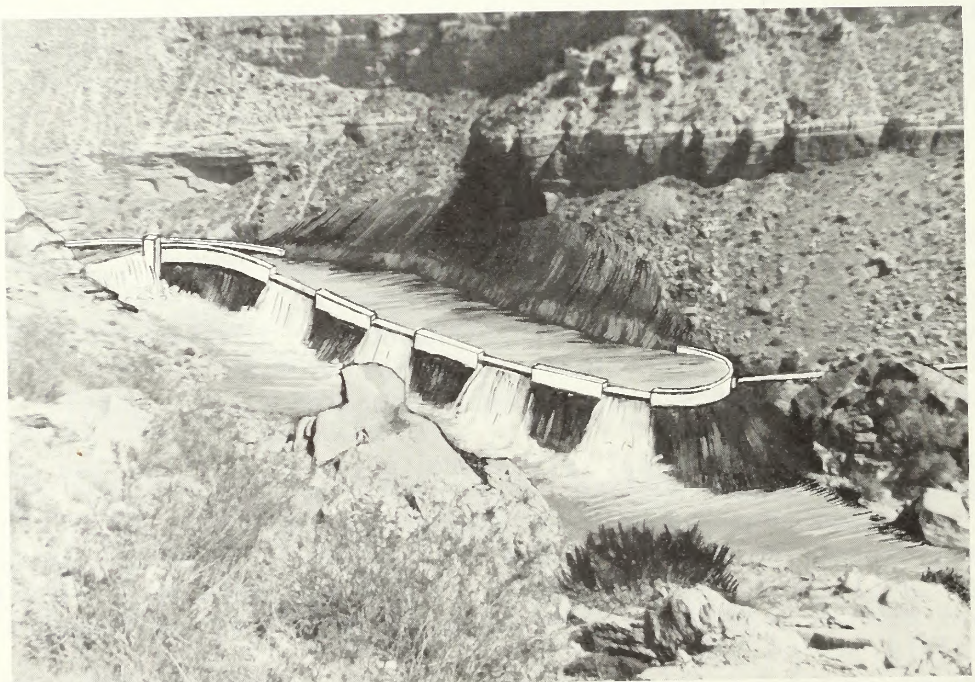
According to a biological assessment prepared by BLM, two officially listed endangered plant species, the dwarf bearclaw poppy (Arctomecon humilis) and the siler pincushion cactus (Pediocactus sileri) would be adversely affected, indicating a need for Section 7 consultation under the Endangered Species Act. An official U.S. Fish and Wildlife (USFWS) biological opinion will be available for inclusion in the final environmental impact statement (EIS).

Habitat of the officially listed endangered woundfin minnow (Plagopterus argentissimus) would be adversely affected by the construction and operation of the proposed Warner Valley water project. A biological opinion concerning impacts to the fish was prepared by USFWS (April 3, 1978) which concluded that the proposed reservoir project would be in violation of the Endangered Species Act. The opinion also set forth certain minimum streamflows required to protect the woundfin minnow from extinction. In 1979, the Washington



PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

HURRICANE DIVERSION



VISUAL SIMULATION BY BUREAU OF LAND MANAGEMENT

VISUAL SIMULATION OF PROPOSED HURRICANE DIVERSION

County Water Conservancy District submitted a redesigned diversion schedule as a compromise between the minimum flows recommended by USFWS and their earlier proposal. As a result, BLM initiated Section 7 reconsultation on the project with USFWS to determine if the redesigned diversion structure would impact the woundfin minnow. A revised biological opinion is expected to be available from USFWS by October 1980 and will be included in the final EIS.

BLM has also prepared biological assessments on two candidate endangered species, the Virgin River roundtail chub (Gila robusta seminuda) and the desert tortoise (Gopherus agassizii). These assessments indicate that the proposed Warner Valley Reservoir project would adversely affect the roundtail chub, but the desert tortoise would not be significantly affected by construction of the slurryline or transmission lines. Consultation with USFWS is ongoing on the roundtail chub.

In accordance with the National Historic Preservation Act of 1966 (Section 106), a description of the proposed AWV Energy System and its alternatives was sent on March 28, 1980 to the Western Division of Project Review of the President's Advisory Council on Historic Preservation. BLM, in cooperation with the State Historic Preservation Officer of Utah, has identified one property on the National Register of Historic Places which would be adversely affected by the proposed project. This property is the Hurricane Canal and Diversion. The Honeymoon Trail, a property nominated for inclusion on the National Register of Historic Places, would also be affected. In compliance with 36 CFR, Part 800, consultation with State Historic Preservation Officers and the President's Advisory Council on Historic Preservation is continuing.

The Dominguez-Escalante Trail is under study by the National Park Service for inclusion in the National Historic and Scenic Trails System. The development of the Warner Valley powerplant and the coal slurry pipeline would adversely affect the natural setting of a portion of this trail.

Expansion of an existing communications facility on Spirit Mountain, Nevada would be offensive to several southwestern Indian tribes. Spirit Mountain (Avikwame) is considered the sacred place of creation for the Mojave, Quechan, Kamia, Diegueno, and Maricopa people of southern Nevada, western Arizona, and southeastern California.

A total of 24,752 acres would incur a change from existing uses to project uses over the life of the project. The following land use plans and controls would be affected by this alternative: a zoning change in Kane County to permit surface mining; modification of the California Desert Conservation Area Plan in regard to proposed electrical transmission lines; a zoning change in Clark County, Nevada to permit the proposed Harry Allen powerplant; and zoning changes in Washington County to permit the proposed Warner Valley powerplant and water project. The 500-kV transmission lines proposed for construction in southern California would pass through portions of Wilderness Study Areas. These areas are presently under an "interim management policy" designed to protect their wilderness values.

An annual 31,000 acre-foot municipal water supply for five southern Utah communities would be created with the construction of the proposed Warner Valley water project, which would provide an impetus for future industrial and community growth.

Substantial changes to the existing lifestyle, tax base, and socioeconomic bases of Kane and Washington Counties, Utah and Clark County, Nevada would occur as a result of project developments. A synopsis of the anticipated impacts is provided below by county.

Kane County. While providing increased employment and income opportunities in the county, this alternative would probably generate some major infrastructural and sociological problems. Increased incomes and expanded tax bases would be very beneficial for the county, but would have to offset added expenditures in such areas as law enforcement, sewage treatment, education, health care, etc. An equity between such benefits and burdens would probably not be achieved very rapidly.

Washington County. This alternative would provide Washington County with additional population and economic growth. This growth during the construction period could generate some temporary housing and sewage disposal problems in some of the affected communities. Expansion of the county's tax base should eventually relieve such problems, although some short-term deficiencies would probably be incurred.

Clark County. Since high population growth rates already exist in the Las Vegas Valley area and since there is a large diversity in employment and business activity, this alternative would not generate much impact on existing trends. The greatest impacts would occur during the construction phase of the project, but these would only yield 1 or 2-percent increases over baseline projections and could probably be absorbed by the area quite readily. The increased tax base could be extremely beneficial, especially in view of the low level of incremental impacts on existing services that would be generated by the project.

Coal-fired generating capacity (2,500 MW) equal to approximately 25 million barrels of oil per year would be available for use in the service areas of NPC, SCE, PG&E, and the city of St. George, Utah. If this capacity would be utilized to reduce oil-fired generation, the electric consumer would benefit from a more stable fuel price structure and the nation would benefit from the reduction in foreign oil imports.

Alternative 2: Construct a 2,000-MW Powerplant at the Harry Allen Site and Slurry Coal from the Alton Coal Fields

The information presented below focusses on anticipated impacts which would be substantially different from those discussed under Alternative 1. Because impacts would be essentially the same for air quality and visibility effects of the proposed Harry Allen powerplant, incremental use of the Class II PSD allowance, biological effects to the desert tortoise, Wilderness Study Areas in southern California, Spirit Mountain (a native American religious site), and the socioeconomic effects to Kane County, the reader is referred back to the impact description for Alternative 1.

Preliminary information suggests that surface coal mining at the 8 million tons per year level in the Alton coal fields would reduce visual range in Bryce Canyon National Park by 1.67 percent. A study is currently under way to address possible visual range impacts. It is anticipated that the study will be completed in June 1980.

PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

VIRGIN RIVER GORGE

PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

COMMEMORATIVE WAGON TREK ON THE HONEYMOON TRAIL

The pumping of 7,800 acre-feet of ground water per year from the Navajo Sandstone Formation near Alton, Utah could adversely affect nearby springs. The extent and severity of the possible impacts cannot be determined until an intensive program of test drilling and pumping is conducted. According to the State of Utah Department of Natural Resources, Division of Water Rights "approval [of the Alton well field] could not be made if there is known or even suspected interference possible [with approved water rights]."

According to a biological assessment prepared by BLM, two officially listed endangered plant species, the dwarf bearclaw poppy (Arctomecon humilis) and the siler pincushion cactus (Pediocactus sileri) would be adversely affected by the construction of the coal slurry pipeline near the city of St. George. The assessment indicates that while individual plants may be destroyed, neither species as a whole would be significantly affected. These assessments have been sent to USFWS for review under Section 7 regulations of the Endangered Species Act.

BLM, in cooperation with the State Historic Preservation Officer of Utah, has identified an adverse impact to the Honeymoon Trail, a site nominated for National Register status. The coal slurry pipeline and its ancillary facilities would alter the natural setting of a portion of the trail. Prior to any project implementation the procedures outlined in 36 CFR, Part 800 will be followed.

A total of 15,685 acres would incur a change from existing uses to project uses over the life of the project. The following land use plans and controls would be affected by this alternative: a zoning change in Kane County to permit surface mining; modification of the California Desert Conservation Area Plan in regard to proposed electrical transmission lines; and a zoning change in Clark County, Nevada to permit the proposed Harry Allen powerplant.

Coal-fired generating capacity (2,000 MW) equal to approximately 20 million barrels of oil per year would be available for use in the service areas of NPC, SEC, and PG&E. If this capacity would be utilized to reduce oil-fired generation, the electric consumer would benefit from a more stable fuel price structure and the nation would benefit from a reduction in foreign oil imports.

Alternative 3: Construct a 250-MW Powerplant at Warner Valley with Coal Trucked from the Alton Coal Fields, Construct the Warner Valley Water Project, and Construct a 1,000-MW Powerplant at the Harry Allen Site with Coal Railed from Central Utah or Wyoming

As indicated in Alternative 2, the following discussion focusses on those impacts which would be substantially different from those discussed under Alternative 1. For a discussion of the following impact areas, refer to the impact description under Alternative 1: utilization of a portion of the appropriate PSD class increments, impacts to endangered plants, cultural values, Spirit Mountain, land use changes, and Wilderness Study Areas in southern California.

EPA Regions VIII and IX have not evaluated this alternative for compliance with air quality values. However, studies by Radian (1980) indicate that emissions from the 1,000-MW Harry Allen powerplant would violate Class II standards in the vicinity of the powerplant if Wyoming coal would be used.

Information is not presently available on possible cumulative air quality impacts from a combination of the proposed Harry Allen powerplant and the Reid Gardner powerplant with its planned additions.

In accordance with the Clean Air Act (as amended, 1977), visibility has been identified as an important aesthetic value in Zion National Parks. A study is currently being conducted to determine possible visibility impacts to Zion National Park. It is anticipated that the study will be included in the final AWV EIS.

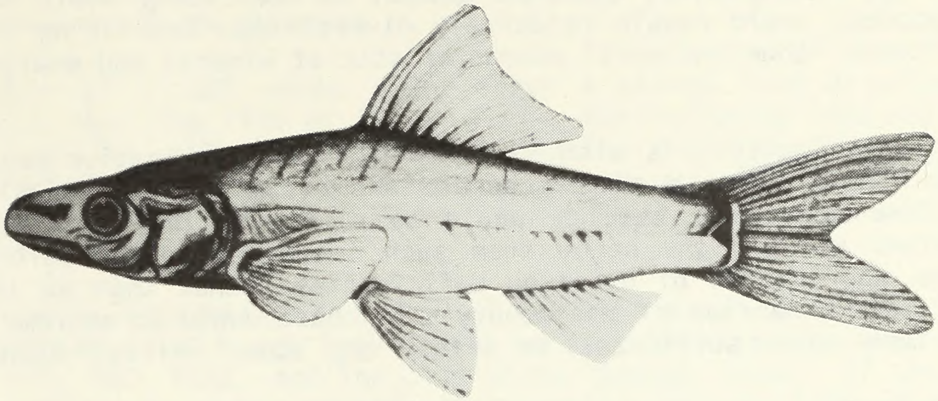
BLM has prepared biological assessments on two candidate endangered species, Virgin River roundtail chub (Gila robusta seminuda) and the desert tortoise (Gopherus agassizii). These assessments indicate that the proposed project would not have a significant effect on the desert tortoise. The assessment on the chub indicates that insufficient information exists to draw a conclusion on the sigificance of the possible impact. USFWS is expected to respond to these biological assessments before October 1980.

An annual 10,000 acre-foot municipal water supply for five southern Utah communities would be created with the construction of the proposed Warner Valley water project, which would provide an impetus for future industrial and community growth. A major regional water-based recreational area could be developed near St. George.

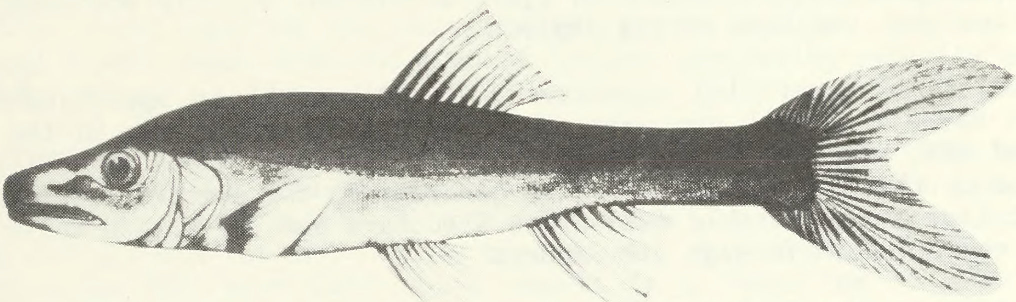
Substantial changes to the existing lifestyle, tax base, and socioeconomic bases of Carbon, Emery, Kane, and Washington Counties, Utah, and Sweetwater County, Wyoming would occur as a result of project developments. Substantial increases in the amount of tax base would also occur in Clark County, Nevada. A synopsis of the anticipated impacts is provided below by county.

Carbon and Emery Counties. Assuming central Utah coal would be used for the Allen plant, the expansion of the workforce attributable to the Allen project alone would blend together with the anticipated overall regional expansions. Lag time between the buildup of such a workforce, the demand for services, and the flows of tax revenues to the region's municipalities could be expected to precipitate some service failures and consequent declines in quality of life in the region. Overall, employment in the region would be expected to increase with the expansion of mining activities. This would, however, also increase the area's dependence on mining as an economic mainstay, making the region susceptible to major declines if mining activities would decrease in the future.

Sweetwater County. Assuming southwestern Wyoming coal would be used for the Allen powerplant, the effects of resulting work force expansion would blend with the anticipated overall regional growth of around 15 percent between 1980 and 1985. This could be expected to generate some infrastructural problems for muncipalities, especially in localized areas. Increased employment in the region would be highly beneficial, but would at the same time make the region more vulnerable to major economic declines if mining activities would decrease in the future.



WOUNDFIN
(Plagopterus argentissimus)



ROUNDTAIL CHUB
(Gila robusta seminuda)

RARE FISHES OF THE VIRGIN RIVER

Kane County. While this alternative would not provide for the maximum development of the Alton coal fields, it would provide Kane County and its communities with relatively controllable growth. Additional demands would be placed on the existing infrastructure, but extreme hardships and difficulties would not be anticipated. Economic growth in the county would be moderate and the economy would remain relatively diversified, insulating it somewhat from the common "boom and bust" characteristic of mineral and energy development.

Washington County. As with Kane County, this alternative would provide Washington County with a more moderate and relatively manageable rate of growth. Some additional demands would be placed on local infrastructures. Most problems which might occur from such increased loads would be in the form of an aggravation of existing deficiencies rather than an infusion of new ones. The expansion of the county's tax base would be extremely beneficial and more than sufficient to offset any added infrastructural costs.

Clark County. Since high population growth rates already exist in the Las Vegas Valley area, and since there is a large diversity in employment and business activity, this alternative would not generate much impact on existing trends. The greatest impacts would occur during the construction phase of the project, but these would only yield about a 1-percent increase over baseline projections and could probably be absorbed by the area quite readily. The increased tax base could be extremely beneficial, especially in view of the low level incremental impacts on existing services that would be generated.

Hauling coal by truck from the Alton coal fields to the 250-MW Warner Valley powerplant could result in 1,376 additional vehicle accidents and 12 fatalities over the life of the project.

Coal-fired generating capacity (1,250 MW) equal to approximately 12.5 million barrels of oil per year would be available for use in the service areas of NPC, SEC, PG&E, and the city of St. George, Utah. If this capacity would be utilized to reduce oil-fired generation, the electric consumer would benefit from a more stable fuel price structure and the nation would benefit from a reduction in foreign oil imports.

Alternative 4: Construct a 2,000-MW Powerplant at the Harry Allen Site with Coal Railed from Wyoming or Central Utah

The information presented below focusses on anticipated impacts which would be substantially different from those discussed under Alternative 1. Because impacts would be essentially the same for cumulative air quality impacts of the Harry Allen powerplant, Spirit Mountain, Wilderness Study Areas in southern California, and socioeconomic impacts to Clark County, the reader is referred back to the impact description for Alternative 1. The reader is referred to the discussion of socioeconomic impacts under Alternative 3 for an evaluation of Carbon, Emery, and Sweetwater Counties because the impacts would be essentially the same.

Preliminary air quality modeling studies done for the proposed Harry Allen powerplant by Radian (1980) indicate that there could be a violation of Class II air quality standards in the vicinity of the plant. The problem area would probably be the 24-hour SO_2 Class II increment. Studies by Radian (1980) also indicate that emissions from the Harry Allen powerplant would violate Class I standards in Nevada's Valley of Fire State Park, a potential Class I area. Definitive conclusions regarding the extent, duration, and importance of these air quality impacts have not yet been made by the responsible Federal and State agencies.

A total of 18,189 acres would incur a change from existing uses to project uses over the life of the project. The following land use plans and controls would be affected by this alternative: modification of the California Desert Conservation Area Plan in regard to proposed power transmission lines, and a zoning change in Clark County, Nevada to permit the proposed Harry Allen powerplant.

Coal-fired generating capacity (2,000 MW) equal to approximately 20 million barrels of oil per year would be available for use in the service areas of NPC, SEC, PG&E, and the city of St. George, Utah. If this capacity would be utilized to reduce oil-fired generation, the electric consumer would benefit from a more stable fuel price structure and the nation would benefit from a reduction in foreign oil imports.

Alternative 5: Energy Conservation and Alternate Energy Sources

Impacts that would be incurred with the implementation of this alternative in the participating utilities' service areas of the city of St. George, NPC, PG&E, and SCE primarily concern those to energy demand (consumption and peak demand) and socioeconomics.

Based on projections of peak energy demand, the implementation of this alternative would supplant the need for additional capacity for the city of St. George in the years 1990 and 2000 if current generating capacity would be maintained.

Approximately 176 MW of peak energy demand would be displaced with the implementation of this alternative in the NPC service area in 1990. This would represent approximately 62 percent of the capacity that could result from the AWV project for NPC in this time frame. Full implementation of this alternative by the year 2000 would result in a reduction in peak energy demand of 413 MW. This would represent a surplus of 68 MW over and above the capacity that could result from the AWV project for NPC in the year 2000.

The application of this alternative in PG&E and SCE service areas would result in a 3,059 MW and 1,108 MW surplus respectively over and above the capacity needed (and represented by the AWV project) by the utilities in 1991. These surpluses could be used to further reduce energy demand and displace current oil-fired capacity in the California utilities' service areas. The reduction in total energy consumption would result in the lowering of overall energy costs to consumers.

The total capacity represented by energy savings and displacement in this alternative would be approximately 4,349 MW in 1991. If this capacity would be utilized to reduce oil-fired generation, it would be equivalent to approximately 43.5 million barrels of oil per year.

The elements of this alternative which would generate socioeconomic impacts would be: possible increases in building capital costs from the installation of alternative energy sources and conservation components; some shifts and/or expansions in employment as alternative energy sources support industries come into existence; and changes in the patterns of energy use to reduced consumption with possible related changes in current lifestyles (i.e., some sacrifices or "belt-tightening" in order to conserve energy).

Alternative 6: No Action

According to NPC, SCE, and PG&E, the utilities' electric power reserve margin would be reduced without the AWV Energy System. It would be probable that the applicants would intensify their participation in other major energy developments, such as "California Coal" or the development of programs for energy conservation and/or alternative energy sources (Alternative 5) to maintain these margins.

The city of St. George would have to continue to purchase power from Utah Power and Light Company to supply projected energy demands, or it could obtain lay-off power from the Intermountain Power Association, whose 3,000-MW power generating facility will be constructed near Lynndyl, Utah. The city of St. George could also develop a program of energy conservation and/or develop alternative energy sources (Alternative 5).

UNRESOLVED ISSUES AND AREAS OF CONTROVERSY

Certain controversial issues which could have a direct bearing on the implementation of the applicants' proposal or alternatives have not been resolved. Additional analyses of these issues will provide new data for determining potential project impacts and will identify areas where agencies other than BLM have integral consultation or regulatory roles. The following is a list of unresolved issues, the agency responsible, and the date by which the issue is expected to be resolved.

1. The Need For Power. CPUC is expected to make a final decision by January 9, 1981 concerning the participation of the two California utilities (PG&E and SCE) in the AWV Energy System in accordance with California State regulations.

2. Coal Unsuitability Petition. The Office of Surface Mining Reclamation and Enforcement (OSM) has been petitioned jointly by the Environmental Defense Fund, Sierra Club, Friends of the Earth, and Alton-area landowners to declare lands within the Alton coal fields of southern Utah as unsuitable for all or certain types of mining. Some of the reasons cited as a basis for this action by the petitioners are: strip-mined lands would not be reclaimable; accelerated erosion would cause increased sedimentation in surface streams; shallow ground water resources would be seriously degraded; springs and wells in the area would be adversely impacted; blasting could destroy the delicate erosional features of Bryce Canyon National Park; and coal mining activities would cause visual intrusion and generate fugitive dust and pollutants which would impair air quality and visibility at Bryce Canyon National Park.

OSM is expected to make a determination by November 30, 1980 on the suitability of the Alton coal fields for mining developments in accordance with the Surface Mining and Reclamation Act. Within the umbrella of the unsuitability petition are several specific issues which are under evaluation. For example, NPS, BLM, EPA, and OSM are involved in additional analysis (to be concluded by August 1980) of the air quality/visibility/visual intrusion impacts. NPS is also contracting for a visitor perception study and an analysis of the potential effects of blasting on the geological structures of Bryce Canyon National Park. These studies should be completed by August 1980. The Forest Service is preparing a report that will analyze the effects of mining on wells and springs in Dixie National Forest. NPS, BLM, and the Forest Service will make recommendations to the Secretary of the Interior on the significance and acceptability of these impacts on lands managed by their respective agencies.

3. Alton Mining Plan. Utah International Inc. must prepare a mining plan and receive mining plan approval by OSM and U.S. Geological Survey prior to project initiation. As part of this approval process, NPS, BLM, and FS (as Federal land managers) must make a determination and advise OSM of the acceptability of potential project impacts on unresolved issues including blasting, air quality, visibility, visual intrusion, and water supply and quality. A mine plan is expected to be submitted in July 1980.

4. Compliance With Air Quality Regulations. EPA is responsible for determining if any project related emissions or pollutants would be in violation of National Ambient Air Quality Standards or pollutant increments for Class I or Class II areas, and issue or deny a PSD permit. If NPS demonstrates to EPA's satisfaction that emissions from this project would have an adverse impact on the air quality related values (including visibility) in Class I areas (Bryce Canyon and Zion National Parks) even though the impact would not exceed the maximum allowable increases for a Class I area, the permit may not be issued.

The issue of whether or not the project would have adverse impacts on air quality related values of the Class I areas is the subject of several ongoing studies by NPC, EPA, NPS, OSM, Utah International, and BLM, but remains unresolved at the present time.

EPA Regions VIII and IX are unable to commit to specific dates for completion of the PSD process because of ongoing analyses. Region VIII presently has the target date of November 1980 for a final PSD permit decision. Region IX expects to complete their final decision by October 1980.

5. Threatened and Endangered Species. BLM has made a biological assessment indicating an adverse impact from construction of the Warner Valley powerplant and water project on the siler pincushion cactus and the dwarf bearclaw poppy, officially listed endangered species.

USFWS is in the process of preparing biological opinions on these two plants. They are also reviewing their biological opinion of the woundfin minnow (an officially listed endangered species) in light of the redesigned water diversion schedule by the water project applicant. Biological opinions are also being prepared on the desert tortoise and the Virgin River chub, candidate species for official endangered listing. The biological opinions from USFWS are expected in July 1980 for the plants and desert tortoise and in September 1980 for the two fishes.

6. Cultural Values. BLM and the Utah State Historic Preservation Officer have determined that the construction of the proposed Hurricane diversion dam would destroy a National Register property and have requested the comments from the President's Advisory Council on Historic Preservation. Procedures for the protection of historic and cultural properties (36 CFR, Part 800) have not yet been complied with; however, these procedures will be followed before implementation of any one or parts of an alternative.

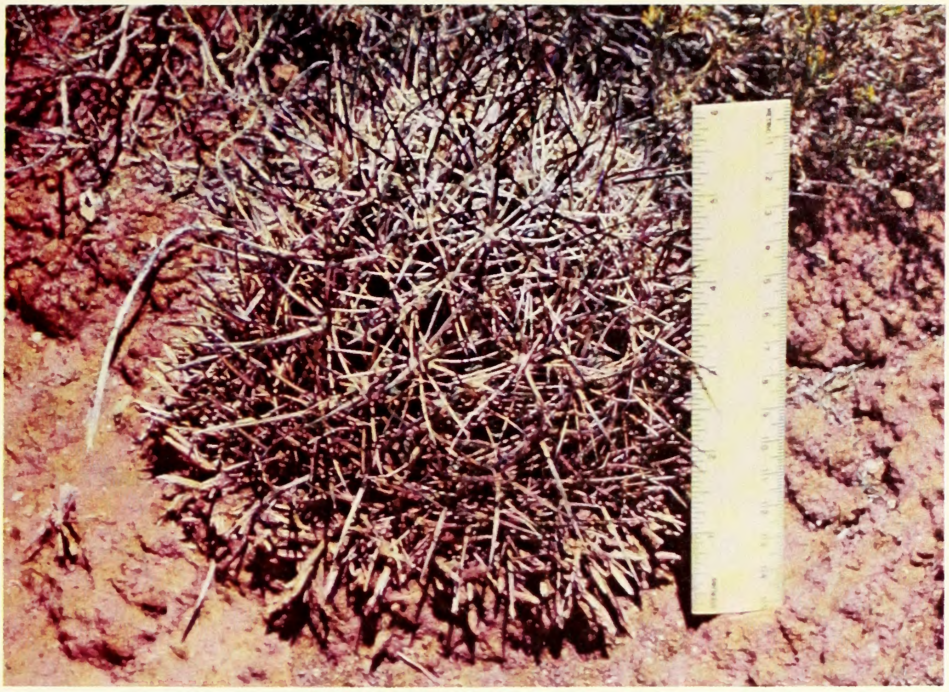
7. Wilderness Study Areas. The proposed transmission line routes of the Western Transmission System would traverse Wilderness Study Areas in California. This issue is being resolved by BLM in consultation with the applicant and the County of San Bernardino. However, no date for reaching an agreement has been established.

8. Floodplain Restrictions. Portions of the proposed Harry Allen powerplant site would be located within the 50-year floodplain of a playa in Dry Lake, Nevada. Potential flood hazards to the plant from a 100-year flood have not been determined in accordance with Executive Order 11988. This evaluation will be included in the final EIS.

9. Land Use Conflicts with Transmission Lines. The crowding of various transmission lines into single corridors would preclude or otherwise impact other existing or potential land uses for the same area. This crowding effect would occur near Rainbow Gardens, in Eldorado Valley, and through McCullough Pass in southern Nevada, and in the Interstate 15, Eldorado-Lugo, or Victorville-McCullough alternative corridors of the Western Transmission System in southern California. Problems may also arise in the limitation or preclusion of future transmission line routing. The applicants and the appropriate land managers would have to agree upon the final routing and design of the transmission system in order to minimize the impacts of crowding.

IDENTIFICATION OF THE BUREAU OF LAND MANAGEMENT PREFERRED ALTERNATIVE

A decision by the Secretary of the Interior on the Alton unsuitability petition filed for the Alton coal field will not be made until late November 1980. BLM has determined that identification of an Agency Preferred Alternative at this time would be prejudicial to the Secretary's decision making process. Therefore BLM has been authorized by the U.S. Department of the Interior to publish this draft EIS without identifying a preference for either the applicants' proposal or any of the five alternatives analyzed herein. A BLM preferred alternative will be identified in the final EIS, which is currently scheduled for publication in November 1980.



PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

SILER PINCUSHION CACTUS

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DWARF BEARCLAW POPPY

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CHAPTER 1

THE PURPOSE AND NEED OF THE PROPOSED ACTION

INTRODUCTION

In accordance with the National Environmental Policy Act of 1969 (Public Law 91-190, 1970), the Bureau of Land Management (BLM), acting as lead agency, has prepared this document in response to the filing of rights-of-way applications by Nevada Power Company (NPC), Southern California Edison (SCE), Pacific Gas and Electric (PG&E), the Washington County Water Conservancy District, and the city of St. George for use of approximately 28,500 acres of public land. The applicants propose to utilize these public lands in southern Utah, Nevada, California, and northern Arizona to develop their proposed 2,500-megawatt (MW) Allen-Warner Valley (AWV) Energy System.

This chapter identifies: the purpose and need of the proposed project; the scoping procedures which were used in determining the more significant environmental impacts; the scope of the environmental impact statement (EIS) itself; and interrelated projects which could have a cumulative effect.

PURPOSE AND NEED OF PROPOSED PROJECT

According to the applicants, the proposed energy project is designed to meet, at least in part, the need for increased power supplies in the early 1990s and beyond for the participating utilities.

From the proposed AWV Energy System, the participating utilities have projected a need for the following generating capacities by 1990: NPC, 285 MW (NPC, 1975); SCE and PG&E, 1,045 MW each (SCE and PG&E, 1979); and the city of St. George, 43.7 MW (all of which would come from the AWV Energy System; personal communication, Rudger McArthur St. George City Utilities Director, May 27, 1980).

The ownership and initial electrical generating capacity entitlements of the participating utilites in the proposed Harry Allen and Warner Valley powerplants would be:

Participants	Ownership	Initial Capacity Entitlement
Harry Allen Powerplant		
Nevada Power Company	20%	8% (160 MW)
Southern California Edison Company	40%	40% (920 MW)
Pacific Gas and Electric Company	40%	46% (920 MW)
Warner Valley Powerplant		
Nevada Power Company	25%	25% (125 MW)
Southern California Edison Company	25%	25% (125 MW)
Pacific Gas and Electric Company	25%	25% (125 MW)
City of St. George	25%	25% (125 MW)

Thirteen years after initial operation, and throughout the remainder of the proposed project life, NPC would recapture generating capacity from SCE and PG&E in annual steps as needed (with limits), to supply the electrical energy needs of NPC's customers.

The question - "Is the power really needed?" - was raised numerous times during the EIS scoping process. In order to better respond to this question, the utility forecasts as listed above were subject to independent verifications. The year 1990 is used as a base for energy need comparisons because the four utilities have indicated need projections for this date.

NPC's proposed electrical energy needs were verified by the Nevada Public Service Commission, which stated that the company would require at least 285 MW by 1990 (letter of January 23, 1980).

The California Public Utilities Commission (CPUC) is conducting a proceeding on an application filed by SCE and PG&E for a Certificate of Public Convenience and Necessity for the AWV Energy System. In a letter dated April 11, 1980, from the staff of CPUC to the BLM State Director of Utah, the following statement is made:

> . . . In my letter of January 25, 1980, I wrote that there appeared to be two possible reasons for needing the energy that would be generated by the Allen-Warner system: using coal to displace oil in the fuel mix of the utilities involved in the project, a matter of national importance; and providing additional electric capacity to help assure reliable service for consumers. There appear to be compelling arguments to justify the capacity represented by the Allen plant on the first grounds, that of fuel displacement. As to the second, I believe it important to clarify the statements in our January 25 letter: our staff position is that, while insuring reliable electric power for California consumers is a matter of highest priority to us, it appears at this time that the capacity represented by the Allen plant would not be needed solely for reliability reasons provided that a number of reasonable assumptions are made. These assumptions include, for example, that power is available from several large nuclear projects (Diablo Canyon, San Onofre, and Palo Verde); that no long-term shutdowns or mechanical problems occur with existing and new power plants; and that certain sources of purchase power are available as currently scheduled. In addition, a key assumption in this conclusion is the use of the recent electric demand forecast of the California Energy Commission.

After the California Energy Commission (CEC) authorized intervention in the CPUC proceeding, the CEC staff developed the following proposed recommendation in a letter to the Energy Commissioners dated April 25, 1980:

> A. The CEC recommends to the PUC that there is need for 1,642 MW of AWVES consisting of 503 for PG&E and 1,139 MW for SCE.
>
> B. The CEC recommends to the PUC that it find a need for the 1,642 MW at the Harry Allen site but that there is no necessity for using the Warner Valley site.

On May 21, 1980, the CEC reviewed this staff position and tentatively determined that current utility plans contain sufficient preferred resources that, if constructed, they would reduce PG&E's need for power from the AWV Energy System to 498 MW. The need for SCE would be at least its proposed share (1,045 MW). A final determination on whether preferred resources in the plans of PG&E and other northern California utilities can in fact be relied upon to displace all but 498 MW of PG&E's share of the AWV Energy System will be deferred to the filing of briefs after all parties have had an opportunity to testify on the viability of the preferred alternative (personal communication, Dave Marcus, representative of CEC, May 22, 1980).

The Public Service Commission of Utah was asked for an opinion on the future power needs of the city of St. George. The Commission declined to comment since it does not have jurisdiction over municipal utilities. However, BLM assessments indicates that the city of St. George would not "need" the 125 MW of capacity that would be available from the proposed AWV Energy System by 1990. This assessment is based on the city's own projection of additional energy need of only 43.7 MW, and the continuation of existing power supply contracts with Utah Power and Light Company (UP&L), which can be adjusted yearly depending upon the city's projected energy needs. According to UP&L, unless these contractual agreements would be rescinded, UP&L would meet the energy needs of its customer in amounts specified in the contract (personal communication, Dean Bryner, Vice-President of System and Resource Planning, UP&L, May 29, 1980).

In summary, independent verifications of the need for power indicates that 1,828 MW from the AWV Energy System would be needed by the year 1990. It must be recognized that these figures could change since the proceedings on SCE and PG&E's application for a Certificate of Public Convenience and Necessity have not yet been completed.

While the proposed Warner Valley water project would provide cooling water to the proposed Warner Valley powerplant and supply supplemental irrigation water, most of the water from this facility would be used to supply municipal and industrial users in five southern Utah communities and the State of Utah. In fact the State of Utah has identified this project for possible State funding should alternate financing become necessary. According to the Washington County Water Conservancy District (Memorandum from Rudger McArthur, Secretary-Treasurer, December 6, 1979) the water project would provide, at full operation, some 26,200 acre-feet of fully treated culinary water. This amount of water would be sufficient to supply culinary and industrial water to a city of 73,105 people, based on an 800 gallon per day connection requirement of the State of Utah, Division of Health (letter of April 6, 1977) and assuming 2.5 people per hook up. According to Conservancy District projections, culinary water deliveries would start as soon as water would be impounded and treatment facilities constructed.

According to a recent BLM-sponsored study, however, only a small portion of the proposed municipal water supply system would be needed (Socioeconomics, Centaur Associates, Inc., 1980). The study indicates that with the recently completed Snow Canyon Water Project located northeast of St. George, the following municipal water supply/demand situation would exist by the year 2020:

Water User	Demand in the Year 2020 (Percent of Present Capacity)
St. George (assuming an annual compounded growth rate of 2.2%)	78
Santa Clara (assuming an annual compounded growth rate of 3.2%)	81
Ivins (assuming an annual compounded growth rate of 2.1%)	81
Washington (assuming an annual compounded growth rate of 2.9%)	127
Bloomington (met by St. George surplus)	
State of Utah (no proposed use)	

According to the forecasts, only Washington's municipal water supply would be less than needed by the year 2020. It would, however, be probable that this deficit could be eliminated with the transfer of surplus water from the other communities.

SCOPING PROCESS

In accordance with the National Environmental Policy Act of 1969 (as amended) and the implementing regulations of the Council on Environmental Quality (Federal Register, Vol. 43, No. 230), a notice announcing a series of EIS scoping meetings was published in the Federal Register on June 14, 1979 (Vol. 44, No. 116). Four EIS scoping meetings were held during July and August 1979 in Las Vegas, Nevada; St. George, Utah; Kanab, Utah; and Salt Lake City, Utah. A written invitation was sent to all parties who had expressed an early interest in the project, together with media releases designed to inform the general public. Approximately 335 people attended one or more of the scoping meetings and provided guidance in terms of defining the scope and level of detail of the EIS.

Each person attending a scoping meeting was requested to complete a scoping meeting form designed to document public input (Appendix 1). This form called for the listing of at least five topics which the participant believed should be addressed in the EIS. A numerical value was assigned to all of the topics listed, starting with 6 points for the most important issue or topic, 5 points for the next most important, etc. The fifth and all other topics listed were given 1 point each. After tabulating all of the scoping meeting rating forms the following results were obtained.

Issue	Numerical Rating
Hydrological Impacts	1,375
Socioeconomics	1,009
Air Quality (Including Visibility as it Relates to Zion and Bryce Canyon National Parks)	631
Need for Energy	329
Land Use Impacts	203
Future Situation Without Project	146
Alton Coal Field Impacts	116
Threatened or Endangered Species	115
Aesthetics	110
Wilderness Values	86

The 335 scoping meeting participants were also asked to identify at least two possible alternatives to the proposed AWV Energy System. Forty-six possible alternatives were suggested by the participants (Appendix 2). In order to determine which of the suggested alternatives should receive an in-depth evaluation in the EIS, a set of alternative screening criteria was developed and used to determine the "reasonableness" of the 46 suggested alternatives. An alternative was considered to be reasonable if it met all of the screening criteria. The following six alternatives (including the applicants' proposal) were determined to be reasonable and suitable for a detailed evaluation within this EIS. It is recognized that any one or parts of the six alternatives could be included in the eventual selection of a preferred alternative. Therefore, components under one alternative may be interchanged with components of another (e.g., any of the coal sources could be used by a powerplant). These reasonable alternatives, as listed below, are fully described in Chapter 2.

1. Construct a 500-MW powerplant in Warner Valley, a 2,000-MW powerplant at Dry Lake, Nevada slurry coal from the Alton coal fields, and construct the Warner Valley water project (applicants' proposal).

2. Construct a 2,000-MW powerplant at Dry Lake, Nevada site and slurry coal from the Alton coal fields.

3. Construct a 250-MW powerplant at Warner Valley with coal trucked from the Alton coal fields, construct the Warner Valley water project, and construct a 1,000-MW powerplant at Dry Lake, Nevada site with coal railed from central Utah or Wyoming.

4. Construct a 2,000-MW powerplant at Dry Lake, Nevada with coal railed from Wyoming or central Utah.

5. Energy conservation and the development of alternative energy sources.

6. No action.

Specific questions were raised about the feasibility of railing coal to the proposed Warner Valley powerplant site from sources other than the Alton coal fields (i.e., central Utah, Kaiparowits, or Wyoming). An analysis resulted in conclusions unfavorable to such a transportation system on the grounds of economic unfeasibility. The applicants believe that the expense of building a railroad to the plant site from existing routes, added to the cost of fuels, would be prohibitive for the Warner Valley powerplant.

Scope of the EIS

The AWV EIS provides an analysis of the proposed AWV Energy System and its reasonable alternatives. In accordance with the guidance provided by the Council on Environmental Quality Regulations of 1978 and based upon public input noted under Scoping Process, this EIS is designed to focus primarily on significant impacts associated with hydrology, socioeconomic changes, and air quality. Discussions are also provided concerning cultural resource values, threatened and endangered species, land use changes, aesthetic values, energy efficiency, and wilderness impacts.

Environmental elements not identified as being of major public concern nor considered significant by the technical specialists preparing this document are given substantially less emphasis. These elements include: climate, fugitive dust, topography, geology, paleontology, minerals development, soils, and commonly occurring species of vegetation and wildlife.

Impact analyses focus primarily on the proposed powerplants, transmission systems, and coal transportation systems of the applicants' proposal and the alternatives. Impacts of coal mining for the different coal sources are generalized with reference to previously published EISs which concern the specific coal mining regions.

Although scoping meeting responses urged an intensive evaluation of the Alton coal fields, such an evaluation is not included in this analysis. The AWV project is one of several proposed energy developments discussed in Development of Coal Resources in Southern Utah Final Environmental Statement (SU) (U.S. Department of the Interior, 1979). This regional environmental statement provides analyses of the cumulative and general impacts of developing the AWV Energy System, including development of the Alton coal fields of southern Utah (Vol. 2, Site-Specific Analysis). It also discusses the anticipated impacts of developing just the western half of the Alton coal fields (Alton west) with a 1-million ton annual production rate. The impact analyses, however, were not based on a mine plan, and are therefore not complete.

The general environmental impacts that would occur from expansion of coal mining in central Utah and southwestern Wyoming are addressed in Development of Coal Resources in Central Utah Final Environmental Statement (CU) (U.S. Department of the Interior, 1979) and Development of Coal Resources in Southwestern Wyoming Final Environmental Statement (SW) (U.S. Department of the Interior, 1978) respectively. Material presented in the "high level production scenario" of CU includes analysis of the production of coal for unspecified markets, which could include the coal needs of the AWV

Energy System. Use of southwestern Wyoming coal would involve the expansion of coal mining over and above the level specified in the "high level production scenario." For analyses of impacts of coal mining in the proposed Alton coal fields and the alternative coal sources in central Utah and southwestern Wyoming, information is summarized or simply referenced from these previously published statements in accordance with the concepts of "tiering" and "incorporation by reference" contained in the Council on Environmental Quality Regulations of 1978. Under the principle of "incorporation by reference," these and several other publications are extensively utilized throughout this EIS. (Appendix 3 contains a list of Government Depository Libraries where public reading copies are available for review.) In addition, certain specific actions associated with complete development of the applicants' proposal or the alternatives (i.e., borrow areas, construction activities, camps, etc.) are not addressed because they would be subject to more detailed evaluations as onsite engineering takes place for the alternative finally selected for implementation.

A detailed mining plan for proposed development of the Alton coal fields has not yet been submitted to the U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement (OSM). Should a mining plan be submitted to OSM, it would be subject to an environmental review by that office. This review would be in accordance with the National Environmental Policy Act of 1969 and would result in the preparation of an environmental assessment document subject to public review and comment.

A petition requesting the OSM to designate certain lands in the Alton coal fields of southern Utah as unsuitable for surface coal mining operations is presently before the OSM (Environmental Defense Fund et al., 1979). The Secretary of the Interior must make a decision by late November 1980 as to whether or not certain lands will be designated unsuitable for all or certain types of mining, and will decide on stipulated conditions to any coal mining activities in the area covered by the petition. Some of the reasons cited by the petitioners for designating the lands unsuitable are: strip mined lands would not be reclaimable; accelerated erosion would cause increased sedimentation in surface streams; shallow ground water resources would be seriously degraded; springs and wells in the area could be adversely impacted; blasting could destroy the delicate erosional features of Bryce Canyon National Park; fugitive dust and pollutants from coal mining activities would impair air quality and visibility; and mining activities would be visible from Bryce Canyon National Park. Should the Secretary designate lands in the Alton fields as unsuitable for mining, then mining would be prohibited on those lands. If the Secretary sets conditions or limits mining in the Alton area, any level of coal development in the Alton field could be affected. OSM is presently preparing an environmental assessment on which to base a decision in regards to this petition.

The CPUC is presently preparing an Environmental Impact Report (EIR) on the AWV Energy System focusing primarily on the Western Transmission System. This EIR is being prepared in response to the filing of an application for a Certificate of Public Convenience and Necessity (a-59308), and will address proposed and alternative transmission line routes, feasibility, economics, technical characteristics and reliability of the entire project, and impacts in California related to the proposed project and alternatives including

Energy Conservation and Alternative Energy Sources. The EIR will be published on June 24, 1980, with a final decision on the application due by January 9, 1981. The information to be provided in this EIR will be used as the analysis of Alternative 5 of this EIS (Energy Conservation and Alternative Energy Sources) for the participating California utilities. To obtain a copy of this document, the reader should contact CPUC at the following address:

California Public Utilities Commission
Allen-Warner Valley Project
1390 Market Street
Fox Plaza, Room 724
San Francisco, California 94102

INTERRELATED PROJECTS

BLM, in cooperation with the National Park Service and the State of Utah, is studying the feasibility of the placement of a coal transportation system which would provide access to the southern Utah coal fields (i.e., Kaiparowits and Alton). Should such a system be implemented, the construction of a railroad connecting the proposed Warner Valley powerplant would be more feasible.

NPC's Reid Gardner generating station is located about 25 miles northeast of the proposed Harry Allen powerplant. The Environmental Protection Agency recently granted NPC a Prevention of Significant Deterioration permit to expand the station to 580 MW. Emissions from this facility and from the proposed Harry Allen plant could have a cumulative effect on the air quality of southeastern Nevada.

In December 1979, the Intermountain Power Project (IPP) was approved for development on public lands by the Secretary of the Interior. One of the transmission lines (230 kV) from the generating station would extend to the city of St. George, Utah. It is probable that electrical energy from this facility could be made available to the city of St. George. The IPP transmission line network and alternative routes are extensively discussed in the final EIS for IPP (BLM, U.S. Department of the Interior, 1979). These same transmission line routes would be proposed as possible routes for the AWV Energy System's southern California electrical transmission line network and are discussed only briefly in this EIS.

SCE and PG&E have both recently announced their intention to develop coal-fired power generating stations within the State of California. These generating stations would be in the 1,500 to 1,600-MW range. Planning for these generating stations may have a bearing on the purpose and need for electrical energy from the AWV Energy System.

The U.S. Air Force is studying several valleys within eastern Nevada and western Utah for the siting of the proposed MX Missile System. A draft EIS is scheduled for public release in July 1980. The construction and operation of the MX Missile System and the AWV Energy System could have a cumulative effect on the socioeconomic environment of Nevada and Utah. These cumulative impacts cannot be analyzed until the release of the Air Force EIS.

CHAPTER 2

ALTERNATIVES INCLUDING THE PROPOSED ACTION

INTRODUCTION

This chapter presents a description of the applicants' proposal and the five alternatives to that proposal, a discussion of actions needed to authorize the implementation of the proposal or alternatives, a discussion of standard operating procedures and mitigating measures required to receive approval to utilize public lands, a comparative summary of the impacts of the applicants' proposal and the five alternatives, and information pertaining to the Bureau of Land Management (BLM) preferred alternative(s).

ALTERNATIVE 1: APPLICANTS' PROPOSED ACTION

This alternative is the applicants' proposal. It involves the construction and operation of a 2,500-megawatt (MW) coal-fired steam-electric generating system. The system would consist of a coal mine, a coal processing facility, a coal slurry pipeline system, two separate powerplants, a water reservoir project, and an electrical transmission system. Projected life would be 40 years. Figure 2-1 (located at the back of this volume) indicates the location of the various components of the system. Table 2-1 provides a summary of the requirements of land, water, fuel, manpower, etc. under this alternative. The distribution of ownership of lands proposed for development is shown in table 2-2. A full description of design features of the applicants' proposal can be found in Allen-Warner Valley Energy System: Environmental Assessment (Nevada Power Company [NPC], 1975). Following is a brief description of the major components of this alternative.

Coal Mine

The applicants have proposed the Alton coal fields of southern Utah as their preferred coal source, although they are presently studying the feasibility of using other coal sources. Results of the study are expected in May 1980 but are considered proprietary information by the applicants.

As proposed, a new coal mine would be opened in the Alton coal field (about 25 miles north of Kanab, Utah) to provide coal for this alternative (fig. 2-2). Existing Federal and State coal leases and private lands would be developed to produce about 312 million tons of washed coal over the 40-year project life. Coal would be produced by both surface and underground mining methods. The average heat value of the Alton coal (as mined) would be 9,647 British thermal units per pound (Btu/lb). Average quality (as fired) would be 8,897 Btu/lb, 0.86 percent by weight of sulfur, and 7.19 percent by weight of ash (NPC, 1975). The mine would occupy about 8,328 acres.

As proposed by the applicants, the surface mine would yield about 212 million tons of coal. Dragline mining methods would be used to develop a 35-mile long coal outcrop through a contour strip mining operation.

Although a mining plan has not been submitted, it would be probable that underground mining would start about 7 years after initiation of surface

TABLE 2-1

Alternative 1 - Resource Requirements (Daily Averages)

	Input							Output							
											Wastes				
Project Components	Land[a] (acres)	Water (acre-feet)	Coal[b] (tons)	Electricity (MW)	Oil (barrels)	Lime (tons)	Manpower (worker days)	Water (acre-feet)	Coal[b] (tons)	Electricity (MW)	Solids (tons)	Liquids (acre-feet)	Emissions (tons)[c] SO_2	TSP	NO_x
ALTON COAL MINE															
Construction	......	......	......	.....	......	...	85	.....	......	.....	.....	....	.....	....	......
Operation	8,328	0.65	......	24.6	......	...	[d]1,050	.....	[e]31,951	.....	.....	....	.....	....	......
COAL PREPARATION PLANT															
Construction	......	......	......	.....	......	...	350	.....	......	.....	.....	....	.....	....	......
Operation	1,826	26.5	31,951	25.4	......	...	50	22.69	28,532	.....	3,419	....	.....	....	......
WARNER VALLEY POWERPLANT															
Construction	......	0.07	......	.....	......	...	1,000	.....	......	.....	.....	....	.....	....	......
Operation	4,295	15.9	5,663	.....	65.23	156	100	.....	......	350	1,207	1.4	10.38	2.04	34.3
WARNER VALLEY WATER PROJECT															
Construction	2,993	......	......	.....	......	...	150	.....	......	.....	.....	....	.....	....	......
Operation	1,127	162.0	......	.....	......	...	5	99.45	......	.....	.....	....	.....	....	......
HARRY ALLEN POWERPLANT															
Construction	......	0.35	......	.....	......	...	2,000	.....	......	.....	.....	....	.....	....	......
Operation[f]	5,887	64.97	22,869	.....	260	302	300	.....	......	1,400	3,398	0.57	40.8	8.16	136.22
COAL SLURRY PIPELINE															
Construction	2,218	......	......	.....	......	...	300	.....	......	.....	.....	....	.....	....	......
Operation	1,000	22.69	28,532	0.7	......	...	60	22.69	28,532	.....	.....	....	.....	....	......
ELECTRICAL TRANSMISSION SYSTEM															
Construction	11,434	......	......	.....	......	...	200	.....	......	.....	.....	....	.....	....	......
Operation	500	......	......	.....	......	...	10	.....	......	.....	.....	....	.....	....	......

Source: Nevada Power Company, 1975; Washington County Water Conservancy District, 1975

[a]Acreage computed on a 40-year project life.
[b]Tonnage of all coal computed as having a moisture content of 25.23 percent.
[c]Emissions tonnage includes sulfur dioxide (SO_2), total suspended particulates (TSP), and nitrogen oxides (NO_x). Calculations made assuming properly functioning control devices.
[d]Coal mine work force would build over 10-year period.
[e]Daily average coal production computed from an average operation of 80 hours per week.
[f]Powerplant operation computed at 70-percent capactiy.

TABLE 2-2

Land Ownership of Acreage Affected
Alternative 1

Component	Affected Acreage	Land Ownership (Percent of Total Acreage) Public	State	Private
Alton Coal Mine	8,328	78.0	3.4	18.6
Coal Preparation Plant	1,826	22.0	0.0	68.0
Coal Slurryline	2,218	77.0	11.5	11.5
Warner Valley Powerplant	4,295	85.0	15.0	0.5
Warner Valley Water Project	2,993	68.0	23.0	9.0
Harry Allen Powerplant	5,887	98.5	0.0	1.4
Electrical Transmission System				
Spry to Alton	815	38.5	7.5	54.0
Warner to St. George	46	70.0	30.0	0.0
Warner to Pecos	1,975	86.7	11.7	1.6
Allen to Eldorado	1,598	77.0	10.5	12.5
Western Transmission System Alternatives				
Interstate Highway 15	7,000	69.0	0.0	31.0
Eldorado-Lugo	7,400	73.0	0.0	27.0
Victorville-McCullough	7,160	73.0	0.0	27.0
Highway 66	9,520	73.5	0.2	25.3

Source: Nevada Power Company, 1975; SCE and PG&E, 1979

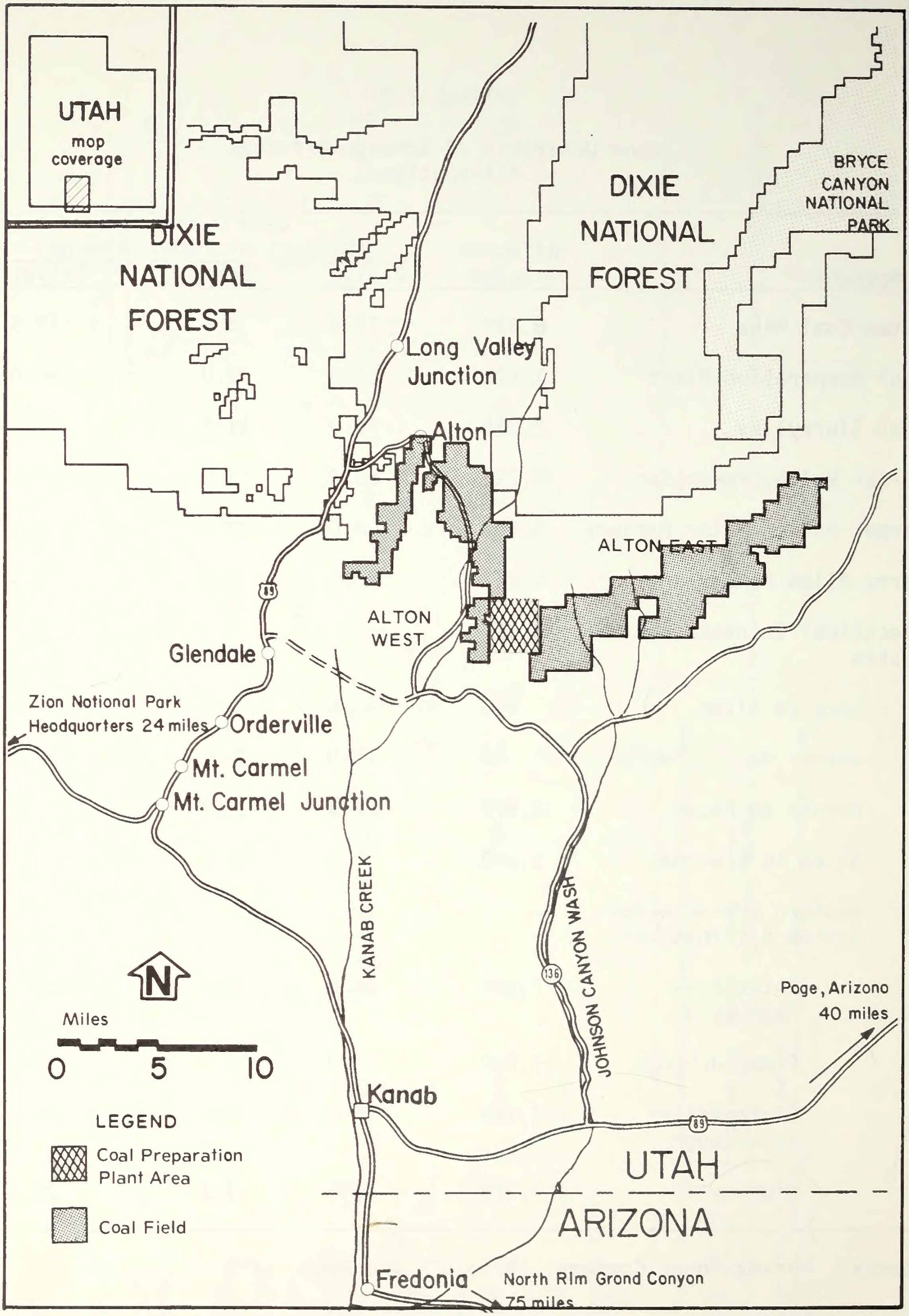


FIGURE 2-2

REGIONAL LOCATION - PROPOSED COAL PREPARATION PLANT AND COAL FIELDS mining and would run concurrently with the surface mining operation. About 94 million tons of washed coal would be produced by longwall mining methods. Three entry headings (15 by 20 feet) on 500-foot centers would be driven from the stripping wall to the lease boundary. Entries would be connected by headings that would be required to begin the longwall face. Equipment would consist of continuous miners, shuttle cars, and ancillary equipment. Mining would begin at the center of the property near the coal preparation plant.

Coal Preparation Plant

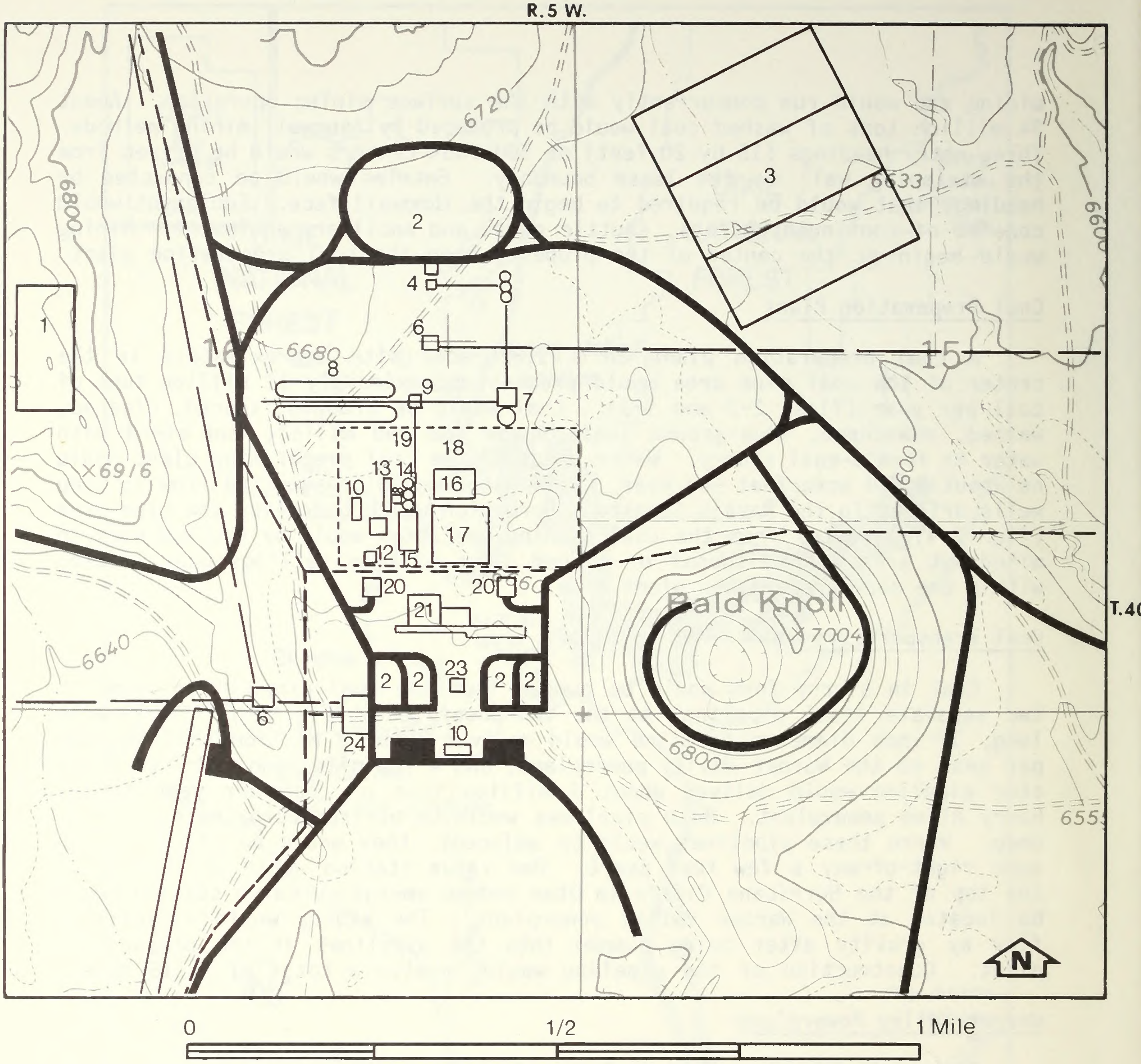
A coal preparation plant on a 1,826-acre site approximately in the center of the coal mine area would process approximately 11 million tons of coal per year (figs. 2-2 and 2-3). Coal would be crushed, stored, cleaned, washed, dewatered, fine-ground (using cage and rod mills), and mixed with water to form a coal slurry. Water needs of the coal preparation plant would be about 9,700 acre-feet per year. This water would be supplied from 13 deep wells drilled in the Navajo Sandstone Formation which underlies the mine area (fig. 2-4). Wastes from the coal washing operation would be trucked back to mined-out areas for disposal or placed in a 62-acre tailings pond located within the coal preparation plant area.

Coal Transport System

Coal in slurry form would be pumped from the coal preparation plant in two separate steel pipelines to the two powerplants (fig. 2-1). A 73-mile long, 12-inch diameter pipeline would deliver about 2 million tons of coal per year to the Warner Valley powerplant, and a 183-mile long, 22-inch diameter pipeline would deliver about 9 million tons of coal per year to the Harry Allen powerplant. Both pipelines would be buried approximately 3 feet deep. Where these pipelines would be adjacent, they would be placed in the same right-of-way a few feet apart. One valve station would be located at the top of the Hurricane Cliffs in Utah and an emergency valve station would be located at the Warner Valley powerplant. The slurry would essentially flow by gravity after being pumped into the pipelines at the preparation plant. Construction of the pipeline would involve a total of 2,218 acres.

Warner Valley Powerplant

The proposed powerplant would be located in Washington County, Utah, about 13 miles southeast of St. George (figs. 2-5 and 2-6). The coal-fired steam-electric powerplant would include two generating units with 500-foot high smokestacks. Each steam-turbine unit would be designed to have an estimated net generating capacity of approximately 250 MW. The total net electrical production of the proposed plant would be approximately 500 MW. The primary fuel for these units would be dewatered, pulverized coal, which would be consumed at a maximum rate of 8,090 tons per day. Number 2 fuel oil would be used for cold startup and maintenance of low-load flame stability in the boilers. Water for the proposed plant would be provided by the proposed Warner Valley reservoir and the reclaimed water from the coal dewatering facilities within the plant site. The entire plant site would be fenced. Total land area required for the powerplant and related facilities would be 4,295 acres.



NOTE: Contour Interval 200 Feet

LEGEND

Access Roads
Water Supply Lines
Pump Power Lines

1 Reservoir Alternative
2 Emergency Stockpile
3 Tailings Ponds
4 Hopper
5 Raw Coal Silos
6 Substation
7 Mill Building
8 Clean Coal Stockpiles
9 Sample Building
10 Administration Building
11 Shops and Warehouse
12 Substation
13 Pumpstation
14 Coal Slurry Tanks
15 Preparation Building
16 Equipment Storage
17 Coal Storage
18 Expansion Area
19 Conveyor
20 Dead Line
21 Shops And Warehouse
22 Readyline
23 Change House
24 Well Site

FIGURE 2-3

LAYOUT OF ALTON COAL PREPARATION PLANT

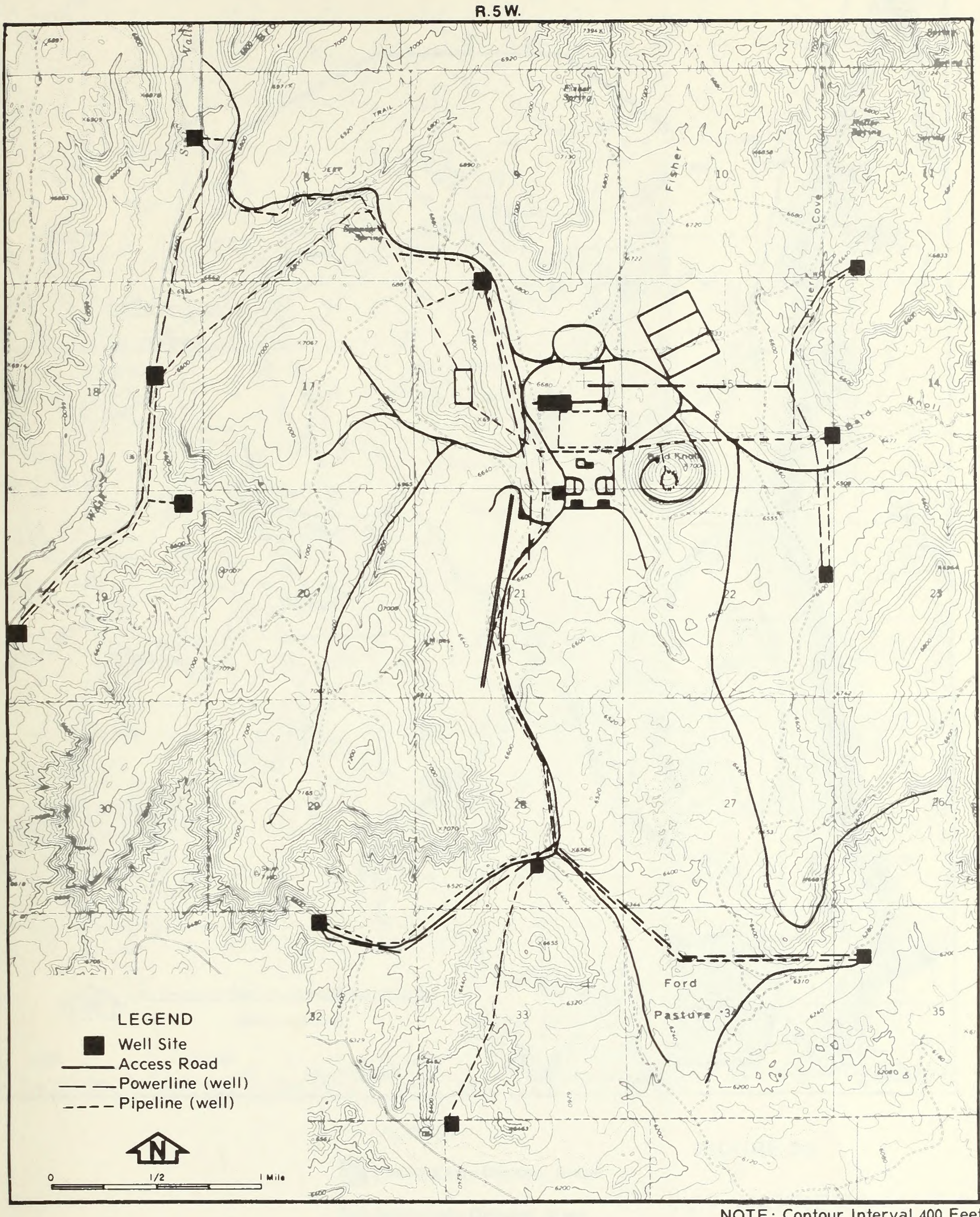
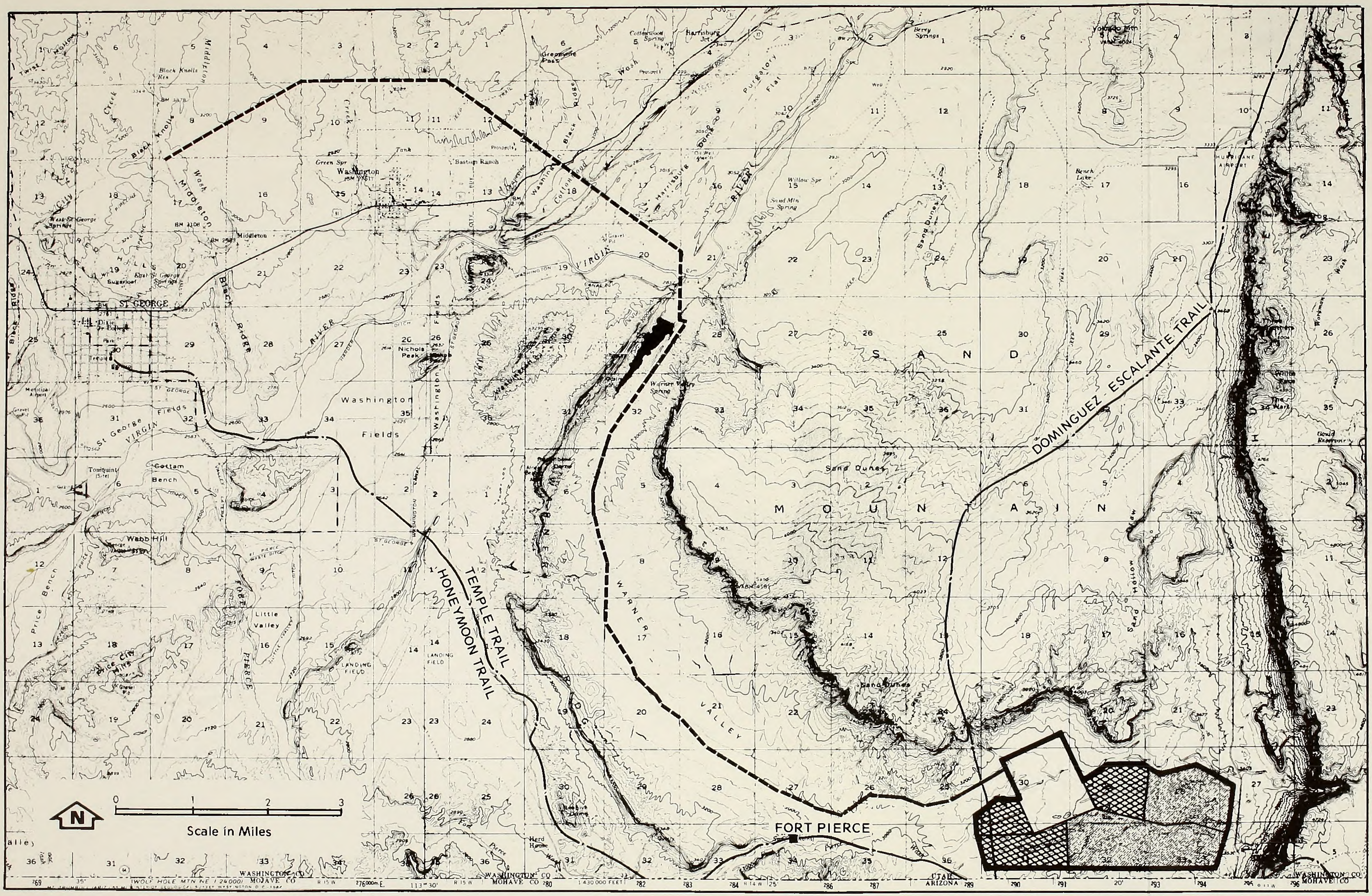


FIGURE 2-4

PROPOSED COAL PREPARATION PLANT, WELL SITE LOCATIONS, AND RELATED FACILITIES



LEGEND

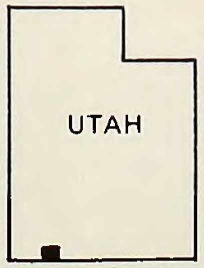
Liquid Waste Disposal Areas

Solid Waste Disposal Areas

Principal Station Facilities Area

Warner Valley Water Project

Warner to St. George Electrical Transmission Route



Locator Map

FIGURE 2-5

LOCATION OF WARNER VALLEY POWERPLANT SITE WITH WASTE DISPOSAL AREAS, WATER PROJECT, AND TRANSMISSION ROUTE

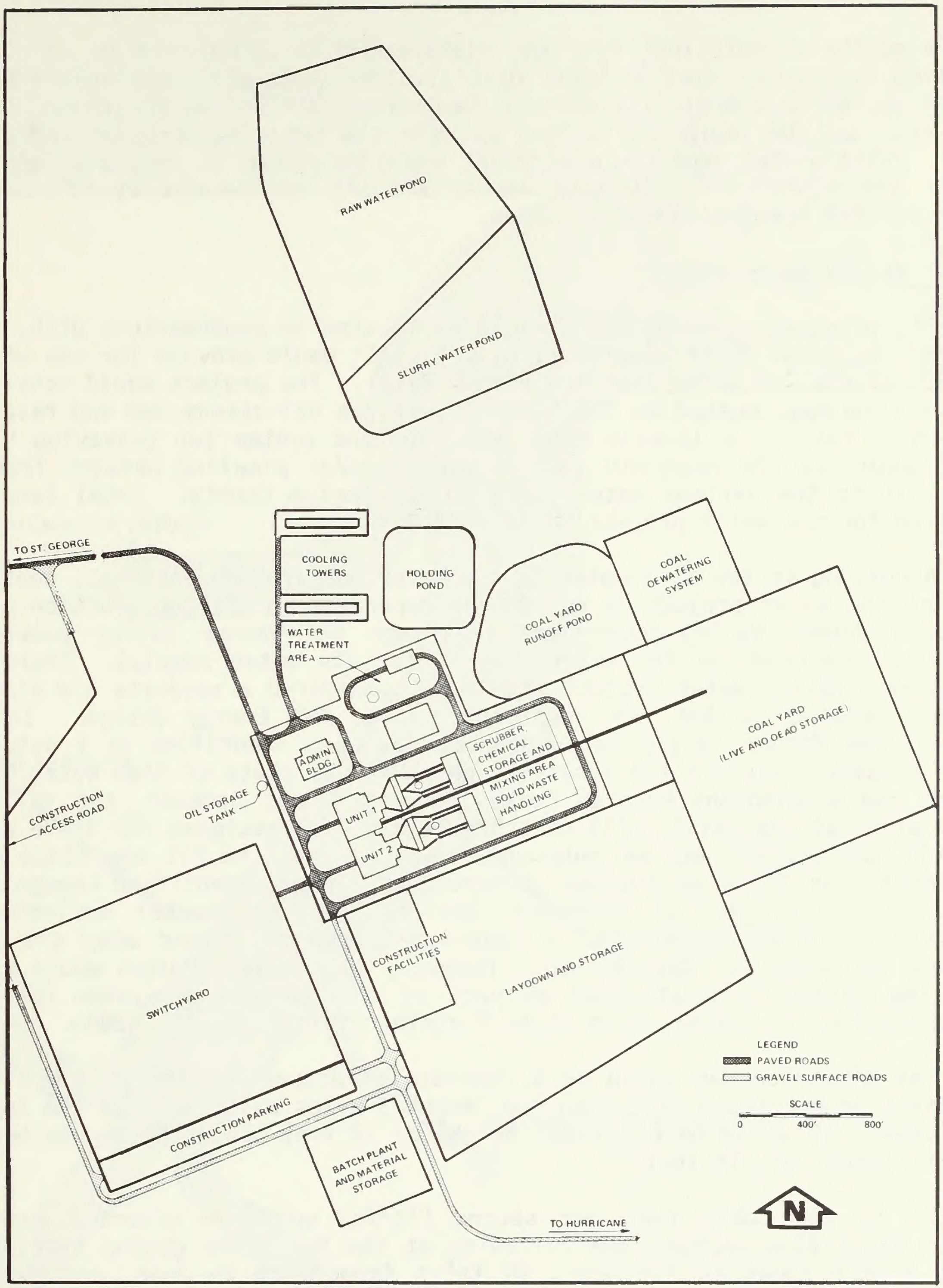


FIGURE 2-6

WARNER VALLEY POWERPLANT FACILITIES

Atmospheric emissions from the plant would be controlled by the use of wet-lime scrubbers, electrostatic precipitators, and efficient boiler design according to Best Available Control Technology (BACT) specifications. Dust from coal and ash would be controlled with the spraying of water and chemicals. Solid wastes from the powerplant would be placed in sanitary landfills within the plant site. Liquid wastes and all nonreusable water would be slurried into lined evaporation ponds.

Warner Valley Water Project

The proposed water project would be located in southwestern Utah, about 8 miles southeast of St. George (fig. 2-5). It would provide for the storage and utilization of water from the Virgin River. The project would consist of a diversion dam located on the Virgin River, an off-stream dam and reservoir in Warner Valley, a 16-mile canal and pipeline system for conveying Virgin River water to the reservoir, and a canal and/or pipeline network from the reservoir to the various water users in Washington County. Total land area required for the water project would be 2,993 acres.

According to the Washington County Water Conservancy District, construction of the water project is not wholly dependent on the construction of the proposed Warner Valley powerplant (although the Warner Valley powerplant would be dependent on the water project for its water supply). Therefore, the Warner Valley water project should be considered a separate and distinct project related to but not dependent on the AWV Energy System. In this regard, the Warner Valley water project has been identified as a potential State sponsored project for construction under the State of Utah Water Conservation and Development Program (Water Bonding Fund); however, the following two qualifications exist: (1) no schedule has been assigned for State action, and (2) the project may be redesigned (scaled down) to fit the State money available (the State development program has not yet identified enough money to build the project as currently designed). Supplemental environmental analysis would be needed for a redesigned project if and when the State decided to undertake sponsorship. However, the State of Utah would rather have the reservoir constructed as part of the AWV Energy System (personal communication, J. Butler, Utah State Planning Office, May 15, 1980).

The diversion dam would be a concrete structure located at the site of the existing Hurricane Diversion dam, about 3 miles upstream from the town of Hurricane. It would have a crest height of 19 feet above the stream bed and a crest length of 118 feet.

Up to 160 cubic feet per second (ft^3/s) would be diverted when the Virgin River flow exceeds the following at the Hurricane gaging station: 40 ft^3/s from October to February, 90 ft^3/s from March to June, and 80 ft^3/s from July through September. The total water to be withdrawn would be about 56,100 acre-feet per year (fig. 2-7). This water would be transported about 16 miles via ditches and pipelines to the site of the Warner Valley reservoir.

The Warner Valley dam would be a zoned earthfill structure. The dam would be 3,340 feet long at the crest and 226 feet high (fig. 2-8). The reservoir would have a total storage capacity of 55,000 acre-feet and a reservoir surface area of 750 acres at full capacity. Annual water yield from the reservoir would be about 32,600 acre-feet.

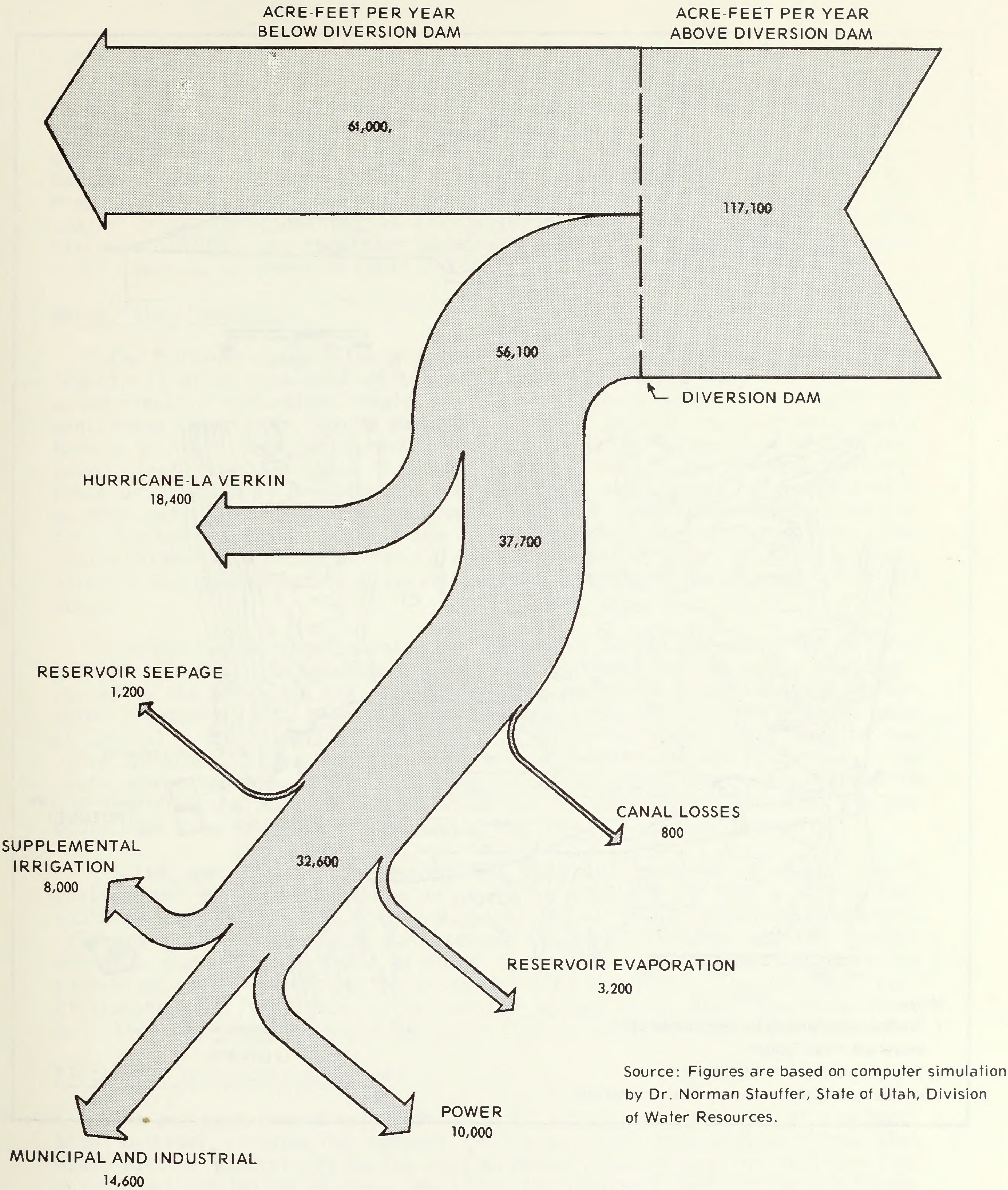
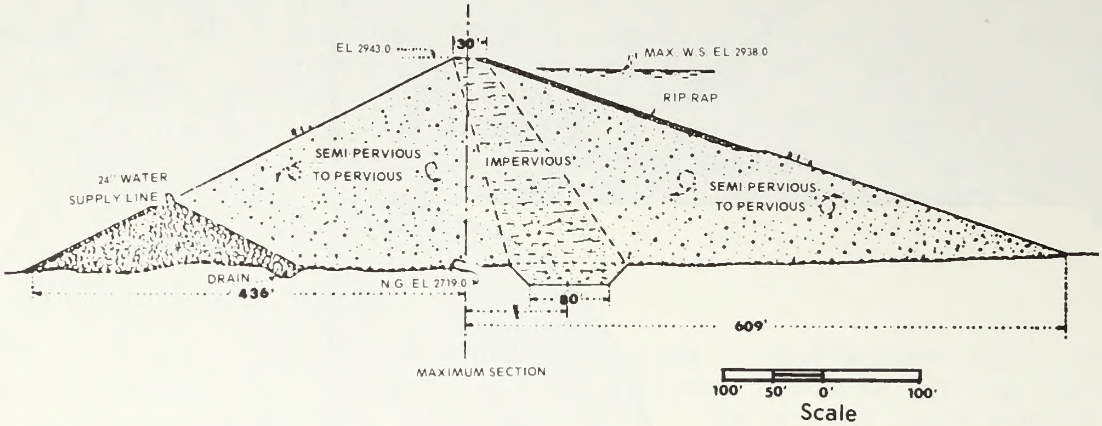
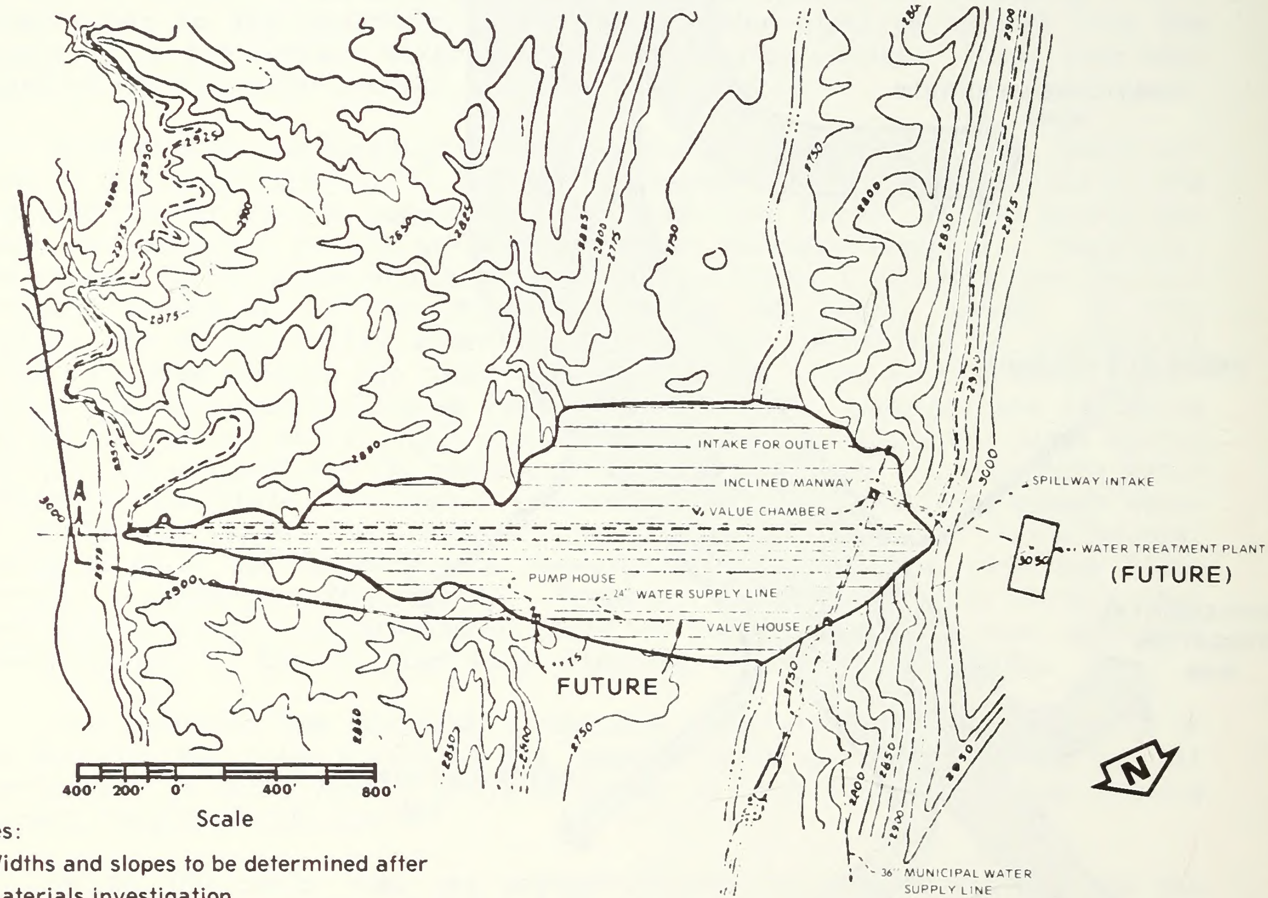


FIGURE 2-7

ALTERNATIVE 1
PROJECTED WATER DIVERSIONS FROM VIRGIN RIVER
(Acre-Feet Per Year)





Notes:

1. Widths and slopes to be determined after materials investigation.
2. Filters and drains to be designed as required by engineering properties of materials.

FIGURE 2-8

PROPOSED WARNER VALLEY DAM

A 24-inch pipeline 11.2 miles long would be constructed to deliver up to 10,000 acre-feet of water per year to the Warner Valley powerplant. About 8,000 acre-feet of supplemental irrigation water would be utilized to supplement water use on 8,930 acres of presently irrigated land in Washington County. Ninety percent of this acreage is cultivated for feed and forage crops, with the remaining 10 percent used for growing truck fruits or specialty crops, or remaining as fallow (Washington County Water Conservancy District, 1975). The remaining water would be used for municipal and industrial purposes as shown in table 2-3.

Harry Allen Powerplant

The 2,000-MW Harry Allen powerplant would be located in Dry Lake, approximately 25 miles northeast of Las Vegas, Nevada (fig. 2-9). The coal-fired steam-electric powerplant would include four units with an estimated net generating capacity of 500 MW each (fig. 2-10). Each of the four units would have a 575-foot high smokestack. The net electrical production of the proposed plant would be about 2,000 MW at peak level. The primary fuel for these units would be dewatered, pulverized coal, which would be consumed at a maximum rate of 31,248 tons per day. Number 2 fuel oil would be used for cold startup and maintenance of low-load flame stability in the boilers. The entire plant site would be fenced and enclosed by 6 miles of flood control dikes. The powerplant and facilities would require development of 5,887 acres.

Average water requirements for the plant would be about 31 million gallons per day. An average 24.5 million gallons per day would be transported to the plant via buried pipeline from the Clark County Advanced Wastewater Treatment (AWT) plant in East Las Vegas, Nevada (presently under construction). The pipeline would be 24.5 miles long and would require two valve stations. Each station and reservoir would occupy 2.5 acres. The route would require an 850-foot long tunnel to cross Interstate Highway 15 and the Union Pacific Railroad. About 5.8 million gallons of water per day would come from the coal slurry dewatering facility at the plant site.

Solid wastes from the powerplant (ash and scrubber sludge), liquid wastes, and all nonreusable water would be combined to form a slurry that would be pumped to lined slurry disposal ponds. Water would be evaporated from the ponds and as each pond became filled with sludge the top surface would be stabilized to avoid airborne dust. Atmospheric emissions from the powerplant would be controlled using wet-lime scrubbers, electrostatic precipitators, and efficient boiler design according to BACT specifications. Dust from coal and ash would be controlled by spraying water and chemicals.

Electrical Transmission System

The proposed transmission system would consist of a network of overhead, high voltage, alternating current (AC) electrical transmission lines that would deliver electricity to the coal mine and processing plant at Alton from a proposed substation at Spry, and from the proposed Harry Allen and Warner Valley powerplants to the city of St. George, NPC, and California utilities' service areas (fig. 2-1).

TABLE 2-3

Proposed Distribution of Water Uses

Applicant	Acre-Feet Per Year	Water Use	Comments
Firm Commitment			
Warner Valley Generating Station	10,000	Power Generation	....
Washington Fields Canal Company	8,000	Irrigation	Supplemental irrigation water for approximately 8,930 acres of presently irrigated lands.
Potential Uses			
Utah Department of Natural Resources, Division of State Lands	6,000	Municipal and Industrial (M&I)	Developments have not been specified by the State.
St. George City	15,000	M&I	Would require complete water treatment.
Ivins	800	M&I	Would require complete water treatment.
Santa Clara	1,000	M&I	Would require complete water treatment.
Washington	3,000	M&I	Would require complete water treatment.
Bloomington	600	M&I	Would require complete water treatment.
Powerplant Reserve	5,000	M&I	....
Total Reservoir Yield	[a]49,400		

Source: Memorandum from Rudger McArthur, Director of St. George Utilities Commission, December 6, 1979.

[a]Assumes a dead storage volume of 5,000 acre-feet in reservoir.

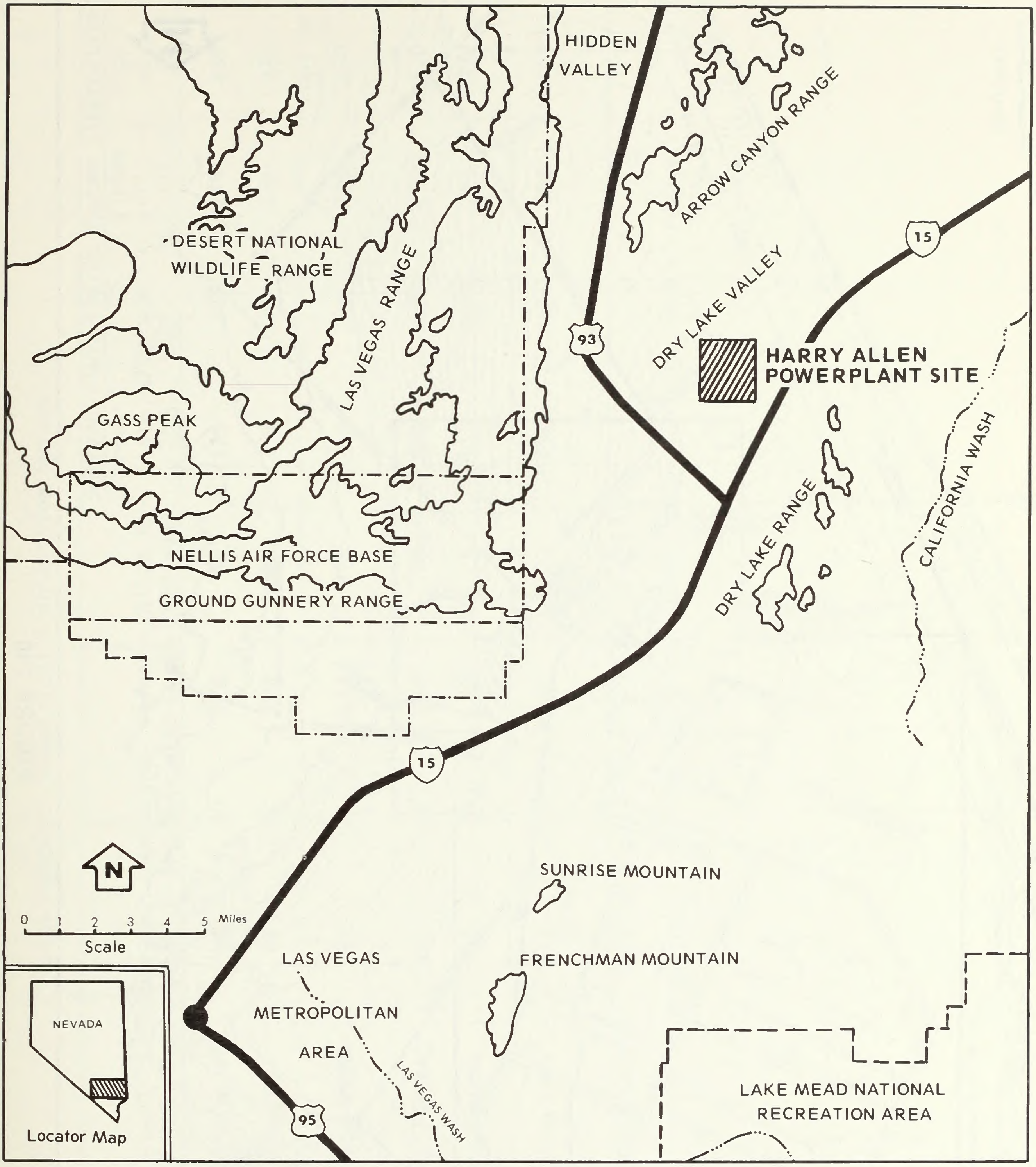
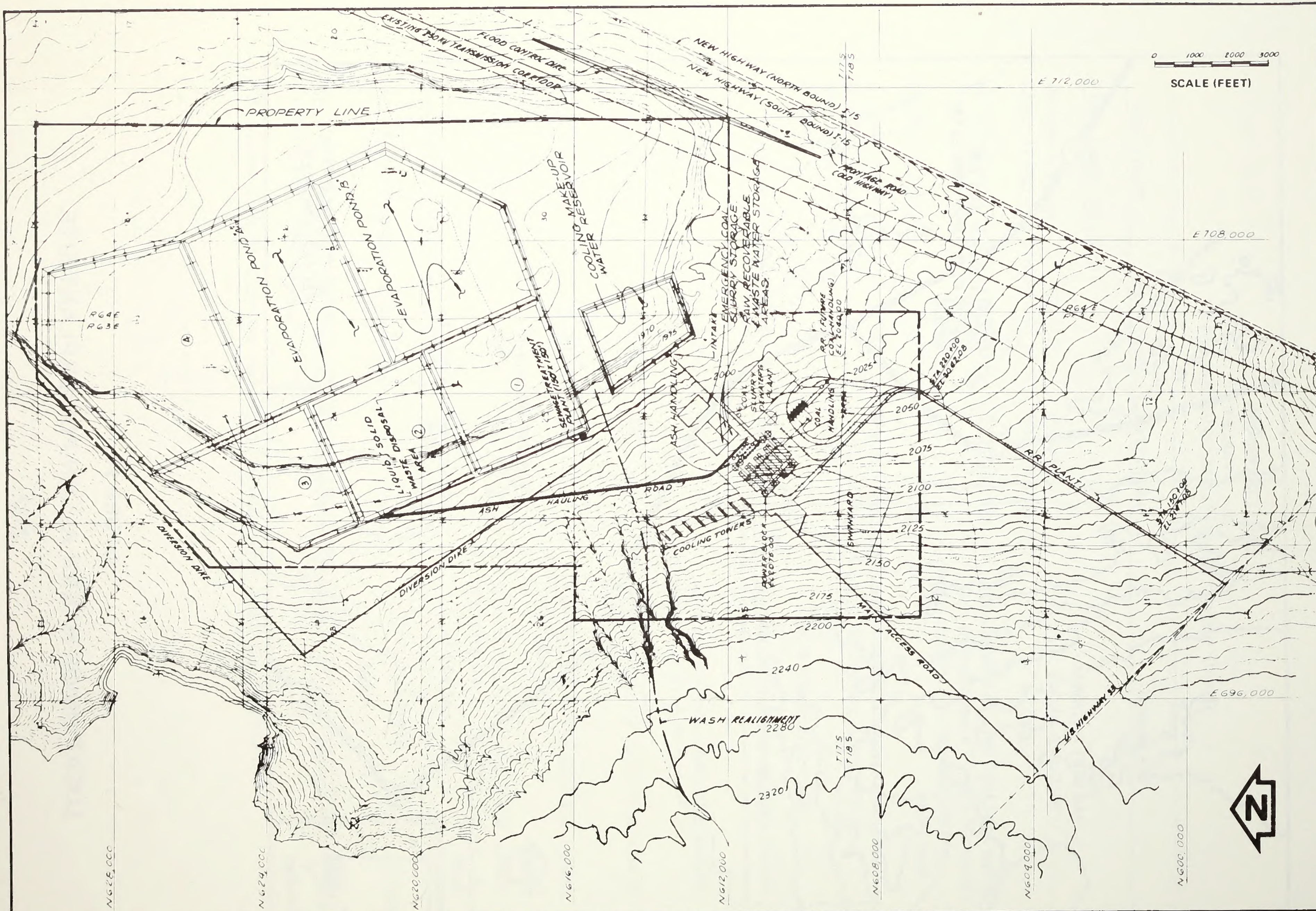


FIGURE 2-9

LOCATION OF HARRY ALLEN POWERPLANT SITE



NOTE: Contour Interval 5 Feet

FIGURE 2-10

HARRY ALLEN POWERPLANT FACILITIES

TABLE 2-4

Data Summary: Electrical Transmission System

					Western Transmission System Alternatives			
Datum	Spry to Alton	Warner to St. George	Warner to Pecos	Allen to Eldorado	Inter-state 15	Eldorado - Lugo	Victor ville - McCullough	High-way 66
Right-of-Way Length (miles)	84	20	120	48	175	185	179	238
Transmission Line Length (circuit miles)	84	20	120	96	350	370	358	476
Nominal Right-of-Way Width (feet)	80	25	136	275	330	330	330	330
Total Right-of-Way (acres)	815	61	1,975	1,598	7,000	7,400	7,160	9,520
New Access and Spur Roads Required (miles)	27	20	48	13	117	260	215	327
Permanently Occupied Area[a] (acres)	81	34	83	23	202	445	368	560

Source: Nevada Power Company, 1975; SCE and PG&E, 1979

[a]Includes those areas to be occupied by new access and spur roads, tower footings, and microwave communication sites.

The transmission system would involve the construction of 138, 345, and 500-kilovolt (kV) lines. Following is a brief description of each of the proposed transmission line segments. Table 2-4 provides a data summary of the electrical transmission system.

Spry to Alton. This 138-kv line would transmit power from a Utah Power and Light substation approximately 19 miles north of Panguitch, Utah to the coal mine area near Bald Knoll. The line would be about 84 miles long and would require an 80-foot wide right-of-way. Transmission structures would consist of two wooden poles with crossarms and braces. The line would be approximately 70 feet above the ground (Garkane Power Association, 1979).

Warner to St. George. Electricity from the Warner Valley powerplant would be delivered to the St. George substation by this 138-kV powerline. The line would be about 20 miles long and would require a 25-foot wide right-of-way. The line would utilize single 75 to 90-foot high pole structures.

Warner to Pecos. This double circuit, 345-kV transmission line would be constructed from the Warner powerplant to the Utah-Arizona border and would then run parallel and adjacent to the existing 500-kV Navajo-McCullough transmission line to Dry Lake, Nevada. From this point the line would run parallel and adjacent to the existing Reid Gardner-Pecos line to the Pecos substation. The transmission line would be about 120 miles long and would require a 200-foot wide right-of-way (9 miles) except when running parallel to the existing Navajo-McCullough and Reid Gardner corridors (111 miles), in which case a 130-foot right-of-way would be required. The line would utilize 120-foot high steel towers.

Allen to Eldorado. This segment would consist of two 500-kV lines. From the Harry Allen powerplant the proposed lines would run parallel and adjacent to the west side of the existing Reid Gardner-Pecos line for about 5 miles. The lines would then run southeast, cross Interstate Highway 15, and after about 5 miles would rejoin the Navajo-McCullough corridor. Running parallel and adjacent to the existing corridor, the proposed line would cross U.S. 95 south of Henderson and continue to the Eldorado substation. The total distance covered by these lines would be about 48 miles. The 500-kV lines would have free-standing steel lattice towers, ranging in height from 108 to 150 feet. Right-of-way width requirements for the first 500-kV line would be 200 feet (for 11 miles), except where paralleling the existing Navajo-McCullough corridor where a 130-foot right-of-way would be required (for 37 miles). The second 500-kV line would require a 130-foot right-of-way throughout its length (48 miles).

Eldorado to Lugo (Western Transmission System). The Western Transmission System would transmit electricity via two 500-kV transmission lines from the Eldorado substation in southern Nevada to the California system tie-in point 6 miles west of the Lugo substation in southern California. Four alternative routes were studied by the project applicants, the results of which were published in Allen-Warner Valley Energy System: Proponents' Environmental Assessment (Southern California Edison Company [SCE] and Pacific Gas and Electric Company [PG&E], 1979). These routes were also studied as alternatives in the preparation of Intermountain Power Project Final Environmental Impact Statement (IPP) (BLM, U.S. Department of the Interior, 1979). A description of each of the alternatives follows. The two

500-kV lines could be routed down a single alternative corridor or the lines could be separated, each occupying one of the alternative corridors. See figure 2-1 for routing and table 2-4 for a summary of the transmission components of each of the alternatives.

Interstate Highway (I-15). This alternative route would run adjacent to SCE's existing 138-kV line from the Eldorado substation to the Lugo substation in California (except for a detour around Cave Mountain) and would essentially parallel I-15 and a proposed IPP 500-kV line. From Yermo, California up to Victorville the corridor would parallel, at a 2,000-foot separation, an existing Los Angeles Department of Water and Power transmission line and the IPP line. It would then cross over existing (as well as proposed) lines and continue through Victorville in a southwesterly direction until reaching the tie-in point 6 miles west of the Lugo substation.

The BLM Riverside District, in conjunction with the California Public Utilities Commission, San Bernardino County, and the applicants, is studying the feasibility of accommodating both the proposed Allen-Warner Valley (AWV) lines and one of the IPP lines within this same alternative route.

Eldorado-Lugo. This alternative route would essentially run parallel to the northwest of SCE's existing transmission corridor (which includes one 220-kV and two 500-kV lines) with one line adjacent to the existing lines and the other separated by 2,000 feet. The route would exit the Eldorado substation in a southwesterly course, crossing into California at Nipton. The route would bypass the Cima substation and cross the Old Dad Mountains, Devil's Playground, and run northwest of Twentynine Palms Marine Corps Base. It would then continue in a westerly direction until intersecting the I-15 alternative route to the east of Victorville. The route would be the same as the I-15 route from the point of intersection to the Lugo tie-in point.

Victorville-McCullough. This alternative would be the same as the I-15 route from the Eldorado substation to where it would intersect I-15 on the Nevada-California border. The Victorville-McCullough route would then separate from the I-15 route and run parallel at a separation of 2,000 feet to the south of three existing AC lines (Los Angeles Department of Water and Power) and a 500-kV direct current line (IPP). The route would cross the Clark Mountains, Silver Dry Lake, run south of the Irwin Military Reservation, and continue on a southwesterly course until it intersected the I-15 alternative route at Yermo. The route would be the same as the I-15 alternative from Yermo to the Lugo tie-in point.

Highway 66. This alternative would be the same as the Eldorado-Lugo route from the Eldorado substation to where it would separate 10 miles to the south and parallel adjacent and to the west of an existing Metropolitan Water Department 230-kV line until reaching Homer Mountain. At this point the route would turn southwest. From Goffs, California the route would parallel the Atchison, Topeka, and Santa Fe Railroad until it would cross Highway 66. From this point it would run parallel to the south of Highway 66 until again intersecting the Eldorado-Lugo alternative route near Pisgah Crater. This route would be the same as the Eldorado-Lugo alternative from the point of intersection to the Lugo tie-in point.

Ancillary Facilities

In addition to the principal components described above, this alternative would involve the construction and operation of various ancillary facilities. Four air strips (one each) would be needed at the Harry Allen and Warner Valley powerplants, the Alton coal preparation plant, and the Hurricane Cliffs valve station. Eleven microwave stations would be needed to facilitate communication between the various project components. Proposed stations would include 0.25-acre, high-elevation sites at the Alton coal preparation plant, Elkhart Cliffs, the slurryline valve station at the Hurricane Cliffs, Hurricane Cliffs communication station, and the Warner Valley powerplant in Utah; the Harry Allen powerplant, Apex Peak, Nelson, and Spirit Mountain in Nevada; Cottonwood Spring in Arizona; and Clipper Mountain in California.

Applicants' Proposed Design and Operating Procedures

The applicants would incorporate the design and operating procedures as listed in Appendix 4 in the event of the construction and operation of their proposed AWV Energy System. The design and operating procedures listed would not apply to the proposed coal development.

ALTERNATIVE 2

This alternative would be identical to Alternative 1 without the Warner Valley powerplant and water project. It would consist only of the 2,000-MW coal-fired steam-electric generating system. The system would contain a coal mine, a coal processing facility, a coal slurry pipeline, a coal-fired powerplant, and an electrical transmission system. Project life would be 40 years. Figure 2-11 (located at the back of this volume) indicates the location of the various components of the system. Table 2-5 provides a summary of the requirements of land, water, fuel, manpower, etc. for the various components of this alternative. The distribution of ownership of lands proposed for development is shown in table 2-6. Following is a brief description of the major components of this alternative.

Coal Mine

A new coal mine would be opened in the Alton coal field (about 25 miles north of Kanab, Utah) to provide coal for this alternative (fig. 2-2). Federal and State coal leases and private lands would be developed to produce about 245 million tons of washed coal over a 40-year period. Coal would be produced by both surface and underground mining methods. The average heat value of the Alton coal (as mined) would be 9,647 Btu/lb. Average quality (as fired) of Alton coal would be 8,897 Btu/lb, 0.86 percent by weight of sulfur, and 7.19 percent by weight of ash (NPC, 1975). The proposed surface mine would yield about 212 million tons of mine-run coal. Further discussion is provided under the same component in Alternative 1. Underground mining would start about 7 years after surface mining and would run concurrently with the surface mining operation. About 33 million tons of mine-run coal would be produced by underground mining methods. The mine would occupy approximately 6,662 acres.

TABLE 2-5

Alternative 2 - Resource Requirements (Daily Averages)

Project Components	Input: Land[a] (acres)	Input: Water (acre-feet)	Input: Coal[b] (tons)	Input: Electricity (MW)	Input: Oil (barrels)	Input: Lime (tons)	Input: Manpower (worker days)	Output: Water (acre-feet)	Output: Coal[b] (tons)	Output: Electricity (MW)	Output: Wastes: Solids (tons)	Output: Wastes: Liquids (acre-feet)	Output: Wastes: Emissions[c] (tons) SO_2	Output: Wastes: Emissions[c] (tons) TSP	Output: Wastes: Emissions[c] (tons) NO_x
ALTON COAL MINE															
Construction	......	......	......	.....	......	...	85	.....	......	.....	.....	....	....	....	......
Operation	6,662	0.65	......	.....	......	...	842	.....	[d]25,683	.....	.....	....	....	....	......
COAL PREPARATION PLANT															
Construction	......	......	......	.....	......	...	281	.....	......	.....	.....	....	....	....	......
Operation	1,826	21.3	25,683	20.4	......	...	40	18.23	22,869	.....	2,814	....	....	....	......
HARRY ALLEN POWERPLANT															
Construction	......	......	......	.....	......	...	2,000	.....	......	.....	.....	....	....	....	......
Operation[e]	5,887	64.97	22,869	.....	260	302	300	.....	......	1,400	3,398	0.57	40.8	8.16	136.22
COAL SLURRY PIPELINE															
Construction	2,218	......	......	.....	......	...	241	.....	......	.....	.....	....	....	....	......
Operation	1,000	18.23	22,869	0.7	......	...	48	18.23	22,869	.....	.....	....	....	....	......
ELECTRICAL TRANSMISSION SYSTEM															
Construction	9,665	......	......	.....	......	...	160	.....	......	.....	.....	....	....	....	......
Operation	363	......	......	.....	......	...	8	.....	......	.....	.....	....	....	....	......

Source: Nevada Power Company, 1975

[a]Acreage computed on a 40-year project life.
[b]Tonnage of all coal computed as having a moisture content of 25.23 percent.
[c]Emissions tonnage includes sulfur dioxide (SO_2), total suspended particulates (TSP), and nitrogen oxides (NO_x). Calculations made assuming properly functioning control devices.
[d]Daily average coal production computed from an average operation of 80 hours per week.
[e]Powerplant operation computed at 70-percent capacity.

TABLE 2-6

Land Ownership of Acreage Affected
Alternative 2

Component	Affected Acreage	Land Ownership (Percent of Total Acreage) Public	State	Private
Alton Coal Mine	6,662	78.0	3.4	18.6
Coal Preparation Plant	1,826	22.0	0.0	68.0
Coal Slurryline	2,218	77.0	11.0	12.0
Harry Allen Powerplant	5,887	98.6	0.0	1.4
Electrical Transmission System				
Spry to Alton	815	38.5	7.5	54.0
Allen to Pecos	252	100.0	0.0	0.0
Allen to Eldorado	1,598	77.0	10.5	12.5
Western Transmission System Alternatives				
Interstate Highway 15	7,000	69.0	0.0	31.0
Eldorado-Lugo	7,400	73.0	0.0	27.0
Victorville-McCullough	7,160	73.0	0.0	27.0
Highway 66	9,520	73.5	0.2	26.3

Source: Nevada Power Company, 1975; SCE and PG&E, 1979

Coal Preparation Plant

A coal preparation plant on a 1,826-acre site approximately in the center of the coal mine area would be used to process approximately 8 million tons of coal per year (fig. 2-3). Coal would be mixed with water to form a coal slurry. Water needs of the coal processing facility would be about 7,800 acre-feet per year, supplied from 10 of the 13 deep wells (Alternative 1) drilled in the Navajo Sandstone Formation (fig. 2-4). Wastes from the coal washing operation would be trucked back to mined-out areas for disposal or placed in a 50-acre tailings pond located within the coal preparation plant area (fig. 2-3).

Coal Transport System

Coal in slurry form would be pumped from the coal preparation plant to the Allen plant site in Dry Lake, Nevada (fig. 2-11). The 22-inch, 183-mile long pipeline would deliver about 8.3 million tons of coal per year to the Harry Allen powerplant. The pipeline would be buried approximately 3 feet deep. One valve station would be located at the Hurricane Cliffs in Utah. The slurry would essentially flow by gravity after being pumped into the pipeline at the Alton coal preparation plant. Construction of the coal transport system would involve a total of 2,218 acres.

Harry Allen Powerplant

Powerplant design would be identical to the same component in Alternative 1. The 2,000-MW powerplant would be located in Dry Lake, approximately 25 miles northeast of Las Vegas, Nevada (fig. 2-9). The coal-fired steam-electric powerplant would include four units with estimated net generating capacity of 500 MW each, and each with a 575-foot high smokestack (fig. 2-10). The net electrical production of the proposed plant would be about 2,000 MW at peak level. The primary fuel for these units would be dewatered, pulverized coal, which would be consumed at a maximum rate of 31,248 tons per day. Number 2 fuel oil would be used for cold startup and maintenance of low-load flame stability in the boilers. The powerplant and facilities would require the development of 5,887 acres.

Average water requirements for the plant operating at maximum load would be about 31 million gallons per day. About 24.5 million gallons per day would be transported 24.5 miles to the plant via buried pipeline from the Clark County AWT plant. About 5.8 million gallons per day would come from the coal slurry dewatering facility within the plant site.

Solid wastes from the powerplant (ash and scrubber sludge), liquid wastes, and all nonreusable water would be combined to form a slurry and would be pumped to lined slurry disposal ponds. Water would be evaporated from the ponds and as each pond became filled with sludge the top surface would be stabilized to avoid airborne dust. Atmospheric emissions would be controlled using wet-lime scrubbers, electrostatic precipitators, and efficient boiler design according to BACT specifications. Dust from coal and ash would be controlled with the spraying of water and chemicals.

Electrical Transmission System

The proposed transmission system would consist of a network of overhead, high voltage, AC electrical transmission lines that would deliver electricity to the coal mine, and from the proposed Harry Allen powerplant to the NPC and California utilities service areas. The transmission system would involve 138, 230, and 500-kV lines (fig. 2-11). Following is a brief description of each of the proposed transmission lines. Table 2-7 provides a data summary of the electrical transmission system.

Spry to Alton. This 138-kv line would transmit electricity from a Utah Power and Light substation approximately 19 miles north of Panguitch, Utah to the coal mine area near Bald Knoll. The line would be about 84 miles long and would require an 80-foot wide right-of-way. Transmission structures would consist of two wooden poles with crossarms and braces. The line would be approximately 70 feet above the ground.

Allen to Pecos. This system would consist of two 345-kV lines on single towers to be constructed between the proposed Harry Allen powerplant and the Pecos substation (about 8 miles north of Las Vegas). This double-circuit line would run parallel and adjacent to the west side of the existing 230-kV Reid Gardner-Pecos corridor for most of its length. For the first 5 miles it would also parallel the proposed Allen to Eldorado lines. The total distance covered by each line would be about 16 miles. The two lines would require a total right-of-way width of 175 feet. Steel transmission towers 120 feet high would be used.

Allen to Eldorado. This segment would consist of two 500-kV lines. From the Harry Allen powerplant the proposed lines would run parallel and adjacent to the west side of the existing Reid Gardner-Pecos line for about 5 miles. The lines would then turn southeast, cross Interstate 15, and after about 5 miles join the Navajo-McCullough corridor. Running parallel and adjacent to the existing corridor, the proposed line would head in a southerly direction, cross U.S. 95 south of Henderson, and continue to the Eldorado substation. The total distance covered by these lines would be about 48 miles. The 500-kV lines would have free-standing steel lattice towers, ranging in height from 108 to 150 feet. Right-of-way requirements for the first 500-kV line would be 200 feet except when paralleling the existing power corridor, then only 130 feet would be required. The second 500-kV line would require a 130-foot right-of-way throughout its length.

Eldorado to Lugo (Western Transmission System). The two 500-kV lines could be constructed in one of the following four alternative routes or could be separated with one line constructed in each of two of the alternatives: Interstate Highway 15, Eldorado-Lugo, Victorville-McCullough, or Highway 66 (fig. 2-11). The routes and their components are described in Alternative 1 and would be identical for this alternative.

Ancillary Facilities

In addition to the principal components described above, this alternative would involve the construction and operation of various ancillary facilities. One air strip would be needed at each of the following locations: the Harry Allen powerplant; the Alton coal preparation plant; and the

TABLE 2-7

Data Summary: Electrical Transmission System

Datum	Spry to Alton	Allen to Pecos	Allen to Eldorado	Western Transmission System Alternatives: Interstate 15	Eldorado - Lugo	Victorville - McCullough	Highway 66
Right-of-Way Length (miles)	84	16	48	175	185	179	238
Transmission Line Length (circuit miles)	84	16	96	350	370	358	476
Nominal Right-of-Way Width (feet)	80	130	275	330	330	330	330
Total Right-of-Way (acres)	815	252	1,598	7,000	7,400	7,160	9,520
New Access and Spur Roads Required (miles)	27	2	13	117	260	215	327
Permanently Occupied Area[a] (acres)	81	4	23	202	445	368	560

Source: SCE and PG&E, 1979

[a]Includes those areas to be occupied by new access and spur roads, tower footings, and microwave communication sites.

Hurricane Cliffs valve station. Ten microwave stations would be needed to facilitate communication between the various project components. Proposed stations include 0.25-acre, high-elevation sites at the Alton coal preparation plant, Elkhart Cliffs, the slurryline valve station at the Hurricane Cliffs, and the Hurricane Cliffs communication station in Utah; the Harry Allen powerplant, Apex Peak, Nelson, and Spirit Mountain in Nevada; Cottonwood Spring in Arizona; and Clipper Mountain in California.

ALTERNATIVE 3

This alternative would consist of a 250-MW powerplant at the Warner Valley site and a 1,000-MW powerplant at the Harry Allen site. Coal for the Warner powerplant would be trucked from the Alton coal field, and coal for the Allen powerplant would be delivered by rail from the southwestern Wyoming or central Utah coal fields. Project life would be 40 years. Figure 2-12 (located at the back of this volume) indicates the location of the various components of the system. Table 2-8 provides a summary of the requirements of land, water, fuel, manpower, etc. for the various components of this alternative. The distribution of ownership of lands proposed for development is shown in table 2-9. Following is a brief description of the major components of this alternative.

Coal Source

Coal for the Warner Valley powerplant would come from a new coal mine within the presently undeveloped Alton coal field (about 25 miles north of Kanab, Utah; fig. 2-2). Existing Federal leases would be developed to produce about 1 million tons of washed coal per year from the Alton West lease area, involving the development of 1,830 acres. A small plant at the site would process the coal from the mine.

Coal for the Allen powerplant would be railed from central Utah or southwestern Wyoming (fig. 2-12). Central Utah coal would be mined by underground methods. It would come from increased production of existing coal mines and development of several new mines. Approximately 3 million tons of coal per year would be required. The Development of Coal Resources in Central Utah Final Environmental Statement (CU) (U.S. Department of the Interior, 1979) addressed several new mines that had unspecified coal markets. The "high level production scenario" from central Utah, totaling up to 42 million tons per year, would be sufficient to meet the fuel needs of this proposed powerplant. The average coal quality for central Utah would be 12,600 Btu/lb, 0.45 percent by weight of sulfur, and 6.5 percent by weight of ash. Approximately 4,540 acres would be developed for the coal mine.

Southwestern Wyoming coal would be strip mined from several new mines in the Rock Springs area. The production of about 4 million tons of coal per year for this project would be in addition to that of the projected "high level production scenario" (35.6 million tons per year) and would create a total coal production level in southwestern Wyoming of up to 39 million tons per year (Development of Coal Resources in Southwestern Wyoming Final Environmental Statement [SW], U.S. Department of the Interior, 1978). The average coal quality for southwestern Wyoming would be 9,827 Btu/lb, 0.54 percent by weight of sulfur, and 7.38 percent by weight of ash. As many as 12,670 acres would be involved with the development of mines in southwestern Wyoming.

TABLE 2-8

Alternative 3 - Resource Requirements (Oaily Averages)

	Input								Output						
											Wastes				
Project Components	Land[a] (acres)	Water (acre-feet)	Coal[b] (tons)	Electricity (MW)	Oil (barrels)	Lime (tons)	Manpower (worker days)	Water (acre-feet)	Coal[b] (tons)	Electricity (MW)	Solids (tons)	Liquids (acre-feet)	Emissions (tons)[c] SO_2	TSP	NO_x
ALTON COAL MINE															
Construction	......	......	......	.....	......	...	64	.....	......	.....	.....	....	.....	....	.....
Operation	1,830	0.45	3,184	3.0	......	...	210	.....	2,834	.....	350	0.01	.....	....	.....
CENTRAL UTAH COAL OPTION[e]															
Construction	......	......	......	.....	......	...	131	.....	......	.....	.....	....	.....	....	.....
Operation	4,540	0.48	8,074	.....	174.0	...	1,000	.....	8,074	.....	.....	....	.....	....	.....
SOUTHWESTERN WYOMING COAL OPTION[f]															
Construction	......	......	......	.....	......	...	150	.....	......	.....	.....	....	.....	....	.....
Operation	12,670	0.57	......	.....	310.0	...	320	.....	10,352	.....	.....	....	.....	....	.....
HARRY ALLEN POWERPLANT (1,000 MW)[g]															
Central Utah Coal															
Construction	......	0.17	......	.....	......	...	1,500	.....	......	.....	.....	....	.....	....	......
Operation	5,000	32.48	8,074	.....	130.0	56	225	.....	......	700	1,200	0.29	7.95	1.22	87.2
Southwestern Wyoming Coal															
Construction	......	0.17	......	.....	......	...	1,500	.....	......	.....	.....	....	.....	....	.....
Operation	5,000	32.48	10,352	.....	130.0	86	225	.....	......	700	1,540	0.29	12.06	1.75	72.66
WARNER VALLEY POWERPLANT (250 MW)[g]															
Construction	......	0.04	......	.....	......	...	640	.....	......	.....	.....	....	.....	....	.....
Operation	3,647	7.95	2,834	.....	32.62	78	100	.....	......	175	604	0.7	5.19	1.02	17.15
WARNER VALLEY WATER PROJECT															
Construction	......	......	......	.....	......	...	150	.....	......	.....	.....	....	.....	....	.....
Operation	2,993	127.0	......	.....	......	...	5	65.75	......	.....	.....	....	.....	....	.....
ELECTRICAL TRANSMISSION SYSTEM															
Construction	7,388	......	......	.....	......	...	200	.....	......	.....	.....	....	.....	....	.....
Operation	438	......	......	.....	......	...	10	.....	......	.....	.....	....	.....	....	.....

Source: Nevada Power Company, 1975; CU, 1979; SW, 1978; Washington County Water Conservancy Oistrict, 1975

[a]Acreage computed on a 40-year project life.
[b]Oaily average coal production computed from an average operation of 80 hours per week.
[c]Emissions tonnage includes sulfur dioxide (SO_2), total suspended particulates (TSP), and nitrogen oxides (NO_x). Calculations made assuming properly functioning control devices.
[d]Tonnage of Alton coal computed with moisture content of 25.23 percent. The coal mine would include a small coal processing plant.
[e]Tonnage of Central Utah coal computed with moisture content of 6.1 percent.
[f]Tonnage of southwestern Wyoming coal computed with moisture content of 18.26 percent.
[g]Powerplant operation computed at 70-percent capacity.

TABLE 2-9

Land Ownership of Acreage Affected
Alternative 3

Component	Affected Acreage	Land Ownership (Percent of Total Acreage)		
		Public	State	Private
Central Utah Coal	4,540	85.6	0.0	14.2
Southwestern Wyoming Coal	12,670	41.2	1.2	57.6
Alton Coal Mine	1,830	100.0	0.0	0.0
Warner Valley Powerplant	3,647	85.0	15.0	0.5
Warner Valley Water Project	2,993	68.0	23.0	9.0
Harry Allen Powerplant	5,000	98.6	0.0	1.4
Electrical Transmission System				
Spry to Alton	815	38.5	7.5	54.0
Warner to St. George	46	70.0	30.0	0.0
Warner to Pecos	1,121	86.7	11.7	1.6
Allen to Eldorado	1,164	77.0	10.5	12.5
Western Transmission System Alternatives				
Interstate Highway 15	4,242	69.0	0.0	31.0
Eldorado-Lugo	4,484	73.0	0.0	27.0
Victorville-McCullough	4,340	73.0	0.0	27.0
Highway 66	5,770	73.5	0.2	26.3

Source: Nevada Power Company, 1975; SCE and PG&E, 1979

Coal Transport System

Coal would be moved by truck on paved roads to the Warner powerplant from the Alton coal fields. The haul distance from the coal mine to Warner Valley would be about 100 miles via Johnson Canyon, Kanab, Fredonia, over Arizona Highway 389 to Hurricane, then south to Warner Valley (fig. 2-12). This route would avoid Zion National Park and the steep grades of Utah Highway 15. The 1 million tons of coal per year required by the Warner Valley powerplant would require moving 154 25-ton truckloads per day (260 days per year) over this route. The Johnson Canyon road would be paved and other roads would be upgraded to accommodate the increased truck traffic.

Other truck routes were considered for hauling coal to the proposed Warner Valley powerplant and several alternative routes have been suggested by the Kane County Commissioners (letter dated March 26, 1980). Should this alternative be selected for implementation, the route and design would be finalized with cooperation of local and State governments, individuals, the project applicants, and BLM.

Coal would be moved by rail to the Allen powerplant from the central Utah or southwestern Wyoming coal fields (fig. 2-12). If central Utah coal would be used, it would be trucked from the coal mines to nearby railroad car loading facilities, then railed to the Allen powerplant. The coal would be shipped on existing Denver and Rio Grande Western lines over Soldier Summit, through Thistle, and into Provo. From Provo the coal would be transported on Union Pacific (UP) lines to Lynndyl, then south on UP's mainline tracks to the Allen powerplant site. Should southwestern Wyoming coal be utilized for this alternative, the coal would be railed over short spur lines to UP mainline trackage, then railed on UP lines through Evanston, Ogden, Salt Lake City, and south to the Allen powerplant site.

The 3 to 4 million tons of coal per year would require 0.8 to 1.1, 10,000-ton unit trains per day. Existing trackage along both proposed routes could accommodate this increase in traffic without any new construction.

Warner Valley Powerplant

The size and design of the powerplant have been formulated for analytical purposes only, and do not reflect engineering studies. The proposed powerplant would be located in Washington County, Utah about 13 miles southeast of St. George (fig. 2-5). The coal-fired steam-electric generating system would have two 125-MW generating units with a net output of 250-MW at peak level. Each unit would have a 500-foot high smokestack. The primary fuel for this unit would be coal, which would be consumed at a maximum rate of about 4,000 tons per day. Number 2 fuel oil would be used for cold startup and maintenance of low-load flame stability in the boilers. Water for the proposed plant would be provided by the proposed Warner Valley water project. Approximately 3,647 acres of land would be developed to construct and operate the powerplant.

Solid wastes from the powerplant would be placed in sanitary landfills within the plant site. Liquid wastes and all nonreusable water would be disposed of in lined evaporation ponds. Atmospheric emissions would be controlled by wet-lime scrubbers, electrostatic precipitators, and efficient boiler design according to BACT specifications. Dust from coal and ash would be controlled by spraying water and chemicals.

Warner Valley Water Project

The facility would be as described under Alternative 1 (fig. 2-5), except the total amount of water diverted from the Virgin River would be 47,600 acre-feet per year instead of 56,100 acre-feet per year, due to a reduced water diversion schedule (fig. 2-13). With this reduced diversion schedule an annual reservoir yield of 24,000 acre-feet would be anticipated. A total of 2,993 acres would be needed to construct the project. Although the water project would be needed as a water supply source for the Warner Valley powerplant, its implementation is not dependent on the powerplant. As shown in table 2-10, the project would be used primarily as a water supply for municipal, industrial, and agricultural uses. Interim uses for recreation and sports fisheries could also be developed. Should the Warner Valley powerplant not be constructed, the 6,000 acre-feet of water per year would be delegated for interim uses until another need (municipal, industrial, agricultural) could be found.

Harry Allen Powerplant

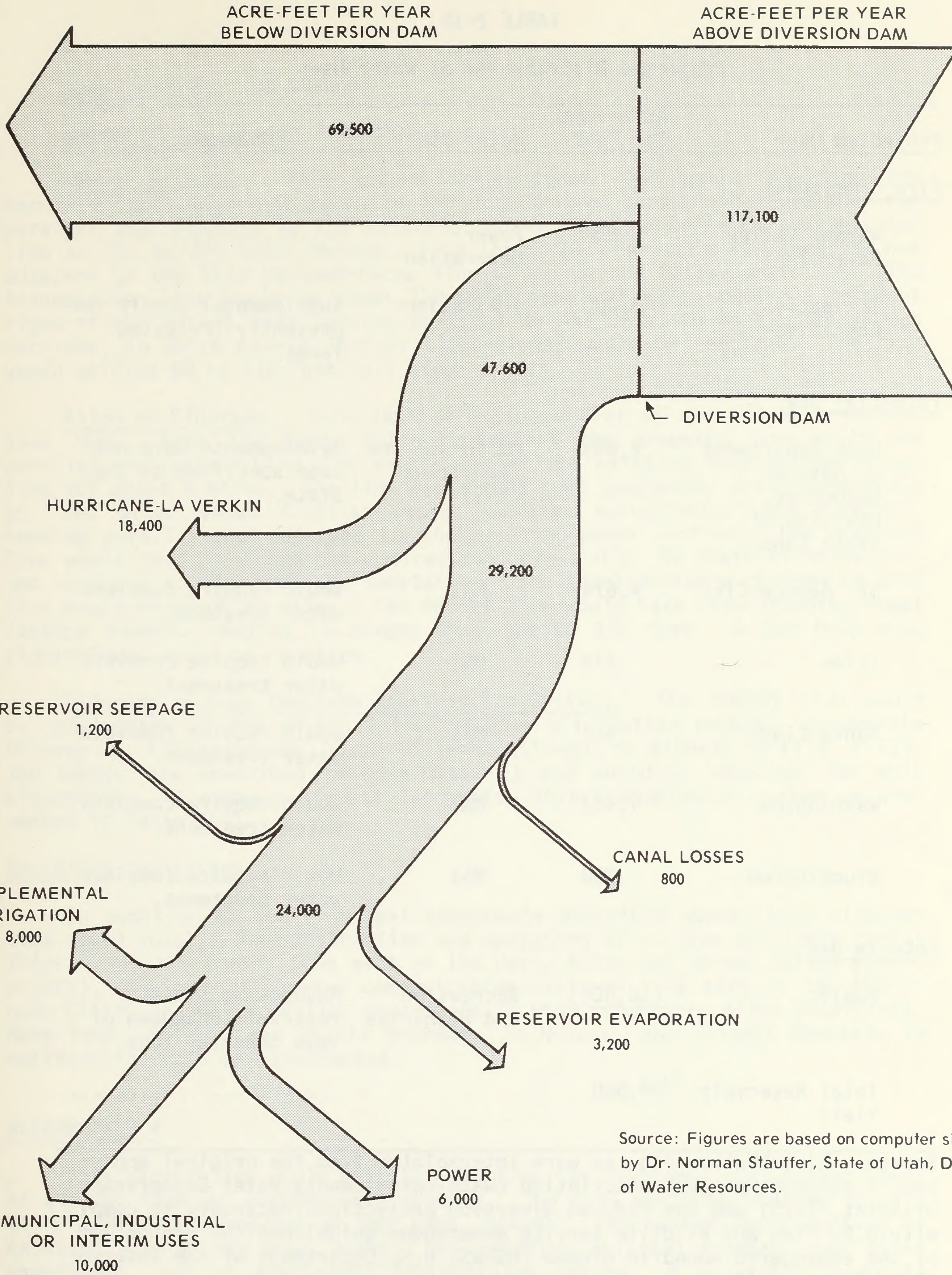
The size and design of the powerplant have been formulated for analytical purposes only, and do not reflect engineering studies. The 1,000-MW powerplant would be located in Dry Lake, approximately 25 miles northeast of Las Vegas, Nevada (fig. 2-9). The powerplant would consist of two 500-MW generating units with accompanying 575-feet high smokestacks (fig. 2-10). The net electrical production of the proposed plant would be 1,000 MW at peak level. The primary fuel would be coal, which would be consumed at a maximum rate of 8,000 to 10,350 tons per day, depending upon the coal source (table 2-8). Number 2 fuel oil would be used for cold startup and maintenance of low-load flame stability in the boilers. Approximately 5,000 acres would be utilized to construct and operate the powerplant.

Average water requirements for the plant would be about 16 million gallons per day. As described in Alternative 1, the water would be transported to the plant via a 24.5-mile long buried pipeline starting at the Clark County AWT plant in East Las Vegas.

Solid wastes from the powerplant (ash and scrubber sludge), liquid wastes, and all nonreusable water would be combined to form a slurry and would be pumped to lined slurry disposal ponds. Water would be evaporated from the ponds and as each pond became filled with sludge the top surface would be stabilized to avoid airborne dust. Atmospheric emissions would be controlled with wet-lime scrubbers, electrostatic precipitators, and efficient boiler design according to BACT specifications. Dust from coal and ash would be controlled with the spraying of water and chemicals.

Electrical Transmission System

The proposed electrical transmission system would be basically the same as described under Alternative 1 (fig. 2-12). Where differences exist, they are noted. Table 2-11 provides a data summary of the transmission system.



Source: Figures are based on computer simulation by Dr. Norman Stauffer, State of Utah, Division of Water Resources.

FIGURE 2-13

ALTERNATIVE 3
PROJECTED WATER DIVERSIONS FROM VIRGIN RIVER
(Acre-Feet Per Year)

TABLE 2-10

Projected Distribution of Water Uses

Projected User	Acre-Feet Per Year	Water Use	Comments
Firm Commitment			
Warner Valley Powerplant	6,000	Power Generation	....
Irrigation Companies	8,000	Irrigation	Supplemental supply for presently irrigated lands.
Potential Use			
Utah Department of Natural Resources, Division of State Lands	2,803	Municipal and Industrial (M&I)	Developments have not been specified by the State.
St. George City	4,674	M&I	Would require complete water treatment.
Ivins	374	M&I	Would require complete water treatment.
Santa Clara	467	M&I	Would require complete water treatment.
Washington	1,402	M&I	Would require complete water treatment.
Bloomington	280	M&I	Would require complete water treatment.
Interim Use[a]			
Public	(10,000)	Recreation and Fisheries	Assumes an annual reservoir drawdown of less than ten feet.
Total Reservoir Yield	[b]24,000		....

Source: Distribution figures were interpolated from the original applicant's proposal project description (Washington County Water Conservancy District, 1975) and the reduced diversion projections necessary to comply with U.S. Fish and Wildlife Service memorandum guidelines for protection of the endangered woundfin minnow (USFWS, U.S. Department of the Interior, 1978; Appendix 13).

[a]Water would be allocated for this use until an actual need develops for potential users.

[b]Assumes a dead storage volume of 5,000 acre-feet in reservoir.

Spry to Alton. No change.

Warner to St. George. No change.

Warner to Pecos. This 230-kV transmission line would run from the Warner Valley powerplant south to the Utah-Arizona border and would then run parallel and adjacent to the existing 500-kV Navajo-McCullough transmission line as far as Dry Lake, Nevada. From there the line would run parallel and adjacent to the Reid Gardner-Pecos line as far as the Pecos substation. The transmission line would be about 120 miles long and would require a 100-foot right-of-way except when running parallel to the existing Navajo-McCullough corridor, in which case a 75-foot right-of-way would be required. The line would utilize 80 to 110-foot tall steel towers.

Allen to Eldorado. This segment would consist of one 500-kV transmission line. From the Harry Allen powerplant the proposed line would run parallel and adjacent to the west side of the existing Reid Gardner-Pecos line for about 5 miles. The line would then turn southeast, cross Interstate 15, and after about 5 miles would join the Navajo-McCullough corridor. Running parallel and adjacent to the existing power corridor, the proposed line would head in a southerly direction, cross U.S. 95 south of Henderson, and continue to the Eldorado substation. The total distance covered by this line would be about 48 miles. The 500-kV line would have free-standing steel lattice towers, ranging in height from 108 to 150 feet. A 200-foot wide right-of-way would be required.

Eldorado to Lugo (Western Transmission System). The 500-kV line would be constructed in one of the following four alternative routes: Interstate Highway 15, Eldorado-Lugo, Victorville-McCullough, or Highway 66 (fig. 2-12). The routes are described in Alternative 1 and would be identical for this alternative. A summary of data concerning this transmission system is presented in table 2-11.

Ancillary Facilities

In addition to the principal components described above, this alternative would involve the construction and operation of various ancillary facilities. Two air strips (one each at the Harry Allen and Warner Valley powerplants), and seven microwave communication stations (one each at the Hurricane Cliffs and Warner Valley powerplant in Utah; the Harry Allen powerplant, Apex Peak, Nelson, and Spirit Mountain in Nevada; and Clipper Mountain in California) would be constructed.

ALTERNATIVE 4

This alternative would utilize coal from the developed coal mining areas of central Utah or southwestern Wyoming. The coal would be shipped by rail to a 2,000-MW powerplant at Dry Lake, Nevada. The system would consist of existing and/or new coal mines, the existing railroad network, the Allen powerplant, and an electrical transmission system. A project life of 40 years is assumed. Figure 2-14 (located at the back of this volume) indicates the location of the various components of the system. Table 2-12 provides a summary of the requirements of land, water, fuel, manpower, etc. for the

TABLE 2-11

Data Summary: Electrical Transmission System

Datum	Spry to Alton	Warner to St. George	Warner to Pecos	Allen to Eldorado	Western Transmission System Alternatives: Interstate 15	Eldorado - Lugo	Victorville - McCullough	Highway 66
Right-of-Way Length (miles)	84	20	120	48	175	185	179	238
Transmission Line Length (circuit miles)	84	20	120	48	175	185	179	238
Nominal Right-of-Way Width (feet)	80	25	77	200	200	200	200	200
Total Right-of-Way (acres)	815	61	1,121	1,164	4,242	4,484	4,340	5,770
New Access and Spur Roads Required (miles)	27	15	43	12	110	254	208	309
Permanently Occupied Area[a] (acres)	81	34	75	21	148	343	280	426

Source: Nevada Power Company, 1975; SCE and PG&E, 1979

[a]Includes those areas to be occupied by access and spur roads, tower footings, and microwave communication sites.

TABLE 2-12

Alternative 4 - Resource Requirements (Daily Averages)

Project Components	Input: Land[a] (acres)	Input: Water (acre-feet)	Input: Coal[b] (tons)	Input: Electricity (MW)	Input: Oil (barrels)	Input: Lime (tons)	Input: Manpower (worker days)	Output: Water (acre-feet)	Output: Coal[b] (tons)	Output: Electricity (MW)	Output: Wastes: Solids (tons)	Output: Wastes: Liquids (acre-feet)	Output: Wastes: Emissions (tons)[c]: SO_2	Output: Wastes: Emissions (tons)[c]: TSP	Output: Wastes: Emissions (tons)[c]: NO_x
CENTRAL UTAH COAL OPTION															
Construction	......	......	......	.....	......	...	175	.....	......	.....	.....	....	.....	....	.....
Operation	9,080	0.95	16,148	.....	348.0	...	2,000	.....	16,148	.....	.....	....	.....	....	.....
SOUTHWESTERN WYOMING COAL OPTION[d]															
Construction	......	......	......	.....	......	...	300	.....	......	.....	.....	....	.....	....	.....
Operation	25,340	1.14	......	.....	620.0	...	640	.....	20,705	.....	.....	....	.....	....	.....
HARRY ALLEN POWERPLANT[e]															
Central Utah Coal															
Construction	......	......	......	.....	......	...	2,000	.....	......	.....	.....	....	.....	....	.....
Operation	5,887	64.97	16,148	.....	260.0	112	300	.....	......	1,400	2,399	0.57	15.9	2.44	174.5
Southwestern Wyoming Coal															
Construction	......	......	......	.....	......	...	2,000	.....	......	.....	.....	....	.....	....	.....
Operation	5,887	64.97	20,705	.....	260.0	172	300	.....	......	1,400	3,076	0.57	24.12	3.50	145.3
ELECTRICAL TRANSMISSION SYSTEM															
Construction	8,850	......	......	.....	......	...	150	.....	......	.....	.....	....	.....	....	.....
Operation	282	......	......	.....	......	...	8	.....	......	.....	.....	....	.....	....	.....

Source: Nevada Power Company, 1975; CU, 1979; SW, 1978

[a] Acreage computed on a 40-year project life.
[b] Tonnage of central Utah coal computed with moisture content of 6.1 percent.
[c] Emissions tonnage includes sulfur dioxide (SO_2), total suspended particulates (TSP), and nitrogen oxides (NO_x). Calculations made assuming properly functioning control devices.
[d] Tonnage of southwestern Wyoming coal computed with moisture content of 18.26 percent.
[e] Plant operation computed at 70-percent capacity.

various components of this alternative. The distribution of ownership of lands proposed for development is shown in table 2-13. Following is a brief description of the major components of this alternative.

Coal Mines

Coal for this alternative would come from the central Utah coal fields in the general vicinity of Price, Utah or from southwestern Wyoming coal fields near Rock Springs, Wyoming (fig. 2-14).

Approximately 6 million tons of coal per year would be required if central Utah would be used as the coal source, involving the development of 9,080 acres. Approximately 8.15 million tons per year would be needed if southwestern Wyoming coal would be used, involving the development of 25,340 acres. The production under the "high level production scenario" (addressed in CU, 1979) would be sufficient to meet the demand for coal from central Utah. The demand for coal would increase production to nearly 44 million tons per year in southwestern Wyoming, which would be approximately 13 million tons over and above projected production rates under the "high level production scenerio" (SW, 1978). Refer to the coal source discussion in Alternative 3 for additional information.

Coal Transport System

The coal transport system would be basically the same as described for the 1,000-MW Allen powerplant in Alternative 3, except 6 to 8 million tons of coal per year would require about 1.6 to 2.2, 10,000-ton unit trains per day. Existing trackage along both proposed routes could accommodate this increase in traffic without any new construction (fig. 2-14).

Harry Allen Powerplant

Facility design would be essentially the same as described in Alternative 1. The 2,000-MW powerplant would be located in Dry Lake, approximately 25 miles northeast of Las Vegas, Nevada (fig. 2-9). The powerplant would consist of four 500-MW generating units with accompanying 575-foot high smokestacks (fig. 2-10). The net electrical production of the proposed plant would be 2,000 MW at peak level. The primary fuel would be coal, consumed at an average rate of 16,150 to 20,705 tons per day, depending on the coal source (table 2-12). Number 2 fuel oil would be used for cold startup and maintenance of low-load flame stability in the boilers. Approximately 5,887 acres of land would be needed for construction and operation of the powerplant.

Average water requirements for the plant would be about 31 million gallons per day. The water would be transported to the plant from the Clark County AWT plant in East Las Vegas via a 24.5-mile long buried pipeline.

Solid wastes from the powerplant (ash and scrubber sludge), liquid wastes, and all nonreusable water would be combined to form a slurry and would be pumped to lined slurry disposal ponds. Water would be evaporated from the ponds and as each pond became filled with sludge the top surface would be stabilized to avoid airborne dust. Atmospheric emissions would be controlled by wet-lime scrubbers, electrostatic precipitators, and efficient

TABLE 2-13

Land Ownership of Acreage Affected
Alternative 4

Component	Affected Acreage	Land Ownership (Percent of Total Acreage) Public	State	Private
Central Utah Coal	9,080	85.6	0.0	14.2
Southwestern Wyoming Coal	25,340	41.2	1.2	57.6
Harry Allen Powerplant	5,887	98.6	0.0	1.4
Electrical Transmission System				
Allen to Pecos	252	100.0	0.0	0.0
Allen to Eldorado	1,598	77.0	10.5	12.5
Western Transmission System Alternatives				
Interstate Highway 15	7,000	69.0	0.0	31.0
Eldorado-Lugo	7,400	73.0	0.0	27.0
Victorville-McCullough	7,160	73.0	0.0	27.0
Highway 66	9,520	73.5	0.2	26.3

Source: Nevada Power Company, 1975; SCE and PG&E, 1979

boiler design according to BACT specifications. Dust from coal and ash would be controlled with the spraying of water and chemicals.

Electrical Transmission System

The proposed transmission system would consist of a network of overhead, high voltage electrical transmission lines that would deliver electricity from the proposed Allen powerplant to the NPC and California utilities' service areas (fig. 2-14). Following is a brief description of each of the proposed lines. Table 2-14 provides a summary of the transmission system.

Allen to Pecos. This system would consist of a double circuit 345-kV line to be constructed between the proposed Harry Allen powerplant and the Pecos substation, located about 8 miles north of Las Vegas. This proposed line would run parallel and adjacent to the west of the existing 230-kV Reid Gardner-Pecos corridor for most of its length. For the first 5 miles it would also run parallel and adjacent to the proposed Allen-Eldorado lines. The total distance covered would be about 16 miles. The line would require a 200-foot wide right-of-way except when paralleling existing lines, then only a 130-foot wide right-of-way would be required. Steel transmission towers 120 feet high would be constructed to accommodate the line.

Allen to Eldorado. The description of this segment would be the same as provided under Alternative 1, consisting of two 500-kV lines, steel lattice towers from 100 to 150 feet high, and 48 miles of right-of-way ranging in width from 130 to 200 feet.

Eldorado to Lugo (Western Transmission System). The two 500-kV lines would be constructed in one of the following four alternative routes or could be separated with one line constructed in each of two of the alternatives: Interstate Highway 15, Eldorado-Lugo, Victorville-McCullough, or Highway 66 (fig. 2-14). The routes and their components are described in Alternative 1 and would be identical to that alternative.

Ancillary Facilities

In addition to the principal components described above, this alternative would involve the construction and operation of various ancillary facilities. One air strip at the Harry Allen powerplant, and five microwave communication stations (at the powerplant, Apex Peak, Nelson, and Spirit Mountain in Nevada, and Clipper Mountain in California) would be constructed.

ALTERNATIVE 5

This alternative would involve the implementation of a variety of conservation programs and the development of nonconventional energy sources in the service areas of the participating utilities: city of St. George, NPC, PG&E, and SCE. Scenarios applicable to each specific service area were developed based on existing and projected population and resource availability criteria. Only those levels of implementation that are considered realistic considering the time frame and existing socioeconomic and political conditions are incuded in this alternative.

TABLE 2-14

Data Summary: Electrical Transmission System

Datum	Allen to Pecos	Allen to Eldorado	Western Transmission System Alternatives: Interstate 15	Eldorado - Lugo	Victorville - McCullough	Highway 66
Right-of-Way Length (miles)	16	48	175	185	179	238
Transmission Line Length (circuit miles)	16	96	350	370	358	476
Nominal Right-of-Way Width (feet)	130	275	330	330	330	330
Total Right-of-Way (acres)	252	1,598	7,000	7,400	7,160	9,520
New Access and Spur Roads Required (miles)	2	13	117	260	215	327
Permanently Occupied Area[a] (acres)	4	23	202	445	368	560

Source: Nevada Power Company, 1975; SCE and PG&E, 1979

[a]Includes those areas to be occupied by new access and spur roads, tower footings, and microwave communication sites.

The year 1990 was chosen as a target date that would allow for at least partial implementation of this alternative in the city of St. George and NPC service areas, with full implementation in 2000. The year 1991 was chosen for the PG&E and SCE service areas because the California Energy Commission (CEC) used this year as a target date in their energy demand forecasts and in the analyses of the impacts of implementing this alternative as they would affect energy demands (Biennial Report, 1979).

Scenarios for the city of St. George and NPC service areas were based on information obtained in Energy Conservation Alternative for the Allen-Warner Valley Project, a report prepared under contract for BLM by Centaur Associates, Inc. (1980).

Scenarios for PG&E and SCE service areas are largely based on extractions of data relating to these utilities from the preferred resources supply mix as published in the CEC Biennial Report (1979) and the Allen-Warner Valley Energy System Proponents' Environmental Assessment (SCE and PG&E, 1979) as modified by testimony in the California Public Utilities Commission (CPUC) hearings for granting a Certificate of Public Convenience and Necessity (April and May, 1980). Preliminary assessments prepared by the CPUC staff were also employed in the preparation of these scenarios. These assessments are tentative and are subject to change.

The implementation of this alternative would involve a reordering of energy priorities and policies, personal attitudes, and lifestyles in each of the respective utilities' service areas. New legislation which would mandate or provide incentives for the conservation of energy and the development of alternative energy sources would have to be enacted on State and local levels.

City of St. George Service Area

There are a number of opportunities for conservation of energy in the St. George service area, but a somewhat lower potential for employing alternative energy sources technologies. Discussions below outline these opportunities, their applicability, relative cost to the consumer, and the relative time frame required for implementation. The following programs could be partially implemented by the year 1990 and fully implemented by the year 2000.

Conservation and Load Management

Under conservation and load management there are a variety of technologies which could be employed. Moderating thermostat settings for both heating and cooling could be immediately implemented by the residential and commercial/ industrial consumer at virtually no cost. The same would be true of reducing temperature settings on water heaters. These would be relatively passive and voluntary measures. More forceful actions could include installing timed thermostats rather than the conventional strictly temperature activated types. This measure would apply to both space heating/cooling and to water heaters. It would involve some initial expense to the consumer to purchase the devices and have them installed. Another possible technique would be the installation of utility-controlled switches which could turn off air conditioning equipment for selected times during peak power demand periods. As with timed thermostats, these devices would involve some expense, but they could be made available in the short term.

All of the above techniques are technologically applicable in varying degrees to all energy consuming sectors (residential, commercial, and industrial) currently in the St. George service area. Additionally, such measures would be applied more economically to any future construction in the area as standard design features.

Energy consumption in the St. George service area could be further reduced by improving the energy efficiencies of existing and future structures, electrical devices, and appliances. Most efficiency improvements would involve moderate to high cost modifications and would tend to require longer periods of time to implement than would be the case for load-management techniques. However, most of the techniques of improving electrical efficiencies are applicable to all energy consuming sectors. The primary efficiency improvement opportunities in the St. George service area would be:

1. Reduction of heat loss or gain in buildings and appliances (e.g., water heaters) by improving existing levels of insulation. The technique would be applicable to all energy consuming sectors and would generally be of a low to moderate initial expense to the consumer. The amount of time needed to implement such measures would be primarily short term.

2. Conversion to more energy efficient devices by replacing existing appliances and devices with others that are more energy efficient. This would include such methods as converting from compressor driven cooling devices to evaporative coolers, converting from conventional central air conditioning to heat-pump systems, converting from resistance type heating to other systems, replacing existing appliances (refrigerators, clothes washers and dryers, etc.) with more efficient ones, and the use of lower wattage and/or more efficient lighting.

These types of changes would be applicable to all energy consuming sectors, but would generally not be expected to achieve much initial support. Most conversions of the types described would be relatively expensive for the consumer. Therefore, it is most likely that many of such conversions would only take place as attrition of existing systems occurs, and in the construction of new buildings and facilities. As such, it could be expected that these techniques would take a relatively long period of time to implement.

<u>Alternative Electrical Energy Sources</u>

There are a limited number of opportunities for applying alternative energy sources technologies in the St. George service area. There is insufficient industrial development in the area to consider cogeneration as a viable energy source. Likewise, there is an insufficient quantity of solid waste produced in the St. George service area to supply a biomass powerplant of any consequence. Although geothermal or wind power could provide economical sources of energy in the area, they have not been given consideration in this evaluation because of the lack of data available. This leaves solar energy as the only alternative source considered for development.

There appear to be two general applications for solar energy in the St. George service area. One would be relatively active water heating systems for both domestic uses and for swimming pools. Such systems, although applicable to almost all situations where heated water is needed, would be anticipated to receive highest initial use in the residential sector. Depending upon the type and extent of system employed in any given situation, solar water heating systems are currently moderate to high expense items for the consumer. This is the case partially because such systems still generally require a conventional type of back-up system. Such systems could, however, be either incorporated in future construction or retrofitted to existing structures, so their application could be achieved in a relatively short time frame. The second major application of solar energy would be in terms of both active and passive solar space heating. These systems would primarily be incorporated in new construction, utilizing special orientation and design features to take advantage of radiant energy from the sun. As with solar water heaters, solar space heating is, in concept, applicable to most space heating situations, but would be anticipated to receive most of its initial application in the residential sector. Although operational costs would be minimal, structural design and back-up system requirements could involve initially expensive investments. Since solar heating usually requires special structural design considerations, it would be more easily applied to new construction rather than retrofitting existing structures, and would therefore probably take a longer time frame to implement.

Energy Savings in 1990 and 2000

It is estimated that if the options of this alternative would be implemented, a total savings of 22.6 million kilowatt hours (kWh x 10^6) would be realized in energy consumption in the year 1990. This would translate to a reduction in peak demand of 5.7 MW (14.4-percent reduction). The demand in the year 2000 would be reduced by as much as 25 percent, resulting in a reduction of peak demand of 12.2 MW.

Nevada Power Company Service Area

The opportunities for applying energy conservation and alternative energy sources techniques in the NPC service area would be quite similar to those discussed for the city of St. George. Such similarities exist in the categories of conservation, load management, and solar technologies, and will not be discussed again in this section. These programs would be partially implemented by the year 1990 and fully implemented by the year 2000.

Additional opportunities for energy savings in the NPC service area beyond those discussed for St. George would be primarily in alternative energy sources and would involve the cogeneration of electrical energy and the generation of electrical energy from solid waste.

Cogeneration of Energy

The application of cogeneration refers to recovering steam produced during industrial processes and using it to generate electrical energy. This process generally only has industrial applications. Cogeneration would involve a relatively long time frame to implement and could be of only moderate reliability, depending upon the stability of the industry supplying the steam.

Generation of Power from Solid Waste (Biomass Technology)

The possibility of generating electrical energy from the incineration of solid waste in the service area has been explored and such an option could be feasible in the near future. At present, however, there is some question about whether the Las Vegas base population produces sufficient quantities of the appropriate type of solid waste to supply a biomass-fired powerplant, and whether such a power source could compete economically with existing power sources. This energy source therefore is not included in this assessment.

Energy Savings in 1990 and 2000

It is estimated that if the options of this alternative would be implemented, a total savings of 766 kWh x 10^6 would be realized in energy consumption in the year 1990. This would translate to a reduction in peak demand of 176 MW (8.6 percent reduction). A reduction of 16 percent in energy demand could be realized in the year 2000 with a resulting decrease in peak demand of 413 MW. These figures are considered conservative because solid waste energy sources were not included in the assessment.

Pacific Gas and Electric Company and Southern California Edison Service Areas

California leads the nation in its promotion of alternative energy sources and conservation measures. State policy is that alternative energy sources such as solar energy, wind, and cogeneration can and should play an increasingly important role in meeting energy needs. In its Biennial Report (1979), CEC states that "[Geothermal, cogeneration, and renewable energy sources including solar] are available now. They should be expanded because of their favorable environmental characteristics, efficiency, more stable costs, and the fact that they are indigenous to California." Likewise, CPUC has clearly stated its support for conservation and nonconventional energy sources. The two commissions, the State Legislature, and the Governor place energy conservation as one of the top energy priorities.

The CPUC staff is currently analyzing the feasibility of various alternatives for meeting California's future energy needs and will publish an Environmental Impact Report (EIR) in draft form in late June 1980. This EIR will include an analysis of these alternatives and will be used in the analysis of Alternative 5 for the service areas of the California utilities in the final AWV Environmental Impact Statement. This document will be available from CPUC and may be obtained by writing to the following address:

California Public Utilities Commission
Allen-Warner Valley Project
1390 Market Street
Fox Plaza, Room 724
San Francisco, California 94102

Two CPUC staff draft reports have been completed to date ("Alternatives to the Harry Allen/Warner Valley Energy System: A Preliminary Assessment of Potential Contributions," February 1980, and "Alternatives to the Harry Allen/Warner Valley Energy System: A Preliminary Examination of Three Alternatives," April 1980). The following information concerning the PG&E and SCE service areas is largely based on data from the Biennial Report (CEC, 1979) and on the preliminary assessments provided by the CPUC project staff.

Three basic types of programs are considered in this alternative:

1. The development of alternative electrical energy sources. Certain amounts of these technologies are already in the utility supply mixes, and additional capacity is included in current resource plans. Only development above that already planned by the utilities could be considered as a valid alternative to the AWV project.

2. Reduction in the demand for electricity through substitution of direct heat obtained from renewable energy sources (solar technology).

3. Reduction in the demand for electricity through conservation and load-management measures. Steps which result in less energy being required by a given process fall under the heading of conservation, while various load-management practices would be aimed at reducing system demands during periods of peak consumption.

Alternative Electrical Energy Sources

Preliminary assessments of various alternative electrical energy sources options are contained in the two CPUC staff studies cited previously. More complete analyses are underway, and will be contained in staff reports submitted in the CPUC proceedings for the Application for a Certificate of Pulic Convenience and Necessity for the AWV project, currently before CPUC.

Only the realistic capabilities of alternative energy sources to supplant capacity represented by the AWV project are analyzed. The potential capacities which could be installed by 1991 (based on technical, economic, and other feasibility criteria) and which are not already in the most current utility resource plans of PG&E and SCE are considered to be the only feasible alternatives.

The current alternative supply mix and planned capacity additions for the PG&E and SCE service areas as outlined in the tables 2-15 and 2-16 were based on the resource plan submitted with the Proponents' Environmental Assessment (SCE and PG&E, 1979) as modified in the CPUC certification hearings for a Certificate of Public Convenience and Necessity (CPCN) for the AWV project. PG&E and SCE will submit updated resource plans to CEC on June 3, 1980 which could change the planned resource additions as well as the projected needs for the SCE service area.

Formulation of the 1991 "Feasible Alternative Supply Mix" for PG&E and SCE as outlined in tables 2-15 and 2-16 are based on the preferred resources supply mix as presented in the CEC Biennial Report (1979). The only exceptions are where PG&E has planned additions of more hydroelectric and geothermal capacity, and SCE has planned additions of more hydroelectric capacity than did CEC in the Biennial Report (1979). These figures are assumed in the "Feasible Alternative Supply Mix." Also preliminary CPUC staff assessments (subject to change) indicate an increased capability in the area for more cogeneration capacity than was assumed by CEC. This increased capacity is also reflected in the "Feasible Mix." Application of the "Feasible Mix" would result in an additional 1,195 MW of electrical generating capacity from nonconventional sources for PG&E and 1,103 MW for SCE.

TABLE 2-15

Electrical Energy From Alternative Sources:
PG&E Service Area

	1980 Capacity (MW)	Planned Additions 1980-1990 (MW)	Feasible Alternative Energy Sources Mix for 1991 (MW)	Potential Not in Current Resource Plans (MW)	Potential Not in Current Resource Plans kWh/yr x 10^6
Cogeneration	179	921	2,179	1,079	7,560
Geothermal	663	1,246	1,909	0	0
Hydro	5,325	1,560	6,885	0	0
Wind (firm capacity)[a]	0	27	93	66	610
Solar	0	0	50	50	140
Total	6,167	3,754	11,116	1,195	8,310

Sources: Based on data from preferred resources supply mix (Biennial Report, CEC, 1979), and preliminary CPUC staff assessments (unpublished, 1980) Proponents' Environmental Assessment, SEC and PG&E, 1979 as modified by the testimony of R. Bruce Williams, Senior Engineer, PG&E, "CPUC Hearings for Certificate of Public Convenience and Necessity," April, 1980

[a]Installed wind capacity is three-times that of firm capacity (firm x 3 = installed).

TABLE 2-16

Electrical Energy From Alternative Sources:
SCE Service Area

	1979 Capacity (MW)	Planned Additions 1980-1991 (MW)	Feasible Alternative Energy Sources Mix for 1991 (MW)	Potential Not in Current Resource Plans	
				(MW)	kWh/yr x 10^6
Cogeneration	32	438	600	130	911
Geothermal	0	158	900	742	4,745
Hydro	842	551	1,393	0	0
Wind (firm capacity)[a]	0	63	160	97	892
Solar	0	10	70	60	173
Fuel Cells	0	26	100	74	110
Total	874	1,246	3,223	1,103	6,831

Sources: Based on data from preferred resources supply mix (Biennial Report, CEC, 1979) and Proponents' Environmental Assessment, SCE and PG&E, 1979 as modified by testimony of S.P. Barrett, Senior Engineer, SCE, "CPUC Hearings for Certificate of Public Convenience and Necessity," April 29, 1980

[a]Installed wind capacity is three-times that of firm capacity (firm x 3 = installed).

Substitution of Direct Renewable Energy for Electricity

Reduction of the end-use demand for electricity through the direct use of renewable energy sources could be achieved in several ways. Direct combustion of biomass forms such as agricultural and forestry residues, municipal solid wastes, or wood could supply energy for space and water heating and for industrial processes. In addition to its use for electricity generation, geothermal steam could be used directly for a variety of domestic and industrial purposes, the most common being the heating of buildings and industrial drying. However, solar energy, in its various forms, would present the greatest potential in the near-term to displace electricity demand, and is the only renewable energy source potential that the CPUC staff has quantified at this time.

The assessment of direct solar technologies is based on information from the CEC document Decade of the Sun: Program Plan for the Maximum Implementation of Solar Energy Through 1990 (1980). In producing this document, CEC assessed the status and potential of solar technologies in the residential, commercial, industrial, and agricultural sectors. It limited the scope of its study to those direct uses of solar energy for heating water; space heating and cooling; lighting buildings; process heating; mechanical pumping; and the production of electricity. Each solar application was studied for technical feasibility, commercial readiness, cost effectiveness, and the amount of energy that could be supplied by 1990 (data only available to 1990).

For the residential sector, CEC determined the maximum number of residences for which it would be both technically and economically feasible to incorporate solar applications by 1990. The energy savings possible due to passive solar heating, passive cooling, and active water heating were assessed for new construction, retrofit applications, and for single-family and multi-family homes.

The commercial sector is composed of a diverse group of energy users. Sufficient data was not available to allow assessment of the potential applications of solar energy in this sector to the level of detail and accuracy possible in the residential sector. Solar energy potentials were estimated, however, for both new and existing commercial consumers for the uses of space heating, space cooling, service (potable) water heating, and lighting.

While the CEC document contains discussions of a number of potential applications of solar technologies in the industrial and agricultural sectors, no estimates were made of potential savings nor of how much existing use of conventional fuels could be displaced in these two sectors.

The maximum displacement of electricity demand as determined by CEC for the residential and commercial sectors in the PG&E and SCE districts is shown in table 2-17. While it is probably unrealistic to expect that these maximum savings would be achieved, a substantial portion could be realized, especially with the major promotional efforts proposed and already in effect in California. If half the maximum level would be achieved, it would result in a reduction in peak demand in the two utilities' districts of 1,400 MW with a related savings of approximately 3,800 kWh x 10^6 each year.

TABLE 2-17

1990 Maximum Annual Solar Energy Displacement of Electricity

	PG&E		SCE	
	Reduction in Peak Demand (MW)	Total Savings (kWh x 10^6)	Reduction in Peak Demand (MW)	Total Savings (kWh x 10^6)
Residential				
Passive Solar Heating	NA	543	NA	399
Passive Solar Cooling	NA	895	NA	545
Water Heating	NA	811	NA	607
Commerical/Industrial				
Space Heating	NA	187 to 247	NA	257 to 347
Space Cooling	NA	771 to 977	NA	1,059 to 1,374
Water Heating	NA	81 to 106	NA	111 to 151
Natural Lighting	NA	498	NA	687
Total (Maximum)	1,550	3,797 to 4,088	1,250	3,670 to 4,117

Source: Decade of the Sun: Program Plan for the Maximum Implementation of Solar Energy Through 1990, Staff Draft, CEC, 1980

NOTE: NA = not available

Conservation and Load Management

The amount of energy savings that would result from conservation measures (included in the adopted CEC forecast of energy demand in table 2-18) represents an assumption of the reductions in energy demand that would occur in the PG&E and SCE service areas. Obviously, the potential demand reductions that could result from an all-out nationwide conservation effort by utilities, government, industry, and consumers would be substantially higher. The "high conservation scenario" (table 2-18) examines energy savings that would result from these additional conservation measures that could be realized within the next 10 years.

It should be noted that the CEC adopted forecast does not consider any conservation measure not already enacted. California law requires that the CEC forecast include all conservation that would be "reasonably likely" to occur. This requirement was interpreted to mean all actions that have been promulgated by CEC, CPUC, and the U.S. Department of Energy at the time of the forecast.

The CEC "adopted forecast" of electricity demand includes the demand reducing measures presented in table 2-18. In addition, the CEC staff also analyzed the effects of the "high conservation scenario," which also appears in the table. Table 2-19 presents the reduction in energy and peak demand reflecting the difference beween the CEC "adopted forecast" and the forecast including the "high conservation scenario." These reductions would be achieved with the rigorous implementation of those measures included under the "high conservaton scenario" as presented in table 2-18. The "high conservation scenario" does not assess the impacts of such conservation measures as residential energy audits, commercial load management, industrial boiler efficiency standards, and agricultural pump efficiency standards. All these measures would tend to reduce energy demand even further beyond the elements included in the scenario. Adjustments have been made for solar displacement originally assumed in the scenario. This displacement is now assumed in the preceeding section on solar displacement (table 2-17).

The implementation of programs of the "high conservation scenario" would result in a reduction in peak demand of 1,587 MW in the PG&E service area, and a reduction in peak demand of 1,439 MW in the SCE service area.

ALTERNATIVE 6

This "No Action" alternative would involve the denial by Federal land managers of rights-of-way and other appropriate permits necessary for the construction and operation of the proposed AWV Energy System. Such a decision could result from Federal land managers finding that it is in the public interest to deny the use of public lands for this project on environmental and/or socioeconomic grounds or on the basis of a finding of no need for the proposed power generating capacity.

TABLE 2-18

Demand Reducing Measures Included in CEC Adopted Forecast and High Conservation Scenario

Measure	Adopted Forecast	Forecast with High Conservation Scenario
Residential		
Building standards	Present CEC standards	Baseline
Appliance efficiency standards		
CEC standards	Present CEC standards	More efficient standards
Federal standards	Enacted in 1981	Baseline
Pool and water heater load management	8 percent of pools	80 percent by 1995
Air conditioning load management	8 percent of central air conditioning	80 percent by 1995
Insulation retrofit	Utility programs	100 percent by 1990
Solar water heaters	50 percent in nongas regions	90 percent of new homes in nongas regions
Electric backups	0.5 percent in gas regions	90 percent of new homes in gas regions
Commercial		
Building standards	Present CEC standards	Baseline
Utility audit programs	Pre-1980 buildings only	Up to 20 percent savings
Appliance efficiency standards	Present CEC standards	More efficient standards
Lighting standards	Office/miscellaneous buildings only	Baseline
Solar water heating	All new State buildings	Baseline
Street light upgrading	Conversion to sodium vapor	Faster conversion
Industrial		
Building standards	Present CEC standards	Baseline
Utility audit programs	Utility estimates	20-percent savings
Voltage Reduction	Utility estimates	Greater impacts

Source: Energy Futures for California: Two Scenarios, 1978-2000, Staff Draft, CEC, 1979

TABLE 2-19

Reduction in Energy Consumption and Peak Demand
With High Conservation Scenario (1991)

	Pacific Gas and Electric	Southern California Edison
Energy Consumption (kWh x 10^6)		
Residential	3,227	2,239
Commercial	1,272	1,730
Industrial (Including Agriculture)	2,426	2,229
Total Reductions		
Energy Consumption	6,925	6,198
Reductions in Peak Demand (MW)	1,587	1,439
Percent Reduction		
Energy Consumption[a]	8.8	8.2
Peak Demand (MW)[b]	8.8	8.2

Source: Data from Energy Futures for California: Two Scenarios, 1978-2000, Staff Draft, CEC, 1979

[a]Reduction in energy consumption is obtained by subtracting CEC forecast of consumption with "high conservation scenario" from CEC "adopted forecast."

[b]Reduction in peak demand is assumed as the same percentage as that derived for reduction in energy consumption. This figure is considered a conservative estimate because growth rates assumed in the "high conservation scenario" were higher than those finally adopted by CEC for the Biennial Report (1979).

AUTHORIZING ACTIONS

In order to implement either the applicants' proposed project or any one or parts of the alternatives, certain Federal, State and local authorizing actions must be taken. Appendix 5 lists these actions and indicates how they would apply to the applicants' proposal and alternatives listed in this EIS.

STANDARD OPERATING PROCEDURES AND MITIGATING MEASURES

Certain standard operating procedures and mitigating measures are required by BLM as a condition to receipt of approval to utilize public lands. The standard operating procedures are designed to minimize the general impacts of construction and operation activities associated with the implementation of any one or parts of an alternative (excluding coal fields and Alternative 6). A list of the standard operating procedures is provided in Appendix 6. Mitigating measures and an indication of their effectiveness as applicable to specific alternatives are listed below.

Alternative 1

1. The coal slurry pipeline and any associated facilities will be rerouted in accordance with the relocation route report prepared by Engineering Management Inc. (1977) to mitigate impacts to the Honeymoon Trail, the Coral Pink Sand Dunes State Reserve, and the Black Dog Cave/Moapa-Muddy Archaeological Complex.

<u>Effectiveness</u>. Rerouting the slurry pipeline away from where the Honeymoon Trail descends the Hurricane Cliffs would negate adverse effects on that portion of the trail and would preserve the property in essentially the same condition as when nominated to the National Register of Historic Places. However, the valve station, with its 50-foot high microwave tower, and a landing strip would still be visible from the trail.

Placing the pipeline in the shoulder of the road where it would traverse the Coral Pink Sand Dunes State Reserve would confine disturbance to an existing transportation corridor and would avoid the impact on aesthetic quality from the addition of another corridor through the recreation area.

The rerouting of the pipeline would avoid the Black Dog Cave/Moapa-Muddy Complex, thus reducing the chance of adverse impacts due to increased access.

2. A through road in Warner Valley will be provided for public access.

<u>Effectiveness</u>. Public access would be assured through this measure.

3. The slurry pipeline will be routed away from Bloomington Cave. The use of explosives within 0.5 mile (805 meters) of the cave will not be permitted unless approved in advance by the authorized officer.

<u>Effectiveness</u>. Realignment and control of explosives near Bloomington Cave would effectively mitigate potential impacts to sightseeing near the cave and would prevent physical damage to the cave.

4. Construction activities will be conducted during the winter months at the crossing of U.S. 89 and Arizona 389, and where the pipeline would parallel the Yellowjacket Road in the Coral Pink Sand Dunes area. Highway

I-15 will be crossed as late as possible in the summer, commensurate with the requirement to cross the Virgin River at low or no flow periods.

Effectiveness. Sightseeing and tourist activity is greatest during summer months. At major transportation crossings and especially in the Coral Pink Sand Dunes State Reserve, inconvenience, congestion, and detraction from the recreation experience would decline if periods of peak tourist activity would be avoided.

5. The applicant will be required to construct the diversion dam so that river flows below 40 ft^3/s could not physically be diverted into Warner Valley reservoir.

Effectiveness. This measure would be 100-percent effective in protecting the existing water right of CP National Utilities Company for its hydroelectric powerplant diversion of 40 ft^3/s.

6. The applicant will be required to bury the slurryline in bedrock or at least 15 feet below the existing bed at Kanab Creek, Fort Pierce Wash, Virgin River, Beaver Dam Wash, Toquop Wash, Meadow Valley Wash, and Moapa River. Shallower burial may be allowed where the applicant can demonstrate in writing to BLM that the pipeline would not be exposed in the event of a 50-year flood.

Effectiveness. Burying the pipe in bedrock or to a depth of 15 feet on river and wash crossings could eliminate the possibility of a pipeline rupture due to flooding. Burying the pipeline at river and wash crossings would reduce the risks of adverse impacts to endemic fishes caused by slurry discharge.

7. The applicant will be required to install and maintain automatic pressure sensitive valves on both sides of river and major wash crossings, specifically at Kanab Creek, Fort Pierce Wash, Virgin River, Moapa River, Toquop Wash, Beaver Dam Wash, and Sand Wash. With BLM approval, this system could be modified, provided that the protection remained the same or improved.

Effectiveness. In the event of a break, check valves and sectionalized valving would reduce spill volumes to less than 0.02 acre-feet at the Virgin River crossing. This would represent a 98-percent reduction in the maximum amount of slurry that could be discharged at this point. Similar reductions could be expected at other crossings where check valves would be installed. The intensity of ground water impacts would also be reduced by at least 50 percent due to sectionalized valving. Sectionalized valving would substantially reduce risks of adverse impacts to endemic fishes caused by the slurry discharge.

8. The applicant will landscape in areas of high potential visual resources to prevent detracting from the natural landscape, especially where the powerplant would impact the Honeymoon Trail and the Dominguez-Escalante Trail in Warner Valley.

Effectiveness. Visual impacts would be lessened, although degree cannot be determined at this time.

Alternative 2

1. The coal slurry pipeline and associated facilities will be rerouted in accordance with the relocation route report prepared by Engineering Management Inc. (1977) to avoid damage to the Honeymoon Trail, the Coral Pink

Sand Dunes State Reserve, and the Black Dog Cave/Moapa-Muddy Archaeological Complex.

Effectiveness. Refer to Alternative 1, mitigating measure 1.

2. Construction activities will be conducted during the winter months at the crossing of U.S. 89 and Arizona 389, and where the pipeline parallels the Yellowjacket Road in the Coral Pink Sand Dunes area. Highway I-15 will be crossed as late as possible in the summer, commensurate with the requirement to cross the Virgin River at low or no flow periods.

Effectiveness. Refer to Alternative 1, mitigating measure 4.

3. The applicant will be required to bury the slurryline in bedrock or at least 15 feet below the existing bed at Kanab Creek, Fort Pierce Wash, Virgin River, Beaver Dam Wash, Toquop Wash, Meadow Valley Wash, and Moapa River. Shallower burial may be allowed where the applicant can demonstrate in writing to BLM that the pipeline would not be exposed in the event of a 50-year flood.

Effectiveness. Refer to Alternative 1, mitigating measure 6.

4. The applicant will be required to install and maintain automatic pressure sensitive valves on both sides of river and major wash crossings, specifically at Kanab Creek, Fort Pierce Wash, Virgin River, Moapa River, Toquop Wash, Beaver Dam Wash, and Sand Wash. With BLM approval, this system could be modified provided that the protection remained the same or improved.

Effectiveness. Refer to Alternative 1, mitigating measure 7.

Alternative 3

1. A through road in Warner Valley will be provided for public access.

Effectiveness. Refer to Alternative 1, mitigating measure 2.

2. The applicant will be required to construct the diversion dam so that river flows below 40 ft^3/s could not physically be diverted into Warner Valley reservoir.

Effectiveness. Refer to Alternative 1, mitigating measure 5.

Alternatives 4, 5, and 6

No mitigating measures apply to these alternatives. However, the standard operating procedures as presented in Appendix 4 would apply where appropriate.

SUMMARY OF IMPACTS

Table 2-20 presents a summary of the environmental impacts that would be incurred with the implementation of Alternatives 1, 2, 3, 4, 5, or 6.

IDENTIFICATION OF THE BUREAU OF LAND MANAGEMENT PREFERRED ALTERNATIVE

A decision by the Secretary of the Interior on the unsuitability petition filed for the Alton coal field will not be made until late November 1980. BLM has determined that identification of an Agency Preferred

Alternative at this time would be prejudicial to the Secretary's decision making process. Therefore, BLM has been authorized by the U.S. Department of the Interior to publish this draft EIS without identifying a preference for either the applicants' proposal or any of the five alternatives analyzed herein. A BLM preferred alternative will be identified in the final EIS, which is currently scheduled for publication in November 1980.

TABLE 2-20

Cumulative Summary of Major Impacts

Resource Category	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Energy	Total average electrical output of 1,750 MW, reduced by 8-percent line loss to 1,610 MW. Overall energy efficiency of 22.1 percent.	Total average electrical output of 1,400 MW, reduced by 8-percent line loss to 1,288 MW. Overall energy efficiency of 22.1 percent.	Total average electrical output of 875 MW, reduced by 8-percent line loss to 805 MW. Overall energy efficiency of 23.4 percent with central Utah coal, or 23.3 percent with southwestern Wyoming coal.	Total average electrical output of 1,400 MW, reduced by 8-percent line loss to 1,288 MW. Overall energy efficiency of 24.0 percent with central Utah coal, or 23.8 percent with southwestern Wyoming coal.	Total capacity represented by energy savings and displacement equal to 4,349 MW in 1991.	Other methods must be developed to meet energy demand.
Air Quality	Total emissions (tons/day): particulate matter, 10.20; SO_2, 51.18; NO_x, 170.52. Air quality increments exceeded at: Class I, Zion National Park and Valley of Fire State Park; Class II, Sand Mountain and Allen powerplant site.	Total emissions (tons/day): particulate matter, 8.16; SO_2, 40.8; NO_x, 136.22. Air quality increments exceeded at: Class I, Valley of Fire State Park; Class II, Allen powerplant site.	Total emissions (tons/day): particulate matter, 2.24 or 2.77; SO_2, 13.14 or 17.25; NO_x, 104.35 or 89.81 respectively for central Utah or southwestern Wyoming coal. Air quality increments exceeded by southwestern Wyoming coal at: Class I, Valley of Fire State Park; Class II, Allen powerplant site.	Total emissions (tons/day): particulate matter, 2.44 or 3.5; SO_2, 15.9 or 24.12; NO_x, 174.5 or 145.3 respectively for central Utah or southwestern Wyoming coal. Air quality increments exceeded at: Class I, Valley of Fire State Park; Class II, Allen powerplant site.	NA	No impact.
Water Resources	About 22 springs altered in Alton area. Erosion increased on 10,154 acres and downstream sedimentation increased. Ground water pumping could adversely affect well and spring yields in adjacent areas. Stream flow and water quality reduced in Virgin River. About 1,850 acres of Dry Lake playa occupied by Allen powerplant facilities, raising potential flood levels.	About 22 springs altered in Alton area. Erosion increased on 8,488 acres and downstream sedimentation increased. Ground water pumping could adversely affect well and spring yields in adjacent areas. About 1,850 acres of Dry Lake playa occupied by Allen powerplant facilities, raising potential flood levels.	Surface water quality in central Utah or southwestern Wyoming and Alton mine area adversely affected. Springs in Alton mine area altered and erosion and stream sedimentation increased. Yields of spring and well water sources in adjacent areas adversely affected. Stream flow and water quality reduced in Virgin River. About 1,850 acres of Dry Lake playa occupied by Allen powerplant facilities, raising potential flood levels.	Surface water quality in central Utah or southwestern Wyoming adversely affected. Characteristics of underground aquifers altered temporarily and yields of springs and wells in adjacent areas adversely affected. About 1,850 acres of Dry Lake playa occupied by Allen powerplant facilities, raising potential flood levels.	NA	No impact.
Vegetation	Adverse impact to two endangered plants.	No significant impact.	Adverse impact to two endangered plants.	No significant impact.	NA	No impact.
Wildlife	Adverse impact to habitat of one endangered fish and two species proposed for endangered classification in Utah.	Habitat disturbance of one animal proposed for endangered status in Utah and protected in Arizona, Nevada, and California.	Habitat disturbance of one animal proposed for endangered status in Utah and protected in Arizona, Nevada, and California.	Habitat disturbance of one animal proposed for endangered status in Utah and protected in Arizona, Nevada, and California.	NA	No impact.

(continued)

TABLE 2-20 (concluded)

Resource Category	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Cultural Resources	About 329 archaeological sites and three historic trails adversely impacted; one property listed on the National Register destroyed.	About 259 archaeological sites and one property nominated to National Register adversely impacted.	About 162 archaeological sites adversely impacted with central Utah coal, or 419 sites with southwestern Wyoming coal. Three properties of historic value disturbed, and one property listed on the National Register destroyed.	About 112 archaeological sites adversely impacted with central Utah coal, or 627 sites with southwestern Wyoming coal.	NA	No impact.
Recreation and Aesthetics	Increase in overall recreational visitation. Decrease in overall visual resources quality.	Increase in overall recreational visitation. Decrease in overall visual resources quality.	Increase in overall recreational visitation. Decrease in overall visual resources quality.	Increase in overall recreational visitation. Decrease in overall visual resources quality.	NA	No impact.
Land Use	Change in existing use on 24,752 acres.	Change in existing use on 15,685 acres.	Change in existing use on 18,369 acres with central Utah coal, or 26,499 acres with southwestern Wyoming coal.	Change in existing use on 15,196 acres with central Utah coal, or 31,456 acres with southwestern Wyoming coal.	NA	No impact.
Socioeconomics (peak level impacts)	Kane County Population 2,666 Employment 1,062 Income $20,228,700 Tax Base $2,400,000 Washington County Population 8,013 Employment 2,244 Income $29,198,300 Tax Base $73,500,000 Clark County Population 8,000 Employment 3,404 Income $62,563,300 Tax Base $486,720,000	Kane County Population 2,666 Employment 1,062 Income $20,228,700 Tax Base $2,400,000 Clark County Population 8,000 Employment 3,404 Income $62,563,300 Tax Base $489,720,000	Central Utah Region Population[a] 52,000 Employment 22,120 Income $520,650,000 Tax Base NA Southwestern Wyoming Region Population 11,601 Employment 4,195 Income[b] $600,700,000 Tax Base NA Kane County Population 783 Employment 563 Income $10,734,900 Tax Base $10,400,000 Washington County Population 8,103 Employment 2,244 Income $21,400,000 Tax Base $40,000,000 Clark County Population 8,000 Employment 3,404 Income $62,563,300 Tax Base $250,000,000	Central Utah Region Population[a] 52,000 Employment 22,120 Income $520,650,000 Tax Base NA Southwestern Wyoming Region Population 11,601 Employment 4,195 Income[b] $600,700,000 Tax Base NA Clark County Population 8,000 Employment 3,404 Income $62,563,300 Tax Base $489,720,000	Lowering of overall energy costs to consumers from decrease in energy demand. Some shifts and/or expansion in employment. Changes in current lifestyles from changes in patterns of energy use towards reduced consumption.	No impact.

[a] 1990 projection
[b] Total personal income

NOTE: NA = not available

CHAPTER 3

AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes the environment of the areas that would be affected through the implementation of any one or parts of the alternatives described in Chapter 2. Impacts to the environmental elements immediately following were not found to be of sufficient significance to be analyzed in detail. Thus, the affected environment is described only briefly for these elements. Those environmental elements which would sustain more significant impacts, as determined during the scoping process (Chapter 1), are described later in the chapter.

ENVIRONMENTAL ELEMENTS WITH MINOR IMPACTS

Climate

The climate of the affected environment ranges from the lower elevation hot desert of the Mojave Desert (southern California and southwestern Utah), to the upper elevation cold deserts (central Utah and southwestern Wyoming) and is interspersed with mountain climates. Precipitation in the area is influenced greatly by storms out of the Pacific Ocean in the winter and early spring and by Gulf of Mexico storms in the late spring and summer. The desert regions receive the least amount of moisture (e.g., approximately 4 inches per year at Las Vegas) and the mountain regions receive the most (12 inches or greater per year). Areas west of the Sierra Nevada Mountains receive substantially more moisture due to coastal influence (e.g., over 21 inches at Lugo, California in 1977-78).

Prevailing wind directions vary from south-southwest in Nevada and Utah to west-southwest in Wyoming.

Topography and Geology

The topography and geology are characterized by several isolated mountain ranges separated by depositional valleys and basins in southern California and southwestern Utah. The topography of central Utah is characterized by steep, dissected plateaus and canyonlands of the Wasatch Plateau. Low mountains and semiarid basins characterize the region of southwestern Wyoming.

Seismic risk is major in southern California, moderate in southern Nevada and southwestern and central Utah, and minor in southwestern Wyoming.

Commonly Occurring Vegetation

The most common vegetation types of central Utah are the aspen-conifer and the pinyon-juniper associations.

Pinyon-juniper and sagebrush associations are the principal types encountered in the Alton area.

Four vegetation types commonly occur in the southwestern Wyoming mining region: sagebrush, saltbush, greasewood, and juniper.

The common Mojave Desert vegetation types are found in Warner Valley in southwestern Utah, across southern Nevada, and in southern California. They consist of: blackbrush, creosote bush, various understory grasses, Joshua trees, and pinyon-juniper trees.

Paleontology

Vertebrate and plant fossil-bearing rock occur throughout the affected environment. No site-specific inventories have been performed in the affected regions except for a sampling inventory along the alternative corridors of the proposed Western Transmission System (Reynolds, 1979). According to Reynolds, the following locations are considered high in paleontological value: 6.8 miles of Pleistocene and Miocene vertebrate fossils between Bell Mountain and Toomey, California (Interstate 15 Transmission Line Alternative); 15.7 miles of Pleistocene and Tertiary vertebrate fossils between Toomey, California and Stateline, Nevada, (especially near Afton Canyon, the Soda Mountains, Halloran Springs, East Cronese Dry Lake, Mojave River north of Baker, Ivanpah Lake, and Roach Lake [Interstate 15 Transmission Line Alternative]); 5.1 miles of Pleistocene, Miocene, and Cambrian vertebrate and invertebrate fossils between Roach Lake and the Eldorado substation in southern Nevada (Victorville-McCullough Transmission Line Alternative); 10.4 miles of Pleistocene and Miocene fossils from Toomey, California to Stateline, Nevada (Victorville-McCullough Transmission Line Alternative); 7.4 miles of Miocene vertebrate fossils between Lucern Valley and Pisgah, California (Eldorado-Lugo Transmission Line Alternative); and 7.4 miles of Pleistocene vertebrate fossils between Pisgah, California and the Eldorado Valley in Nevada (Eldorado-Lugo Transmission Line Alternative).

Mineral Development

The U.S. Geological Survey, under a very general classification system, considers Warner Valley, Utah and Dry Lake Valley, Nevada as prospectively valuable areas for oil and gas resources (Pera et al., 1976). The Dry Lake site for the proposed Harry Allen powerplant is almost completely blanketed with leases for oil and gas. Seismic exploration has taken place, but there has been no actual drilling.

The present production of the leasable coal reserves in central Utah and southwestern Wyoming is 12 million and 24 million tons per year respectively. Coal reserves in the Alton coal fields in Utah are estimated at a total of 311 million tons: 212 million tons of surface strip mineable coal, and 100 million tons of underground mineable coal (NPC, 1975).

The Springdale Sandstone member of the Moenave Formation outcrops intermittently in Warner Valley. The sandstone is a known producer of silver, copper, and uranium. Numerous mining claims have been staked and one State lease has been issued in the valley, but little exploration has taken place. Approximately 2,000 mining claims have been staked for uranium on the Chinle Formation in Warner Valley since the 1950s. At present there is no active exploration of these claim sites (Bureau of Land Management [BLM], Cedar City District Office Files, 1979). No other minerals of economic value would be affected in the region covered by this environmental impact statement (EIS).

Soils

Silts, sands, and gravels make up the principal soils of the affected environment and are easily eroded by wind and water. Soils occurring in the arid environment of the Mojave Desert from southwestern Utah through southern Nevada and into southern California are extremely susceptible to disturbance, having developed in a region limited in moisture and vegetation cover (organic matter).

Commonly Occurring Wildlife

Big game animals encountered in the central Utah coal mining region include: numerous mule deer, three herds of elk, some transplanted herds of antelope, mountain lion, and black bear. Various species of small mammals occur throughout the region, including: muskrat, mink, rabbits, foxes, coyotes, etc. Also found are various nongame birds, raptors, reptiles, rodents, and fishes.

Antelope are the most prevalent big game species inhabiting the southwestern Wyoming coal region. Mule deer, elk, and moose are also present. Various nongame birds, raptors, small mammals, reptiles, and rodents are habitants of the coal producing region. An increasing population of wild horses is also present.

Commonly occurring game animals in the area of Alton, Utah include mule deer, rabbit, mountain lion, sage grouse, and wild turkey. Other animals include coyote, bobcat, badger, various small mammals, raptors, nongame birds, reptiles, and rodents.

The Mojave Desert region extends from southwestern Utah, across southern Nevada, and into southern California. It is habitat for principally small nocturnal mammals. Predators such as bobcat, kit fox, and coyotes are also common. Various nongame birds and raptors occupy the region primarily in the winter months. The desert region is also habitat for many common species of amphibians and reptiles, including the desert iguana, desert horned lizard, gopher snake, red racer, sidewinder, and the Mojave rattlesnake.

ENVIRONMENTAL ELEMENTS WITH MAJOR IMPACTS

Air Quality

Existing Air Quality

Most of the affected environment has been designated Class II under the Prevention of Significant Deterioration (PSD) Regulations. This means that air quality deterioration that accompanies moderate, well-controlled growth would not be considered significant. Three mandatory PSD Class I areas (areas where nearly any air quality deterioration would be considered significant) are in close proximity to the project areas: Zion, Bryce Canyon, and Capitol Reef National Parks. The Paiute Primitive Area (northwestern Arizona) has been recommended by a U.S. Department of the Interior task force for Class I air quality designation, and the State of Nevada has requested that any analysis consider the Valley of Fire State Park as a potential Class

I area (fig. 3-1; personal communication, Mike Nolan, Planning Coordinator, State of Nevada, January 31, 1980).

The Las Vegas Air Quality Maintenance Area (AQMA) has been classified as a "nonattainment" area for particulate matter, carbon dioxide, and ozone because of urban and industrial growth. The area between Baker and Lugo, California has been classified "nonattainment" for particulate matter because of long-range transport of particulates from southern California and wind-blown dust (Development of Coal Resources in Southwestern Wyoming Environmental Statement [SW], U.S. Department of the Interior [USDI], 1978; Development of Coal Resources in Central Utah Environmental Statement [CU], USDI, 1979; Development of Coal Resources in Southern Utah Environmental Statement [SU], USDI, 1979; Nevada Power Company, [NPC], 1975; Southern California Edison Company [SCE] and Pacific Gas and Electric Company [PG&E], 1979). No significant increase in these air pollutants can be caused by a new or existing source (industrial or electricity generating) in a "nonattainment" area.

Ambient sulfur dioxide (SO_2) measurements in the affected area show no violations of the primary or secondary National Ambient Air Quality Standards (NAAQS) or applicable State regulations. In general, SO_2 concentrations are low because there is not a high concentration of fossil fuel-powered industrial sources in the area.

Nitrogen dioxide (NO_2) concentrations are well below the primary NAAQS and applicable State regulations. This, too, can be attributed to the lack of any high concentration of combustion sources in the affected area. However, under certain meterological conditions NO_2 emissions from powerplants have been known to cause a yellow discoloration of the atmosphere at the Emery, Huntington, Jim Bridger, Naughton, and Reid Gardner powerplants in the EIS area.

Very few ozone (O_3) concentration measurements have been made in the affected environment. The highest measured hourly O_3 concentrations in the rural areas are generally a result of thunderstorms. The majority of measured concentrations are well below the NAAQS for ozone. However, the Las Vegas AQMA and the area from Baker to Lugo, California are nonattainment areas for ozone. The Las Vegas ozone problem is probably due to automobile and petroleum related sources (Clark County Department of Comprehensive Planning, 1978). The Baker to Lugo problem is probably due to long-range transport of ozone from southern California (SCE and PG&E, 1979).

Only limited visibility measurements exist for the affected environment. From airport visibility data, modern visibilities in the nonurban areas of southwestern United States are approximately 65 to 80 miles (SU, 1979). Measurements at Cedar Mountain, Utah, using photographic photometers have shown visibility ranges from 54 to 94 miles (SU, 1979). Visibility measurements in Warner Valley with an integrating nephelometer during 1977 and 1978 showed mean visual ranges of 80 miles and 76 miles, respectively (Stearns-Roger, 1978). However, wind blown dust due to very strong winds can cause as much as 70-percent reduction in visual range on winter mornings and late afternoons and as much as 90-percent reduction on summer mornings (Cramer et al., 1978). Additional visibility studies by both the National Park Service (NPS) and Nevada Power Company are currently in process and should yield better information.

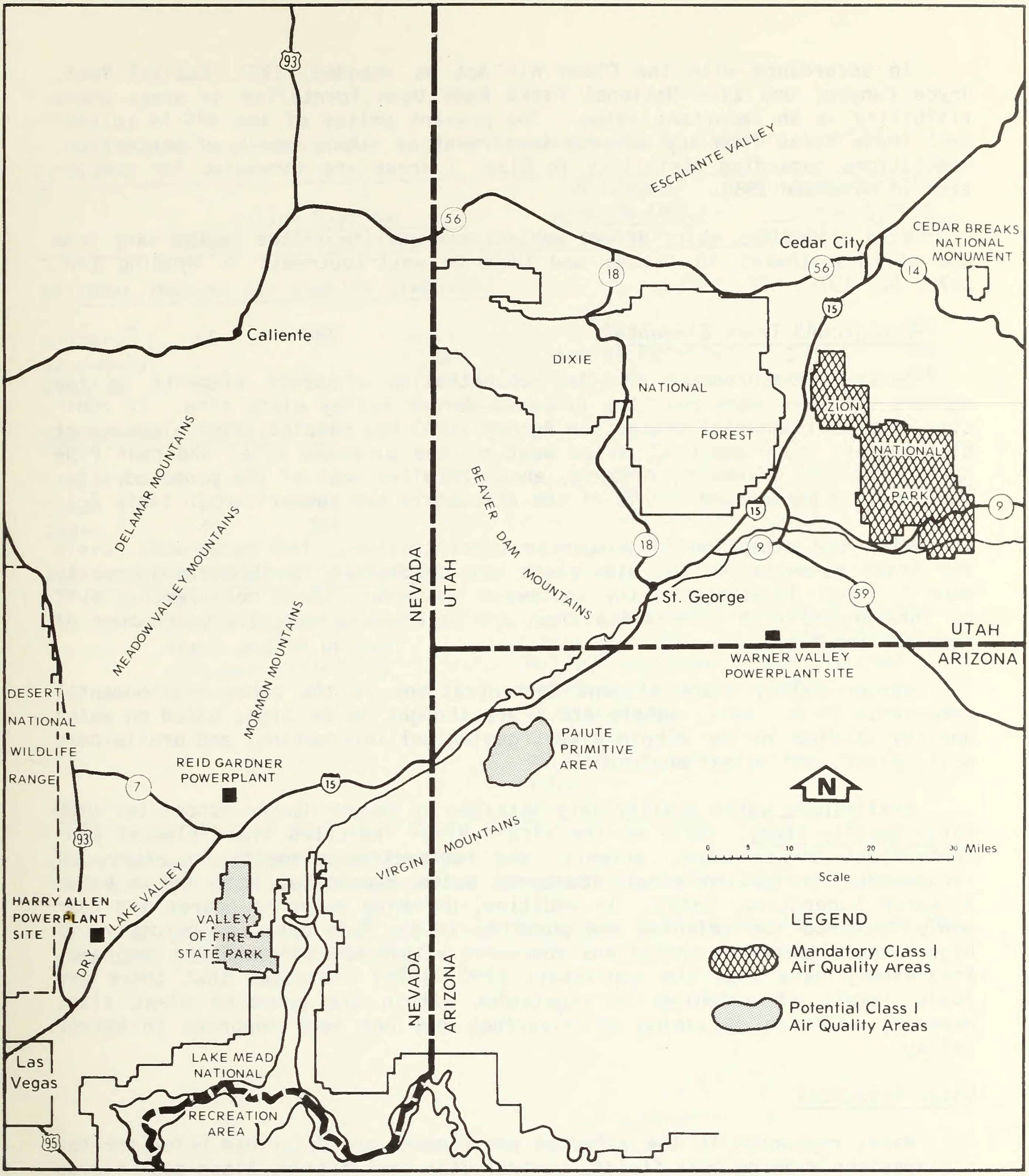


FIGURE 3-1

AREAS OF AIR QUALITY INVESTIGATIONS

In accordance with the Clean Air Act as amended, 1977, Capitol Reef, Bryce Canyon, and Zion National Parks have been identified as areas where visibility is an important value. The present policy of the NPS is to protect these areas from any adverse impairment at human levels of perception. Regulations regarding visibility in Class I areas are scheduled for completion in November 1980.

Wind directions which affect ambient air quality in the region vary from the south-southwest in Nevada and Utah to west-southwest in Wyoming (SU, 1979; SW, 1978; NPC, 1975).

Background Trace Elements

Several measurements of the concentration of trace elements in the ambient air were made near the proposed Warner Valley plant site. In addition, the Environmental Protection Agency (EPA) has sampled trace elements at Bloomington, Utah about 12 miles west of the proposed site, and near Pipe Spring National Monument, Arizona, about 25 miles east of the proposed site. The observed background levels of the atmosphere are summarized in table 3-1.

With the exception of manganese concentrations, the background levels for trace elements in the atmosphere are comparable to other measurements made in rural locations in the southwest. However, these measurements must be interpreted with care since they are based on a very limited number of samples.

Warner Valley trace element concentrations in the other environmental components (i.e., soil, water, etc.) are thought to be high, based on water quality studies in the Virgin River, geological information, and preliminary soil, plant, and animal analyses.

Preliminary water quality data obtained by Vaughn Hansen Associates (208 Water Quality Study, 1977) on the Virgin River indicates trace element concentrations of selenium, arsenic, and radioactive elements in excess of recommended irrigation water standards below Hurricane, Utah (Utah Water Research Laboratory, 1974). In addition, drinking water standards are commonly exceeded for selenium and possibly lead. This data is indicative of high trace element concentrations somewhere within the Virgin River drainage. Preliminary data from the applicants (NPC, 1975) indicates that there are toxic levels of selenium in vegetation within the proposed plant site. However, selenium poisoning of livestock has not been reported in Warner Valley.

Water Resources

Water resources in the affected environment are described below for the southwestern Wyoming coal fields, central Utah coal fields, Alton coal fields, Virgin River system below the Hurricane diversion, and at the proposed powerplant site at Dry Lake, Nevada. Water resources of the coal fields are discussed in detail in the respective environmental impact statements (Scope of EIS, Chapter 1).

The Surface Mining Control Act of 1977 (PL 95-87) provides guidelines designed to protect alluvial valley floors in coal mining regions. Office of

TABLE 3-1

State and Federal Air Quality Standards and Regulations (μg/m³)

	Sulfur Dioxide			Nitrogen Dioxide (NO_2)	Suspended Particulate Matter	
	Annual	24-Hour	3-Hour	Annual	Annual	24-Hour
NATIONAL AMBIENT AIR QUALITY STANDARDS						
Primary[a]	80	365	.....	100	75	260
Secondary[b]	...	...	1,300	Same as Primary	60	150
Wyoming	60	260	1,300	100	60	150
SIGNIFICANT DETERIORATION						
Class I	2	5	25	NA	5	10
Class II	20	91	512	NA	19	37
Class III	40	182	700	NA	37	75
NEW SOURCE PERFORMANCE STANDARDS						
	1.2 lb $SO_2/10^6$Btu heat input and 90 percent scrubber efficiency.			If subbituminous coal: 0.5 lb $NO_2/10^6$ Btu heat input. If bituminous coal: 0.6 lb $NO_2/10^6$ Btu heat input.	0.03 lb particulate matter/ 10^6 Btu heat input.	

[a]For the protection of human health.
[b]For the protection of human welfare (aesthetics, plants, etc.).

NOTE: At present, the Utah and Nevada State air quality regulations are the same as the Federal regulations.

Surface Mining, in conjunction with BLM, will delineate the alluvial valley floors in the Alton area during investigations which will be used as a basis in the unsuitability determination for the Alton coal fields.

Major floodplains in the affected environment are primarily located along tributaries to the Virgin and Colorado Rivers. A few closed basin floodplains exist in southeastern Nevada, such as Dry Lake (fig. 2-9).

Central Utah

The central Utah coal fields are generally drained by tributaries to the Green and Colorado Rivers. Principal tributaries are the Price and San Rafael Rivers and Muddy Creek. A small portion of the western part of the region is drained by Salina Creek, which flows into the Sevier River. Stream flows in the region are essentially ephemeral in nature, although the major tributaries generally flow year round. The flows of all major rivers and tributaries in the region are affected by irrigation diversions, often transferring the water into adjacent basins (CU, 1979).

Surface water quality is relatively good in the headwater areas but deteriorates downstream (from 100 to 500 miligrams per litre [mg/ℓ] of total dissolved solids (TDS) in the upper reaches to 1,000 to 5,000 mg/ℓ of TDS downstream). Concentrations of several metals exceed recommended drinking water standards in the middle and lower reaches of Muddy Creek and the Price, Green, and San Rafael Rivers. These concentrations may be due to a combination of man-made and natural (geologic) contamination. Surface water is primarily utilized for irrigation in the region (80 to 90 percent). Other uses include municipal and industrial applications. One significant water use in the region is water supply for present and projected coal-fired electric powerplants. Water use could reach about 62,000 acre-feet annually when in full production (CU, 1979).

The principal ground water aquifer in the region is the unconsolidated alluvium surrounding the major streams. Wells in these aquifers yield 50 to 500 gallons per minute (gpm) of water with less than 1,000 mg/ℓ of TDS. Wells that tap consolidated (rock) aquifers prevalent throughout the region usually yield less than 50 gpm of poorer quality water (500 to 3,000 mg/ℓ of TDS). Although the total amount of ground water used in the region is small, it is the principal source of water for several small communities (approximately 10,000 acre-feet per year). Other uses include stock and wildlife consumption and some irrigation applications.

Southwestern Wyoming

The southwestern Wyoming coal fields lie on the flanks of the Great Divide Basin and are primarily drained by ephemeral tributaries of the Green River. The extreme western part of the region is drained by Twin Creek, which flows into the Great Basin (an area of interior drainage). Surface water quality in the region is generally good, however TDS concentrations tend to increase downstream from the headwaters, due to both natural and man-made sources (SW, 1978). TDS concentrations in the Green River near Green River, Wyoming normally range from 300 to 600 mg/ℓ.

Ground water conditions in this region are primarily controlled by the complex geology underlying the area. Well yields range from 1 to 500 gpm, but generally average between 10 to 100 gpm. Ground water quality varies considerably over the region due to geologic conditions and depth, but aquifers yielding water with less than 3,500 mg/ℓ of TDS underlie most of the region. Ground water use in the region is small, generally limited to stock watering. Other minor uses include domestic and industrial supplies (including some oil and coal mining operations).

Ground Waters in the Vicinity of the Alton Coal Fields

Ground water aquifers in the vicinity of the Alton coal fields include the Quaternary alluvium, and the Navajo, Dakota, and Entrada Sandstones. Little data is available on the ground water occurring in and near the lease area. Information compiled by Sandberg (1979) indicates that surface and ground waters are closely related and that net water level reductions in irrigation wells may be due to reduced surface flow (and subsequent and reduced ground water recharge) of the adjacent streams. According to Sandberg, "This sensitivity suggests that change in recharge characteristics caused by mining would be likely to affect ground water storage in the area."

The primary aquifer that would be affected by slurry water pumping would be the Navajo Sandstone Formation, which has estimated storage ranging from 19,200 to 200,000 acre-feet per square mile (Goode, 1964 and 1966; Bingham Engineering, 1974; Utah International Inc., 1979). Estimated specific yields for this formation range from 0.08 to 0.04 and saturated thickness near the proposed well sites is approximately 1,100 feet. These characteristics are important in determining the amount of water available by pumping. The influence of faults as mapped by Goode (1973) is unknown, since they may not extend into the Navajo Sandstone Formation and since no significant pumping tests have been completed to date (fig. 3-2). Utah International, Inc. performed a limited pumping test on Bald Knoll well number 3 during 1978, but drawdowns were measured only in the pumped well and pumping lasted only 10 hours. Results of the test were inconclusive except that water quality from the formation was shown to be good and well yields of 270 gpm could be pumped and maintained (Utah International Inc., 1979).

Figure 3-2 shows the location of existing wells in the vicinity of the Alton coal fields.

Virgin River System

The Virgin River, consisting of nearly 200 river miles in Utah, Arizona, and Nevada, is part of the Colorado River Basin. The headwaters are located in the Markagunt Plateau in Utah at elevations of 9,000 to 10,000 feet. The headwater tributaries and the North and East Forks of the Virgin River merge near the west entrance of Zion National Park. Downstream the river passes near the cities of Virgin, Hurricane, St. George, and Bloomington, Utah; Littlefield, Arizona; Mesquite, Bunkerville, and Riverside, Nevada; and finally empties into Lake Mead (fig. 3-3).

River flows are highly variable. The climate and terrain in the Virgin River Basin typically create extremely low flows during the summer months. The greatest monthly flows occur in the spring as a result of snowmelt at the

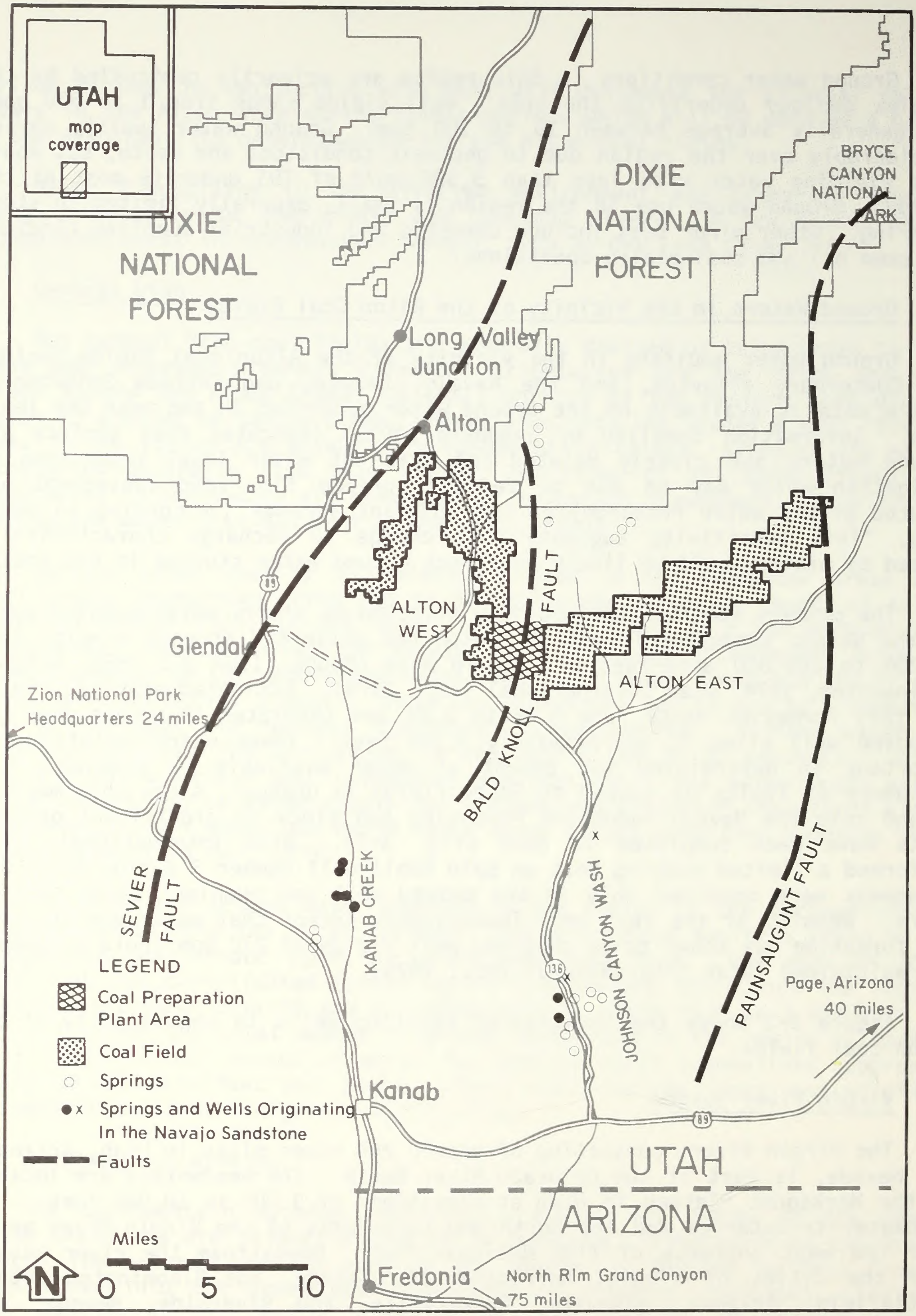


FIGURE 3-2

SPRINGS AND WELLS IN THE VICINITY OF THE ALTON COAL FIELD

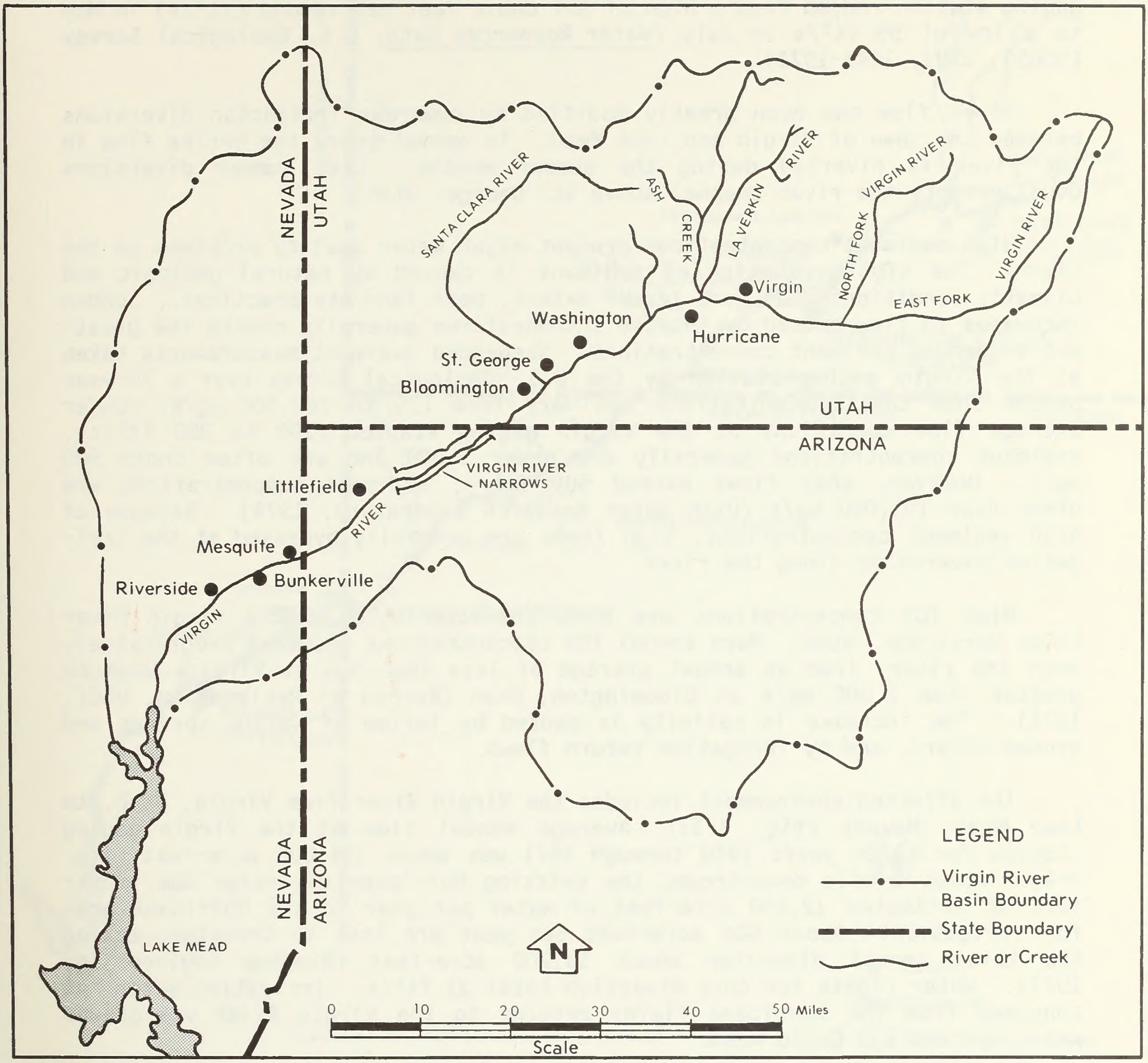


FIGURE 3-3

VIRGIN RIVER BASIN

higher elevations. The average flows from 1945 to 1971 at the Virgin, Utah gaging station ranged from a high of 357 cubic feet per second (ft^3/s) in May to a low of 99 ft^3/s in July (Water Resources Data, U.S. Geological Survey [USGS], USDI, 1945-1971).

River flow has been greatly modified by numerous irrigation diversions between the town of Virgin and Lake Mead. In normal years the entire flow in the river is diverted during the summer months. Late summer diversions usually empty the river channel above St. George, Utah.

High sediment concentrations present major water quality problems on the river. The high production of sediment is caused by natural geologic and climatic conditions and, to a lesser extent, poor land use practices. Sudden increases in flow caused by intense thunderstorms generally create the greatest suspended sediment concentrations. Suspended sediment measurements taken at the Virgin gaging station by the U.S. Geological Survey over a 10-year period show that concentrations can vary from 125 to 268,000 mg/ℓ. Under average flow conditions at the Virgin gaging station (100 to 200 ft^3/s), sediment concentrations generally are under 5,000 and are often under 500 mg/ℓ. However, when flows exceed 500 ft^3/s, sediment concentrations are often over 100,000 mg/ℓ (Utah Water Research Laboratory, 1974). Because of high sediment concentrations, high flows are generally bypassed at the irrigation diversions along the river.

High TDS concentrations are also characteristic of the Virgin River below Hurricane, Utah. Mean annual TDS concentrations increase progressively down the river, from an annual average of less than 500 at Virgin, Utah to greater than 2,000 mg/ℓ at Bloomington, Utah (Bureau of Reclamation, USDI, 1974). The increase in salinity is caused by inflow of saline springs and ground waters, and by irrigation return flows.

The affected environment includes the Virgin River from Virgin, Utah, to Lake Mead, Nevada (fig. 3-3). Average annual flow at the Virgin gaging station for water years 1940 through 1971 was about 124,000 acre-feet (fig. 3-4). About 1 mile downstream, the existing Hurricane diversion dam transfers an estimated 12,600 acre-feet of water per year to the Hurricane area for irrigation. About 600 acre-feet per year are lost in transfer, making the total annual diversion about 13,200 acre-feet (Bingham Engineering, 1977). Water rights for this diversion total 33 ft^3/s. Irrigation water not consumed from the Hurricane fields returns to the Virgin River via ground water systems and Gould Wash.

The LaVerkin Diversion is less than a mile downstream from the Hurricane Diversion (fig. 3-4). Water was originally diverted entirely for irrigation use near the city of LaVerkin, but is now also used for electricity generation at the CP National Utilities Company hydroelectric plant in LaVerkin. Currently, about 40 ft^3/s are continuously diverted for electricity generation by the utility, and 10 ft^3/s are diverted for irrigation part of the year. Total irrigation diversions are estimated to total 4,000 acre-feet per year (Bingham Engineering, 1977).

CP National, formally California Pacific Utilities Company, is presently contesting the Utah State Engineer's decision of February 26, 1976, to grant the Washington County Water Conservancy District the right to divert waters

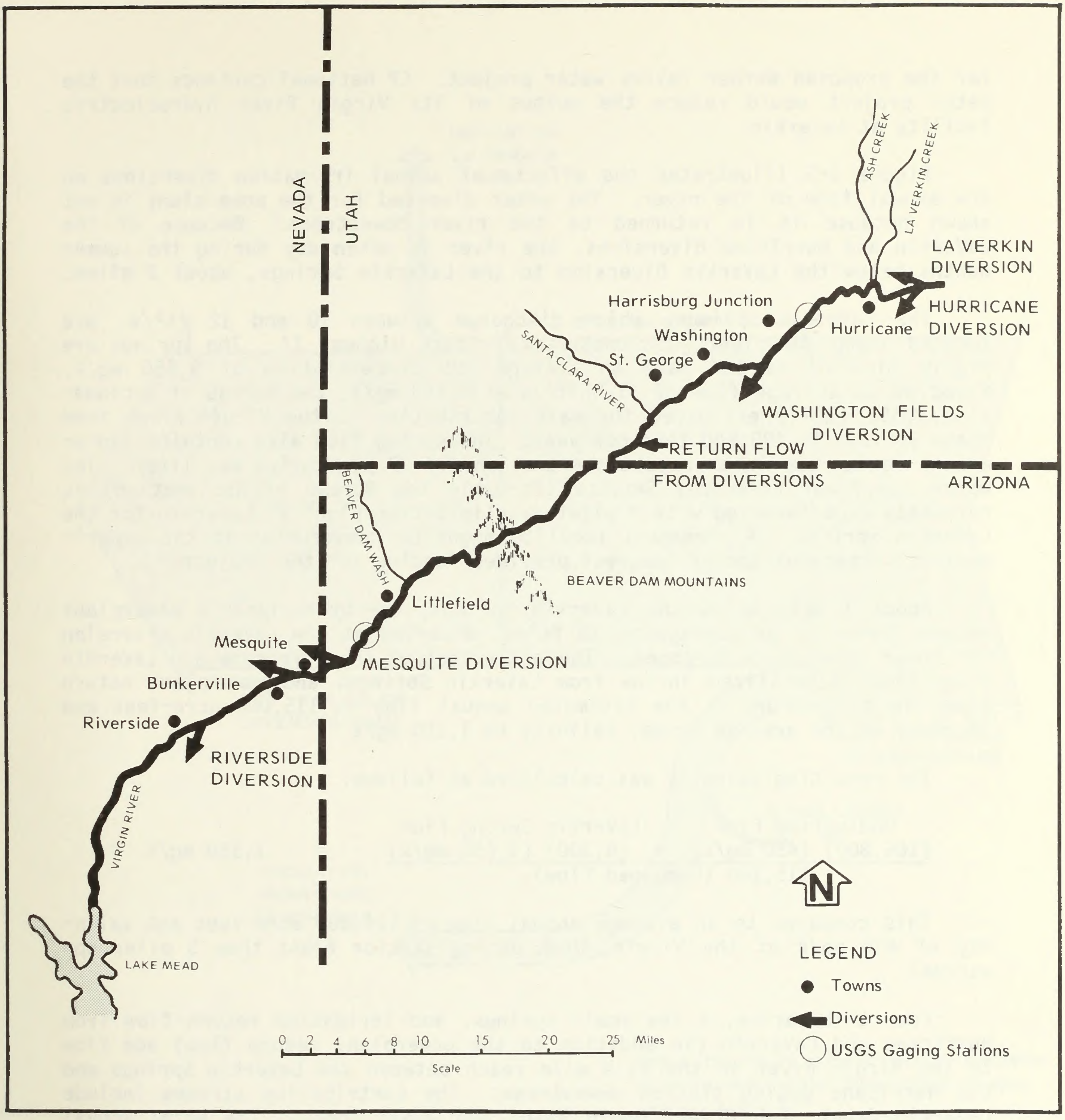


FIGURE 3-4

MAJOR DIVERSIONS OF THE VIRGIN RIVER

for the proposed Warner Valley water project. CP National contends that the water project would reduce the output of its Virgin River hydroelectric facility at LaVerkin.

Figure 3-5 illustrates the effects of actual irrigation diversions on the annual flow of the river. The water diverted for the powerplant is not shown because it is returned to the river downstream. Because of the LaVerkin and Hurricane diversions, the river is often dry during the summer months below the LaVerkin Diversion to the LaVerkin Springs, about 2 miles.

The LaVerkin Springs, which discharge between 10 and 12 ft^3/s, are located along the river just upstream of State Highway 17. The springs are highly mineralized and have an average TDS concentration of 9,650 mg/ℓ. Based on an average flow of 11.5 ft^3/s at 9,650 mg/ℓ, the Bureau of Reclamation, USDI (1974) estimated the salt contribution to the Virgin River from these springs is 109,000 tons per year. The spring flow also contains radioactive radium-226 in average concentrations of 37 picocuries per liter. The Water and Power Resources Service (formerly the Bureau of Reclamation) is currently experimenting with a pilot desalinization plant at LaVerkin for the LaVerkin Springs. A permanent facility might be constructed if the experiment is successful and if Congress provides funding for the project.

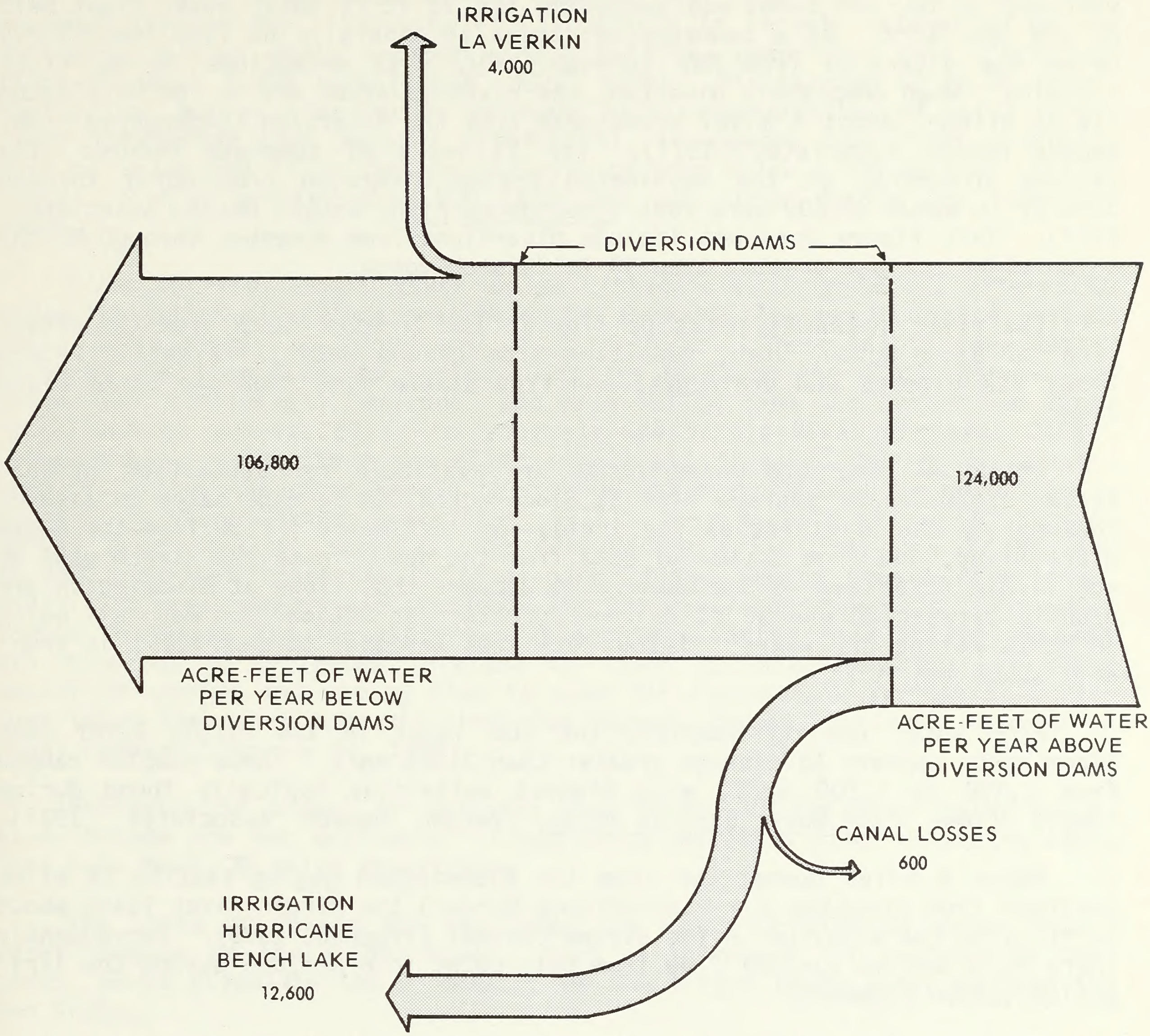
About 1 mile below the LaVerkin Springs, the hydroelectric powerplant returns water at an average of 40 ft^3/s, diverted at the LaVerkin diversion for power generation purposes. The net effect of the Hurricane and LaVerkin diversions, mineralized inflow from LaVerkin Springs, and powerplant return flow, is a lowering of the estimated annual flow to 115,000 acre-feet and increase of the average annual salinity to 1,150 mg/ℓ.

The resulting salinity was calculated as follows:

$$\frac{\overset{\text{Undiverted Flow}}{(106{,}800)\ (490\ \text{mg}/\ell)} + \overset{\text{LaVerkin Spring Flow}}{(8{,}300)\ (9{,}650\ \text{mg}/\ell)}}{115{,}100\ \text{(Combined Flow)}} = 1{,}150\ \text{mg}/\ell$$

This compares to an average annual flow of 124,000 acre-feet and salinity of 490 mg/ℓ at the Virgin, Utah gaging station (less than 5 miles upstream).

Four tributaries, a few small springs, and irrigation return flow from Hurricane and LaVerkin (in addition to the powerplant return flow) add flow to the Virgin River in the 11.5 mile reach between the LaVerkin Springs and the Hurricane gaging station downstream. The contributing streams include LaVerkin Creek, Ash Creek, Gould Wash, and Quail Creek. The total annual inflow is estimated to be about 21,800 acre-feet. Tributary inflow and LaVerkin springflow appear to offset flow diversions for irrigation so that total annual flow at the Hurricane gaging station is normally higher than the Virgin gaging station. For the 4 years of record overlap for the two stations, annual flow at Virgin averaged 147,100 acre-feet, while flows at the Hurricane gaging station averaged 162,000 acre-feet. Average annual flow for the 11 years of record at the Hurricane gaging station is 147,100 acre-feet (Water Resources Data, USGS, USDI, 1945-78).



Source: Figures are based on computer simulation by Dr. Norman Stauffer, State of Utah, Division of Water Resources.

FIGURE 3-5

EXISTING IRRIGATION DIVERSIONS ABOVE HURRICANE, UTAH
(Acre-Feet Per Year)

The St. George/Washington Fields diversion dam is located 4.3 miles below the Hurricane gaging station (fig. 3-4). Water is generally diverted yearlong up to, and sometimes exceeding the 95 ft^3/s total water right held by the operators. As a consequence, there is generally no flow immediately below the diversion from May through July, with exceptions during flash flooding. When completely diverted, the river is often dry to the Washington Fields Bridge, about 4 miles downstream from the diversion (Endangered Fish, Vaughn Hansen Associates, 1977). For 13 years of complete records, the average diversion at the Washington Fields diversion from April through October is about 30,800 acre-feet (Endangered Fish, Vaughn Hansen Associates, 1977). This figure does not include diversions from November through March, which might average greater than 90 ft^3/s each month.

The river gradually picks up flow in the 10-mile reach from the diversion to Bloomington, Utah, resulting from ground water, irrigation return flows via ditches and drainages, and from stream flow from the Santa Clara River.

While no long-term measurements are available for streamflow in this reach, estimates of average flow at Bloomington can be made based on assumed consumptive use efficiencies for irrigation, estimated inflow from the Santa Clara River, and from 1 year of data from the newly installed stream gage on the Virgin River near Bloomington. It appears that flows at Bloomington are usually between 20 and 50 ft^3/s from June through October and may fall below 10 ft^3/s during dry years. Median flow from November through March is probably about 195 ft^3/s.

From water quality samples, the TDS level in the Virgin River near Bloomington appears to average greater than 2,000 mg/ℓ. These samples ranged from 1,420 to 5,900 mg/ℓ, with highest salinities typically found during lowest flows (208 Water Quality Study, Vaughn Hansen Associates, 1977).

About 8 miles downstream from the Bloomington gaging station (4 miles upstream from crossing the Utah-Arizona Border) the Virgin River loses about 50 ft^3/s to the alluvium in the stream channel (Trudeau, 1979). Consequently, there is often no surface flow from this point into Arizona during the irrigation season (summer).

The Virgin River Gorge begins about 1 mile downstream from this point. The river channel winds through the gorge for 20 miles, and eventually emerges from the Virgin Mountains at a point 4 miles northeast of Littlefield, Arizona. In the final 2 miles before leaving the gorge, the river begins to gain flow from springs discharging from the riverbed and adjacent banks. The inflow gradually increases downstream to a total of about 63 to 66 ft^3/s near Littlefield (Trudeau, 1979). With the exception of recession stages of flash floods, this flow is usually the only water available to downstream users during the summer months. The stream gain from springs in the lower end of the gorge appears to originate from the flows lost by the river at the upper end of the canyon (EMRIA Report No. 4, BLM et al., USDI, 1975; Trudeau, 1979).

Average annual flows for 49 years of record at the Littlefield, Arizona gaging station (located below the springs) is 161,600 acre-feet per year (Water Resources Data, USGS, USDI, 1978). Median flow at Littlefield is 200 ft^3/s November through May and 115 ft^3/s June through October.

The median annual TDS for 1941-1972 at Littlefield was 1,900 mg/ℓ (EMRIA, USDI, 1975). Generally, average monthly concentrations of TDS are greater than 2,300 mg/ℓ from June through October and less than 1,900 mg/ℓ from November through May. Salinity at Littlefield is largely determined by the inflowing springs which apparently have uniform, year-round salt concentrations of about 2,900 mg/ℓ (EMRIA, USDI, 1975). Discharging 63 to 66 ft^3/s, the springs act as a buffer to maintain high concentrations of salts in the river. Based on USGS records (1969-1978), it appears that flows generally must be above 500 ft^3/s for the salinity to drop below 1,000 mg/ℓ at Littlefield. A flow greater than 500 ft^3/s may not occur during dry, low-flow years.

Flows in the Virgin River below Littlefield, Arizona are altered by three irrigation diversions near Mesquite, Bunkerville, and Riverside, Nevada. Total water rights in Nevada are about 66 ft^3/s. These rights were determined by the flow from the springs near the mouth of the Virgin Narrows and those near Littlefield, Arizona, and from inflow from the Beaver Dam Wash. These sources average 66 ft^3/s inflow to the Virgin River (Trudeau, 1979). Consequently, river flows are often completely diverted during the summer, when flows from the upper Virgin in Utah do not pass through the gorge (Endangered Fish, Vaughn Hansen Associates, 1977). From 4 years of record, average annual diversions at Mesquite and Bunkerville (fig. 3-4) are 17,000 and 10,000 acre-feet respectively (Endangered Fish, Vaughn Hansen Associates, 1977). No measurements are available for the Riverside diversion. All water rights in Nevada are for year-round diversion. Spring flows during snowmelt are diverted to irrigated farmland to flush accumulated salts. A small amount of winter and spring flow is used for cool-season irrigation during some years (personal communication, Dee Hughes, former President of Mesquite Canal Company, January 23, 1980).

Estimates of annual or seasonal flow in the Virgin River below Riverside, Nevada are not available. Flows which pass this final diversion empty into Lake Mead, 25 miles downstream.

The State of Nevada has requested the State of Utah to enter into a water compact on the Virgin River. Such an agreement, if approved by Congress, would stipulate the allocation of the Virgin River water between the two States.

Dry Lake, Nevada and Las Vegas Wash

Dry Lake Valley is a closed basin draining 175 square miles of Nevada desert. A 50-year storm of 2.7 inches in a 24-hour period would add approximately 20,900 acre-feet of water to the Dry Lake playa, which is normally dry. This would amount to approximately 6.5 feet of flood water above the lowest playa elevation (NPC, 1975).

Water for the proposed Harry Allen plant would primarily be supplied by treated effluent from the Clark County Advanced Wastewater Treatment plant which is currently under construction. Presently the county and city sewage treatment plants discharge 66 million gallons per day into Las Vegas Wash, which is important in the maintenance of existing wash vegetation (personal communication, Jim Parrott, Chief, Clark County Sanitation Department, March 21, 1980).

Wetlands and Floodplains

Wetlands and floodplains are not known to exist in the Alton coal processing site or in the Warner Valley powerplant site. Quantitative information on wetlands and floodplains within the possible coal development areas of Alton, central Utah, and southwestern Wyoming is not available. Such information will be made available by the coal field operator when a mining plan is submitted to the Office of Surface Mining Reclamation and Enforcement.

Wetland and floodplain areas which would be included in the affected environment would be those located in the following areas: Kanab Creek, Virgin River, Beaver Dam Wash, Sevier River, Fort Pierce Wash, Warner Valley Wash, Toquop Wash, Meadow Valley Wash, Muddy River, Las Vegas Wash, Dry Lake playa, and the Mojave River (U.S. Department of Housing and Urban Development, 1978).

Vegetation: Species of Concern

The States of Utah, Arizona, Nevada, and California have a number of vegetation species of concern that might inhabit the affected environment. A list of these species can be found in Appendix 7.

Townsendia aprica and *Astragalus subcinereus* var. *basalticas* (candidates for endangered status) are located in the region of the central Utah coal fields. *Townsendia aprica* is described as the third most critically endangered plant in Utah, with less than 100 individuals in two populations remaining of this species (fig. 3-6 located at the back of this volume; personal communication, Dr. Stanley Welsh, Professor of Plant Taxonomy, Brigham Young University, December 11, 1979).

The corridors of the proposed transmission lines and the coal slurry pipeline have not been inventoried for the occurrence of threatened or endangered species. Based on knowledge of the habitats crossed, the areas most likely to have threatened or endangered plant species present are: Spry to Alton transmission route - the area southwest of Hatch, crossing the Wasatch Formation to which several candidate species for threatened and endangered status such as *Lesquerella rubicundula* and *Cymopterus minimus* are restricted; coal slurry pipeline - the red sandy area north of Coral Pink Sand Dunes which is habitat for several reviewed threatened or endangered species such as *Asclepias welshii*, *Erigeron religiosus*, and *Astragalus striatiflorus*; coal slurry pipeline - the Beaver Dam Mountains which are habitat of *Phacelia anelsonii* and *Eriogonum heermannii* var. *subracemosum*. The slurryline route contains habitat of two officially listed endangered species, *Pediocactus sileri* and *Arctomecon humilis* in the area of Warner Valley (fig. 3-6; personal communication, Dr. Stanley Welsh, Professor of Plant Taxonomy, Brigham Young University, December 11, 1979).

Three of the newly proposed microwave sites for the transmission system (Apex, Nelson, and Spirit Mountain in Nevada) would have two known threatened species that occur in the area: *Arctomecon merriami* and *Placelic anelsonii*.

The officially endangered Siler pincushion cactus (*Pediocactus sileri*) occurs in Warner Valley. This species is a Dixie corridor endemic occurring mainly in Arizona but extending from Price City Hills near St. George to the

Shinarump Cliffs in Utah. Another officially endangered species, Arctomecon humilis (dwarf bearclaw poppy) is located in the area between Warner Valley and St. George (fig. 3-6; personal communication, Dr. Stanley Welsh, Plant Taxonomy Professor, Brigham Young University, December 11, 1979). Several species of concern, Phacelia cephalotes and Astragalus ampullarius are located in the area of the proposed Warner Valley reservoir (Welsh et al., 1975).

Wildlife: Species of Concern

The States of Utah, Arizona, Nevada, and California have a number of wildlife species of concern that might inhabit the affected environment. A list of these species can be found in Appendix 8.

An officially endangered fish, the woundfin minnow (Plagopterus argentissimus) and the Virgin River roundtail chub (Gila robusta seminuda), proposed for endangered classification, occur in the Virgin River from LaVerkin Spring to Lake Mead (fig. 3-7).

The desert tortoise (Gopherus agassizii), proposed for endangered classification in Utah and protected under State laws in Arizona, Nevada, and California, occurs along proposed transmission and coal slurryline routes from the western slope of the Beaver Dam Mountains in Utah and Arizona to Dry Lake, Nevada and into southern California (fig. 3-6). U.S. Fish and Wildlife Service (USFWS) has proposed 22,400 acres on the Beaver Dam slope of Utah as critical habitat of the desert tortoise (Federal Register, Vol. 44, No. 237).

Archaeology, Ethnology, and History: Cultural Resources

Information presently available for this section is outlined below for the affected environment. Inventories are not yet finished for most areas and complete data, therefore, is not available. Should an alternative be approved, full and complete inventories would be accomplished according to Standard Operating Procedures included in Appendix 6. Properties on the National Register of Historic Places and properties nominated to the National Register have been identified. Determinations of eligibility have not yet been evaluated for the balance of the known resources or for as yet unidentified resources that may be surfaced.

A series of archaeological and historical inventories were performed in conjunction with the Development of Coal Resources in Central Utah, Final Environmental Statement (CU, 1979). The most common sites discovered were lithic scatters, usually found in clusters. Cultures indicated in the inventories are the Paleo Indians, Desert Archaic, Fremont-Kayenta, Anasazi, and Ute-Southern Paiute. The coal region has a site density of approximately six sites per 640-acre section.

Several inventories have been completed in the coal mining area of southwestern Wyoming. Several time periods with related sites were indicated in the mining region, including Historic, Late Prehistoric, Middle and Early Prehistoric, and the Altithermal Periods. Site density ranges from 0.5 to 4.35 sites per section over the various surveys conducted. Buried sites could account for a still higher density (SW, 1978).

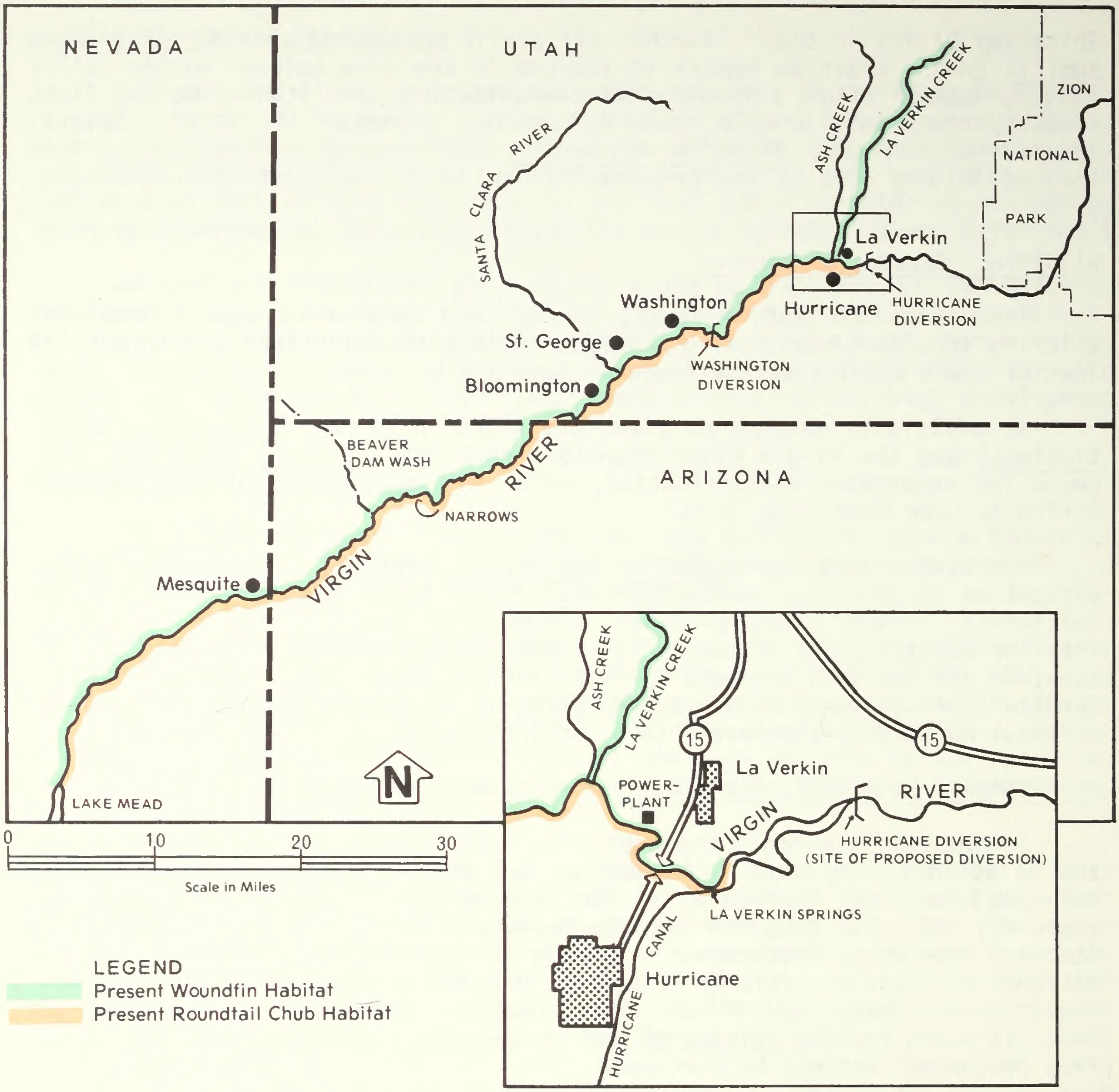


FIGURE 3-7

WOUNDFIN AND ROUNDTAIL CHUB HABITAT ALONG THE VIRGIN RIVER

Information extracted from BLM site inventory files and consultant reports indicate that a number of site-specific inventories were completed in the vicinity of the Alton coal fields in conjunction with coal testing programs. Five archaeological sites were recorded as being on or within 1 mile of the proposed coal processing facilities. An additional 11 sites were found within a 5-mile radius of the complex. Only one pertinent historical site was recorded, located near an archaeological site, and is noted only as a "camp." These 16 archaeological sites are generally rather large in area (up to 200 miles in diameter), and are classed as lithic scatters and/or camps (inferring transient use). Only three of the sites yielded ceramics of Anasazi and Southern Paiute origin, and have shown evidence of structures or other features. Intensive site-specific surveys of the area would be expected to find additional sites, and buried sites may exist in the area. Site density does not appear to be high, however, and sites of a similar nature to those described above would be expected. An average density of one site every 43 acres is expected in the Alton area.

The proposed slurry pipeline corridor was surveyed for cultural resources by the Desert Research Institute (Fowler, 1975; Turner et al., 1975). Because the exact route was not flagged, a corridor ranging from 800 to 1,500 feet wide was inspected. According to Fowler (1975), site types encountered were classed as Architectural, Open Camp, Rockshelter, Quarry (one only), Mescal Pit (one only), Petroglyph, and Lithic Scatter. Cultural affiliations indicated are Archaic, Anasazi, and Southern Paiute. Fifty-three archaeological sites were recorded within or immediately adjacent to the corridor. Buried sites, however, are a distinct possibility in some areas.

Three historic trails are located within the immediate vicinity of the proposed reservoir and powerplant: the Dominguez-Escalante, Honeymoon, and Temple Trails (fig. 2-5).

The Dominguez-Escalante Trail was the route used by the Dominguez-Escalante expedition in 1775-76 while searching for a more direct route between Santa Fe, New Mexico and Spanish settlements in southern California. Approximately 100 to 300 Boy Scouts hike segments of this monumented trail each year. The trail is currently being studied by the National Park Service for inclusion in the National Scenic and Historic Trails System.

From areas to the east and south, Mormon church members followed the Honeymoon Trail to be married in the temple at St. George, Utah. An annual commemorative wagon trek is made along the Honeymoon Trail from Pipe Spring National Monument, Arizona, to St. George, Utah. The segment of trail between Lee's Ferry, Arizona and St. George has been nominated for inclusion in the National Register of Historic Places. The segment of trail across Warner Valley is essentially the same as the Temple Trail, along which wooden beams used in the construction of the St. George Temple were transported from the Mt. Trumbull area.

Fort Pierce is an unroofed stone structure built during the Blackhawk Wars of the 1860s. It was designed to keep raiding Navajo bands from coming up Fort Pierce Wash into Washington and St. George, Utah (fig. 2-5). This property is on the National Register of Historic Places. The proposed slurryline route would lie 0.25-mile north of the fort.

Just south of Moapa, Nevada and across the Muddy River, the proposed slurryline route would run through an archaeologically rich and sensitive area known as the Black Dog Cave/Moapa-Muddy Complex. One specific site, Black Dog Cave, and one cluster of pre-ceramic Basketmaker sites are of apparent National Register caliber, although eligibility determinations have not been made.

Southern Utah State College archaeologists have completed an intensive inventory of major portions of five sections of the Warner Valley powerplant site (Thompson and Thompson, 1976). Only eight sites were recorded over this low potential area. Some of the sites are large in area. The report notes a light scattering of archaeological material over most of the area. Sites noted are classed as exploitive (raw material procurement), flaking, and camp (one only).

The Warner Valley water project site has been inspected for cultural resource values (personal communication, Frank Hull, Staff Archaeologist, University of Utah, April 4, 1977); no sites or materials of archaeological or historical interest were located. The canal/pipeline systems associated with the project, however, have not yet been inspected and some potential exists for encountering sites in these areas.

The Hurricane Canal/Diversion system was built by early Mormon settlers to divert waters of the Virgin River to Hurricane farmland. The canal is particularly striking in areas where it appears to literally hang from the near-vertical Hurricane Cliffs. The system has recently been listed on the National Register of Historic Places. Included in the listing are the diversion structure and the first 6.5 miles of canal. The system is located at the site of the diversion dam proposed for construction as part of the Warner Valley water project.

Areas which would be affected by construction and operation of the proposed Harry Allen plant have been extensively surveyed for cultural resource values. For those areas surveyed, no historical or archaeological sites of significance were encountered (Brooks, 1976; NPC, 1975).

The transmission system would consist of several geographically separate corridors:

Spry to Alton. The corridor for this line has not been surveyed for cultural values. The nature and extent of cultural resources in the area crossed by this line are little known at present.

Warner to St. George. This proposed corridor has not been surveyed for cultural resource values. There are a number of cultural resource sites in the general area and exact alignment would determine whether or not any would be involved.

Warner to Allen. The leg connecting the proposed Warner Valley powerplant with the existing Navajo-McCullough corridor has been surveyed for cultural resource values; no sites were found along the segment (Turner et al., 1975). The parallels to the existing Navajo-McCullough and Reid Gardner-Pecos lines have not been specifically examined.

Allen to Pecos. Cultural resource surveys have not occurred for either new segments or parallels to the existing Reid Gardner-Pecos line.

Allen to Eldorado. Portions of the Navajo-McCullough line have been surveyed with negative results (Turner et al., 1975). The parallels which would be included in the proposed project have not been surveyed.

Western Transmission System. University of California (Riverside) archaeologists have recently reported on a sampling inventory of the four alternative corridors which cross the Mojave Desert from the Eldorado Substation in southern Nevada to the vicinity of the Lugo substation in California (Barker, Rector, and Wilke, 1979). About 26 percent of the alternative corridors were examined by on-ground surveys. Results of the survey for each of the alternatives are: Interstate 15, 14 sites; Eldorado-Lugo, 17 sites; Victorville-McCullough, 17 sites; Highway 66, 12 sites.

An ethnographic and historical resources study completed by Cultural Systems Research, Inc. (1979) lists several areas of high sensitivity involving the proposed Western Transmission System. By far, the most sensitive ethnographic area is Spirit Mountain or Avikwame, the sacred place of creation for the Mojave, Quechan, Kamia, Diegueno, and Maricopa people of southern Nevada, western Arizona, and southeastern California (fig. 3-8 located at the back of this volume).

Other areas of particular concern because of their significant archaeological and ethnographic resources are: the vicinity of the Mojave River near Toomey, California, Halloran Springs and vicinity, Mohawk Hill, Silver Dry Lake-Soda Mountains area, Cronese Valley and Mountains, and Victorville (fig. 3-8).

Recreation and Aesthetics

The visual resource is considered the most important aspect of recreation in the affected environment. The contrasting landscape of depositional valleys, upfaulted ridges, and deeply incised canyons, together with the exceptional air quality and visibility offer a variety of recreational activities such as sightseeing, hiking, and camping.

BLM has developed the Visual Resource Management System (VRM) which is used in classifying geographical areas according to their scenic character (BLM Manual 8400; Appendix 9). The system is used as a management tool in the evaluation of significant impacts to visual resources.

Recreational use within and adjacent to the central Utah coal fields consists primarily of: driving for pleasure and to gain access to the Scofield Reservoir and Manti-LaSal National Forest, sightseeing, fishing, picnicking and camping, and off-road vehicle (ORV) use. The Scofield Recreation Area and the Manti-LaSal National Forest (located a short distance from the coal fields) are the major areas of recreational use in the region.

Recreational use in the southwestern Wyoming coal mining region is mainly confined to sightseeing and ORV use. Sightseeing is generally limited to viewing wildlife. The majority of sightseeing visitor use occurs along U.S. Highway 30 and U.S. Highway 189, which are major travel routes between Utah and Yellowstone and Grand Teton National Parks in Wyoming.

The quality of visual resources of the Warner Valley area varies with geology and topography. The topography of the valley itself is flat with a sparse cover of creosote bush and other arid-climate vegetation types. The valley is surrounded by uplifted cliffs and mountains, including the Hurricane Cliffs to the east, Sand Mountain to the northeast, and Warner Ridge to the west. The area is designated Class III and Class IV under the VRM classification system (fig. 3-9 located at the back of this volume).

Zion National Park, comprising an area of some 146,550 acres, is situated on the western extremity of the Colorado Plateau Province, approximately 20 miles northeast of Warner Valley, Utah. The erosional features of the area were originally protected by Presidential Proclamation in 1909. The area has since been enlarged to protect extraordinary examples of canyon erosion, volcanic phenomena, flora and fauna, and to provide opportunities for visitor enjoyment of its grandeur and scenic features.

In 1979, Zion National Park was visited by some 1,200,000 persons. Historically, over 80 percent of the annual visitors come to the park in the 5 months of May through September. Fifty-five percent of the total visitation occurs in the 3 summer months of June, July, and August.

Southwestern Utah historically has some of the most pristine air quality in the nation. The visual resource at Zion National Park is considered one of the most important aspects of visitor enjoyment at the park, and protecting that visual resource is of high priority to the National Park Service. The park visibility objective is to protect scenic resources from unnatural degradation of visual range, color, and brightness contrasts. Monitoring data from July through November 1979 indicates that visual ranges in excess of 160 kilometers (km) occur 75 percent of the time (from Lava Point looking south-southwest to Mt. Trumbull), and visual ranges in excess of 250 km occur 10 percent of the time. Important vistas within the park include Watchman Point at the south end of the canyon, and Observation Point at the canyon's north end.

Bryce Canyon National Park, comprising an area of some 35,835 acres, is located in south-central Utah, in both Garfield and Kane Counties. A Presidential Proclamation in 1923 originally established Bryce Canyon as a national monument to conserve one of the world's most outstanding examples of geologic erosion. The Proclamation states that ". . . certain lands within the Powell National Forest in the State of Utah, known as Bryce Canyon, are of unusual scenic beauty, scientific interest and importance . . . and public interest will be promoted by reserving these areas with as much land as may be necessary for the proper protection thereof . . . "

Bryce Canyon National Park was visited by some 700,000 persons in 1979. Over 84 percent of the annual visitors come to the park in the 5 months of May through September. Sixty percent of the total visitation occurs in the 3 summer months of June, July, and August.

As discussed for Zion National Park, southwestern Utah historically has some of the most pristine air quality in the nation. The visual resource at Bryce Canyon National Park is considered one of the most important aspects of visitor enjoyment, and protecting the visual resource is of high priority to the National Park Service. The visibility objective for Bryce Canyon is the prevention of any future impairment by manmade pollution of the grand vistas and breathtaking panoramas visible from the rim of the Paunsaugant Plateau. An undetermined amount of the extreme eastern section of the Alton coal fields is visible from Yovimpa Point and consists of VRM Classes III and IV (fig. 3-9). The coal fields lie approximately 4 to 6 miles from the overlook and have been modified by rangeland improvement activities, but essentially appear as a natural landscape. Monitoring data from July through November 1979 indicates that visual ranges overlooking the proposed Alton mining site are in excess of 180 km 75 percent of the time, and visual ranges in excess of 280 km occur 10 percent of the time. The National Park Service, in cooperation with the Environmental Protection Agency, is currently monitoring visibility from Yovimpa Point, looking in various directions at targets such as Mt. Trumbull, the Paria Plateau, Fifty-Mile Bench, and Navajo Mountain.

The proposed slurryline route would cross areas of VRM Classes II, III, and IV (fig. 3-9). Class II areas at White Cliffs near Upper Kanab Creek, at the Hurricane Cliffs, and on the Beaver Dam Mountains are characterized by extremely steep topography. The proposed slurryline would pass directly through the Coral Pink Sand Dunes State Reserve, a recreation area established by the State of Utah containing 3,730 acres. Primary uses of the area are ORV operation, hiking, and sightseeing. Sand dunes, with interesting scenery and suitable terrain to serve sightseers and ORV enthusiasts, are the primary features of the reserve.

The scenic quality at the proposed Harry Allen plant site at Dry Lake, Nevada is typically arid with little vegetation on a desert landscape. The flat terrain of Dry Lake contrasts sharply with upfaulted ridges to the west. The plant site and adjacent lands have been classified as Class III areas according to the VRM system (fig. 3-8).

Most of the proposed electrical transmission system corridors cross the arid environment of the Mojave Desert from southwestern Utah to southern California. Scenic quality varies primarily with local topography and geology. The quality of visual resources varies from Class I to Class IV under the VRM system (fig. 3-8 and fig. 3-9). Recreationists use the desert regions for sightseeing (especially geological, biological, and cultural) and for ORV use. The draft EIS California Desert Conservation Area Plan (BLM, USDI, 1980) provides alternative plans for protecting and preserving the natural character, resource diversity, and aesthetic and recreational values of the Mojave Desert region. Also, the National Park Service is studying a proposal for a 2,200-square mile area in the Mojave Desert of southern California to become the East Mojave National Park.

Land Use, Land Use Plans and Controls

Current land use patterns and land use plans and controls for the Alton coal fields are described specifically in Development of Coal Resources in Southern Utah, Final Environmental Statement under Site-Specific Analysis - Alton Coal Field (SU, 1979). Public (BLM), State, and private lands occupy the area of proposed coal development. On public lands the proposed mining area lies within the BLM Zion Planning Unit, which provides for coal mining under a multiple-use basis, requiring stringent environmental controls (Management Framework Plan, BLM, USDI, 1977). The area also includes a 40-acre public water reserve administered by BLM. The reserve must be protected from contamination or a reduction in size, and excludes surface mining as an appropriate land use. The Kane County Master Plan (Updated, 1976) recommends nondevelopment in certain areas. Current county zoning ordinances permit underground mining in the coal fields only where areas are zoned "forest and recreation." Surface mining would require planning commission approval. The primary use on public, State, and private land in the Alton area is agricultural, specifically livestock grazing. There is a small amount of irrigated and nonirrigated cropland which produces feed for cattle. There is no prime farmland in the area (SU, 1979).

The proposed coal slurry pipeline route would cross public, State, and private lands in Utah, Arizona, and Nevada. It would run through 3 miles of Coral Pink Sand Dunes State Reserve, located in southwestern Utah. The route would also cross several areas in Utah and Arizona which are under intensive inventory for wilderness characteristics (fig. 3-9; Federal Land Policy and Management Act of 1976). These areas are: Upper Kanab Creek (Inventory Unit UT-040-255), Cottonwood Canyon (UT-040-138; AZ-1-71), East Mesa (UT-040-135; AZ-1-72), and Quail Draw (UT-040-134; AZ-1-73). Section 603(c) of the Federal Land Policy and Management Act provides for the "interim management" of lands under intensive inventory for wilderness characteristics. The lands must be managed so as not to impair their suitability for preservation as wilderness. These standards apply except for those activities specifically exempted, such as existing mining, grazing, and mineral lease uses ("grandfathered" uses). This "interim management" will continue until an area under inventory for wilderness characteristics is determined to lack wilderness characteristics. Wilderness Study Areas are those areas which after an intensive inventory have been determined to possess wilderness characteristics and are to be studied for their suitability or nonsuitability for preservation by Congress. BLM State Directors are scheduled to make final intensive inventory decisions by October 1, 1980.

The management plans of both Zion and Bryce Canyon National Parks include among other objectives: to secure, through research or other means, adequate information to optimize management efficiency and to ensure long-term conservation of park resources; and to cooperate with outside agencies, organizations, and members of the public in assuring, to the greatest extent possible, that nearby lands are developed and managed in ways that are compatible with preserving the park's air and water quality, geological resources, ecological communities, and scenery for which the parks are famous (Assessment of Alternatives, National Park Service, USDI, 1979).

A bill presently before both Houses of Congress would expand the existing Moapa Indian Reservation in southern Nevada (fig. 3-8). Some of the lands included in the proposed expansion would be needed for construction of proposed electrical transmission lines and a coal slurry pipeline. The House bill (HR 5584) has provisions that would grant the land subject to existing rights-of-way but the Senate bill does not. Also, the boundary location of the proposed extention could potentially affect the location of one of the settling ponds at the Allen site.

The proposed truck route to be used for transporting coal from the Alton coal fields to the Warner Valley powerplant (Alternative 3) would be subject to the 1979 Utah Statewide average of 4.15 accidents and 0.034 fatalities per million motor vehicle miles traveled (personal communication, Steve Glines, Utah Division of Highway Safety, March 14, 1980).

The Warner Valley sites for the proposed powerplant and water project are currently zoned "open space" by the Washington County Planning Commission. BLM planning regulations under the Management Framework Plan for the Virgin River Planning Unit - Dixie Resources Area (1977) allow for the transfer of ownership or granting of rights-of-way for use of public lands. A portion of the proposed Warner Valley powerplant site lies in BLM's Cottonwood Canyon intensive wilderness inventory unit (UT-040-138; AZ-1-71; fig. 3-9). Current land use in the remainder of Warner Valley is open range and recreation (ORV use).

The proposed Harry Allen powerplant site is currently zoned "rural open" by the Clark County Comprehensive Planning and Environmental Commission. BLM planning regulations under the Management Framework Plan of the Virgin Valley Planning Unit - Caliente Resource Area (1974) allow for the sale or granting of a right-of-way permit for use of public land as a powerplant site. The current use of land at the site is open range.

The principal use of lands proposed for transmission system routing is open range. Approximately 80 percent of all lands that would be involved with transmission line construction is administered by BLM, which provides for the granting of rights-of-way for such routes (Federal Land Policy and Management Act of 1976).

The proposed Western Transmission System (alternatives) would be routed across the Mojave Desert of southern California. BLM is studying several areas in the desert for possible designation by Congress as Wilderness Areas (fig. 3-8). These Wilderness Study Areas are managed under an "interim" policy so as not to impair their suitability for preservation as wilderness. The "interim management" will continue until such time that Congress declares the Wilderness Study Areas as official Wilderness Areas or as nonwilderness areas (Federal Land Policy and Management Act of 1976).

The Mojave Desert of southern California is currently under study by BLM for management purposes under the proposed California Desert Conservation Area Plan (Sec. 501, Federal Policy and Management Act of 1976). BLM has recently published for public review the draft EIS and management plan alternatives concerning the area (The California Desert Conservation Area Plan Alternatives and Environmental Impact Statement, 1980). BLM would provide for proper management of the desert area for optimal use while protecting and preserving the diversity and quality of its natural resources. The management of the area includes plans to allow the routing of transmission lines and pipelines only within certain delineated corridors.

Socioeconomics

Central Utah Region

This region consists of portions of Carbon, Emery, Piute, Sanpete, Sevier, and Wayne Counties. The general area has had a mixed character historically and is by no means homogeneous. Carbon and Emery Counties have long been involved with the mining of coal and their economies have developed around mining and associated activities. The economies of Piute and Wayne Counties have been primarily based on agriculture and trade, and Sanpete County has a split economic base with substantial agricultural and manufacturing sectors. The region itself is sparsely populated with nearly half of its population concentrated in Carbon and Emery Counties, primarily in the towns of Price, East Carbon, and Helper.

All socioeconomic data for this region is based on information contained in Development of Coal Resources in Central Utah Environmental Statement (CU)(USDI, 1979).

Population. The population of the region was estimated at just over 60,000 persons in 1977. Of this amount, Carbon County accounted for 20,500 (34 percent), Emery 9,300 (15 percent), Piute 1,400 (2 percent), Sanpete 13,400 (23 percent), Sevier 13,700 (23 percent), and Wayne 1,800 (3 percent). Historical population figures indicate that the entire region has just reversed a nearly 20-year period of decline. Beginning around 1950, the region's population began to decline from just over 61,000 to around 51,500 in 1960 and 44,500 in 1970. By 1975 this trend had begun to reverse itself and populations had increased to just over 51,000. By 1977 the population was again above 60,000. The central Utah region therefore has considerable experience with major shifts in population, both out of and into the area, and has most recently been experiencing significant inflows of people. According to the Utah Population Work Committee (Kirkham, 1979) the current population is approximately 66,000, which would be an average annual growth rate of nearly 5 percent a year between 1977 and 1979. Such growth rates would continue or increase if regional coal development progresses at its current rate.

Employment and Income. Employment and income in the region have fluctuated proportionately with population, declining from 1950 through 1970 and then rising to or above earlier levels. Over the 25-year period of 1950-1975, agricultural employment experienced an almost continual decline in the region. Governmental employment in the region experienced an almost continual increase, while such sectors as manufacturing, mining, construction, and trade fluctuated, but are currently on the rise. The region's dependence on coal mining and related activities, especially in Carbon and Emery Counties, is the predominant basis for such fluctuations. As mining activity in the area increased or decreased, ripple effects generated similar changes in related sectors. Such relationships would be expected to continue into the future.

Total personal income in the region has been estimated at $239.3 million for 1975. There is, however a large variation between counties, with Carbon - $94.6 million, Sevier - $52.4 million, Sanpete - $47.9 million, and Emery - $33.8 million. The figures then drop markedly to $6.2 and $4.4 million for Wayne and Piute Counties respectively. The per capita personal incomes for the region at the same time were below the national average of $5,852, with Emery - $5,475, Carbon - $5,176, Sevier - $4,517, Sanpete - $4,045, Wayne - $3,568, and Piute - $3,497. The higher levels attained by Carbon, Emery, and Sevier Counties reflect their heavier involvement in mining, construction, and manufacturing, which tend to have higher wage rates than other employment. The figures for the remaining counties are indicative of a high proportion of nonworking-age people in the population (predominately the elderly), lack of high paying jobs, and relatively high unemployment rates. Such intercounty variation would be likely to continue, even with accelerated coal development in the region. This would occur primarily because such development would be likely to concentrate in Carbon and Emery Counties.

Services. The adequacy of services throughout the region varies by county. Communities in Carbon and Sanpete Counties exhibit the greatest adequacy in provision of such services as public water supply, police and fire protection, parks and recreation, and sewage disposal. Communities in Sevier and Wayne Counties tend to be less adequately equipped to supply services, especially in the area of sewage disposal. Housing availability in the region is stable in most counties except Carbon and Emery. In the latter two, population increases since the early 1970s have resulted in chronic housing shortages. Carbon and Sevier County school systems are currently capable of accommodating only moderate growth in enrollments. The other school systems in the region are currently either at or in excess of their designed capacities, and any additional enrollments would aggravate existing problems.

Quality of Life. Lifestyles in the central Utah region are quite diverse. The region is much less homogeneous than in any other areas in the State, and as a result is more capable of absorbing changes in population and economic activity without undergoing socio-cultural upheavals. However, recent trends of increased population in the region have begun to exceed infrastructural capacities in some areas. If such trends go unresolved in the face of potentially higher rates of growth, the general level of the quality of life in the region could be severely diminished. That is, the likelihood of "boom-town" proportioned problems would be high, especially in Carbon and Emery Counties, where the potential growth is most likely to occur.

Southwestern Wyoming Region

This region is the extreme southwestern corner of Wyoming, bordering Utah to the west and Colorado to the south. It contains three counties: Sweetwater, Lincoln, and Uinta, with Sweetwater County being dominant in terms of socioeconomic activity. The historical character of the region has been oriented around an open range, rural ranching type economy. More recently however, the rural character of the area has been increasingly influenced by mining and energy related activities including phosphate, oil, gas, coal development, and electrical power production.

All socioeconomic data for this region is based on information contained in Development of Coal Resources in Southwestern Wyoming Environmental Statement (SW) (USDI, 1978).

Population. The population of the region was estimated at nearly 60,000 in 1977. This figure represents a significant increase (75 percent) over the relatively stable 1970 base population of around 34,000, an average annual growth rate of approximately 11 percent. Such growth trends are extremely difficult to accommodate and have resulted in "boom-town" conditions in Sweetwater County (primarily Rock Springs and Green River).

Employment/Income. Total employment in the region was estimated at about 28,000 in 1977, an 81-percent increase over 1970 levels of around 11,000. Of this, about 40 percent was attributed to the mining and construction sectors, 15 percent in the trade sector, 13 percent in the government sector, and only 5 percent in the agricultural sector.

As with employment, incomes in the region have risen significantly, especially in Sweetwater County. Total personal incomes in the region in 1977 were estimated at $342.8 million, representing an average of over $12,000 per person employed. Of the total regional income, nearly 75 percent or about $258.4 million was concentrated in Sweetwater County. However, despite such relatively high income figures (nearly 50-percent higher in Sweetwater County than the national average for the same period), considerable variation in earning power exists between the various sectors of the region's economy and between the three counties. Uinta County has been least affected by the economic growth of the region since actual developments have been concentrated in Sweetwater and Lincoln Counties. Also, employees in other sectors have not acquired wage rates as high as those in the mining and construction sectors (typically only 40 percent as high), resulting in a migration of employees from the service and retail trade sectors to mining and construction.

Services. Rapid population increases in the region have significantly strained the capabilities of municipalities to provide services to residents. Some of the more acute problem areas include housing shortages, potential overcrowding in schools (most school districts are currently operating at or near their capacities), unmet basic health care needs, and increased law enforcement problems. Such deficiencies are most prevalent in Sweetwater and Lincoln Counties, but also exist to a lesser degree in Uinta County. Growth-related problems, such as the above, would eventually be resolved as growth rates stabilize, but such a process could take a number of years.

Quality of Life. Perceptions of the quality of life in the region vary, depending upon the degrees of change that have taken place in the various counties and their communities. The most dramatic recent impacts to quality of life have occurred around Rock Springs and Green River, where change has been rapid and far-reaching. The past rural atmosphere of the area has been transformed to one of "boom-town" conditions and a largely degraded quality of life.

Southern Utah and Southern Nevada Regions

These regions include two counties in southern Utah (Kane and Washington) and one in Nevada (Clark). The character of the region is dominated by scenic attractions such as Zion National Park, Lake Powell, the Grand Canyon, Lake Mead, etc. Most of the region is sparsely populated and is characterized by small homogeneous communities. The main exception to this characterization is Las Vegas, which is the largest population center in the region and has a very diverse population.

All socioeconomic data for this region is based on information contained in Socioeconomic Impacts of the Proposed Allen-Warner Valley Energy System (Centaur Associates, Inc., 1980). Although the primary source(s) of information in this report were documents produced by area Association of Governments, some local officials have disclaimed the population figures because they consider them to be too low. Such disputes will probably not be resolved until the 1980 census is completed. Therefore, in an effort to provide a consistent analytical base, BLM has elected to utilize the figures provided in the report while acknowledging that some error may be inherent.

For specific baseline statistics, refer to Appendix 10, Baseline Socioeconomic Statistics and Projections.

Population. The estimated 1980 population of the southern Utah region has been estimated at around 26,000. The populations of Kane and Washington Counties were estimated at 4,500 and 21,400 respectively. Most communities in the region experience a moderately high annual growth rates of approximately 4 to 7 percent per year. Exceptions to this trend occurred in some Kane County communities (which have been experiencing net out-migrations) and the St. George area communities (which have had higher than average growth rates in the 7 to 10 percent per year range). Much of the region's population growth has occurred through the attraction of retirement-aged persons to the region's favorable climate and tourist-related retail trade and services (table 1 in Appendix 10).

The 1980 population of the southern Nevada region (essentially the Las Vegas Valley area) has been estimated at approximately 608,000. Populations in the Las Vegas Valley area have been growing over the past several years at the relatively rapid rate of 7 to 10 percent per year. Much of this growth is attributable to the area's warm, dry climate, the tourist industry, and the gaming industry.

Employment and Income. Employment and income in Kane and Washington Counties are dominated by three sectors of the economy - trade, services, and government. In Kane County, 76 percent of all employment (790 of 1,037 jobs) and Washington County, 73 percent of all employment (3,840 of 5,276) is involved with these three sectors. Excluding employment by government, employment in these two counties is dominated by trade (table 2 in Appendix 10). As might be expected, incomes in the region closely parallel the employment percentages. The three primary economic sectors account for neary 70 percent ($5.8 of $8.3 million) of personal incomes in Kane County and nearly 63 percent ($31.4 of $49.4 million) in Washington County. Mining and associated activities account for less than 1 percent of employment and income in the region, while trade, especially tourist-related, tends to dominate.

Employment and income of the Las Vegas Valley area are also primarily dominated by the same three economic sectors as southern Utah - trade, services, and government. Over 81 percent of all jobs in the area (117,264 of 143,110 jobs) are in these three sectors, and $1.7 of $2.3 billion of personal income (83 percent) are so generated (tables 2 and 3 in Appendix 10). Differing from the southern Utah region, the dominant sector in southern Nevada is services, reflecting the area's involvement with the gaming and entertainment industries, while less than 1 percent of southern Nevada's employment and income is derived from the mining sector.

Services. The availability of services in the southern Utah region is generally adequate, but varies markedly between counties. In terms of police and fire protection, water supply, and sewage disposal, Kane County communities tend to be the least adequate. Chronic problems in the county seem to be inadequate fire and police protection. Other deficiencies are inadequate sewage disposal (primarily in Kanab, the principal population center of the county) and water supply. Washington County, on the whole, appears to be better at providing its population with basic services. The only major service problem area in Washington County has been inadequate sewage disposal, primarily in the Hurricane - Toquerville area. However, some school systems are close to problem levels. Kane County's school system already has enrollments in excess of classroom capacity, Washington County is very near capacity.

In Clark County, principally the Las Vegas Valley area, most services are adequate. Police protection, low income housing, and sewage disposal services are, however, near their capacities and could become inadequate in the near future if existing high population growth rates continue. Other types of housing shortages have not been noted in the region, but the Clark County school system, while somewhat better off than those in southern Utah, is also near capacity. Other services, such as health care, appear to be adequate region-wide through 1985.

As indicated above, most infrastructural services in both regions are presently adequate (with a few deficiencies). However, with overall growth rates at around 4 to 8 percent, any existing margins will be rapidly consumed unless aggressive service development is undertaken.

Quality of Life. The large population migration into most of the southern Utah region attests to its general high quality of life. The overall character of the region is one of a rural "western" setting.

The Las Vegas area offers a somewhat different setting, one of a predominantly "western" city combined with the glamor of the gaming industry. The population is very heterogenous, containing immigrants from both the east and west and with minority configurations very close to national averages. Those attributes which form the region's high quality of life should continue at least into the near future, especially if services are provided in pace with population growth.

Western Transmission System Region

The Western Transmission System region traverses portions of both Clark County, Nevada and San Bernardino County, California. Since descriptions of Clark County are given above, the descriptions here are confined to the California portion.

All four potential Western Transmission System routes lie entirely in San Bernardino County and run across an area which is sparsely populated. The routes traverse the Mojave Desert where, with only a few exceptions, no development has taken place. As such, the affected environment tends to be more in physical terms than socioeconomic terms.

All socioeconomic data for this region is based on information contained in Allen-Warner Valley Energy System - Proponents' Environmental Assessment (SCE and PG&E, 1979).

Population. The population of the region was estimated at 147,831 for 1979. Nearly 94 percent of this figure is concentrated in the western portion of the region, around Victorville, Barstow, and Twentynine Palms. Between 1970 and 1979, the region as a whole experienced a net 3.1 percent annual increase in population, with most of the actual growth experienced in the Victorville and Twentynine Palms areas.

Employment and Income. Employment in the region has traditionally been oriented around the service and trade economic sectors. The major industries are retail trade and services, transportation, and public utilities. Much of the income in the region comes in the form of tourist trade. The average per capita income in the region was estimated at around $7,200 in 1979, which compares very favorably with the national average. The region is likely to experience a continuation of such conditions in the near future since there are no proposals for major development.

Services. A study of the region (SCE and PG&E, 1979) has shown no major infrastructural deficiencies. The moderate growth rate of the whole area should be readily accommodated, although the higher growth rate areas of Victorville and Twentynine Palms could experience some problems with annual growth rates of 4.5 and 5.9 percent respectively.

Quality of Life. Lifestyle of the region is dominated by a rural and open country character.

Existing and Projected Electrical Energy Demand

The existing and projected levels of electrical energy demand (total consumption and peak demand) for the service areas of the city of St. George (Utah), Nevada Power Company (Las Vegas Valley, Nevada), PG&E, and SCE service areas in California are presented below.

City of St. George Service Area

The St. George City Utilities Department contracted a report done by Burns and McDonnell (1977) which it considers the best forecast of its electrical energy needs (Chapter 1, Purpose and Need). BLM, however, contracted Centaur Associates to estimate the energy demand for the city of St. George service area.

The existing (1979) levels of electrical energy demand were taken from "Energy Conservation Alternative for the Allen-Warner Valley Project," (Conservation, Centaur Associates, Inc., 1980) and were summarized from "kWh and Revenue Report, July 1, 1978 through June 30, 1979" (St. George City Utilities Department, 1979). The existing levels of consumption (in millions of kilowatt hours [kWh x 10^6]) and peak demand (in megawatts [MW]) are listed below by use sector.

	Residential	Commercial	Industrial	Other	Total
Consumption					
kWh x 10^6	55.8	36.1	7.0	18.2	117.1
Percent	47.7	30.8	6.0	15.5	100.0
Peak Demand					
MW	Not available	Not available	Not available	Not available	32.5

The following projected levels of electrical energy consumption for the years 1980 to 2000 for the city of St. George service area are based upon the assumptions that per capita consumption would remain constant over the 20-year period and that changes in the consumption of electricity would be proportional to changes in the populations of the areas (Conservation, Centaur Associates, Inc., 1980). There are indications, however, that annual per capita consumption rates in the St. George area are increasing somewhat (personal communication, Rudger M. McArthur, Director St. George City Utilities, May 8, 1980). Projected peak demand was computed using a ratio of load growth to peak demand (Burns and McDonnell, 1977).

Year	Energy Consumption (kWh x 10^6)	Peak Demand (MW)
1980	119.3	30.26
1985	139.8	35.46
1990	156.9	39.80
1995	174.4	44.24
2000	192.7	48.88

Nevada Power Company Service Area

Nevada Power Company makes its own energy demand forecasts as a basis for planning and decision making (Chapter 1, Purpose and Need). BLM, however, contracted Centaur Associates to estimate the energy demand for NPC's service area.

As with the St. George service area, the existing (1979) levels of electrical energy demand for NPC's service area were taken from "Energy Conservation Alternative for the Allen-Warner Valley Project" (Conservation, Centaur, 1980) and were summarized from information supplied by NPC as follows:

	Residential	Commercial	Industrial	Other	Total
Consumption					
kWh x 10^6	2,235.0	2,062.0	938.0	262.0	5,497
Percent	40.7	37.5	17.1	4.8	100
Peak Demand					
MW	Not available	Not available	Not available	Not available	1,315

The following projected levels of electrical energy consumption and peak demand in the NPC service area for the years 1980 to 2000 are based upon the assumptions that per capita consumption would remain constant over the 20-year period and that changes in the consumption of electricity would be proportional to changes in the populations of the areas. There are indications, however, that annual per capita consumption rates in the NPC service area are decreasing (personal communication, John Arlidge, Assistant to the Vice President, NPC, May 8, 1980). Thus, the projections are considered conservative. Projected peak demand was computed using a ratio of load growth to peak demand (Burns and McDonnell, 1977).

Year	Energy Consumption (kWh x 10^6)	Peak Demand (MW)
1980	6,026	1375.8
1985	7,348	1677.6
1990	8,961	2045.9
1995	9,993	2281.5
2000	11,316	2583.0

Pacific Gas and Electric Company and Southern California Edison Service Areas

In California, forecasts of energy demand (consumption and peak demand) are made by PG&E and SCE for their respective service areas. Forecasts are also prepared by the California Energy Commission (CEC) in its duties to provide the Governor, the Legislature, and the public of the State of California with the basis for energy policy making. The utilities periodically prepare resource plans for their respective service areas which include energy need projections and proposed methods for meeting these energy needs. The CEC prepares a similar document (the Biennial Report) which it uses to meet its planning requirements.

Overall, the CEC's methodology appears to be a better tool for estimating future demand than the utility methodology. In addition, the disparities in utility and CEC assumptions about future trends in energy prices and conservation impacts in particular make the CEC forecasts more credible. For these reasons, the California Public Utilities Commission (CPUC) staff is using the CEC forecasts in its assessment of projected electrical energy needs for PG&E and SCE (personal communication, Ron Knecht, Allen-Warner Valley Project Manager, CPUC, May 9, 1980).

The existing and projected energy consumption (measured in millions of kilowatt hours) for the respective California utilities' service areas for the years 1979, 1985, 1991, and 2000 is presented in table 3-2. The existing and projected peak demand (measured in megawatts) as forecasted by CEC for the respective utilities is presented in table 3-3.

Need for Additional Capacity by 1991

In its 1979 Biennial Report, CEC indicated the probable capacity additions that will be needed to meet projected demand in each utility's service area through 1991. It calculated the amount of new capacity, or its equivalent, that would be needed for each of four reasons:

1. To meet new demand due to growth, as indicated by the adopted CEC forecasts;

2. To replace existing facilities which will probably be retired during this period;

3. To make up for expected losses of out-of-State power purchases; and

4. To meet a State policy goal of a 50-percent reduction in oil and gas use in California powerplants by 1991.

TABLE 3-2

Forecast of Energy Consumption
(kWh x 10^6)

Year	Residential	Commercial	Manufacturing And Mining	Agriculture And Weather Pumping	Total Demand
PG&E Service Area					
1979	23,436	20,252	15,509	7,721	66,918
1985	25,782	20,301	15,194	8,537	69,815
1991	28,697	22,695	18,501	9,291	79,184
2000	34,180	27,050	20,549	9,938	91,717
SCE Service Area					
1979	17,975	21,688	20,365	3,623	63,650
1985	19,367	22,416	20,644	4,169	66,597
1991	21,584	24,970	24,592	4,681	75,827
2000	25,243	28,959	26,219	5,160	85,581

Source: California Energy Demand 1978-2000, Staff Draft, CEC, 1979

TABLE 3-3

Forecast of Energy Peak Demand (MW)

Year Month	Residential	Commercial	Others	Losses	Total
PG&E Service Area					
1979 August	5,352.2	4,045.5	4,231.3	1,485.6	1,5114.6
1985 August	6,741.9	3,500.5	4,273.2	1,582.2	16,097.7
1991 August	7,334.2	3,987.1	4,939.1	1,772.4	18,032.8
2000 August	7,252.1	5,695.3	5,640.6	2,026.1	20,614.0
SCE Service Area					
1979 September	4,320.0	5,219.1	4,265.5	1,062.9	14,867.6
1985 September	4,802.4	5,325.7	4,420.5	1,120.2	15,668.9
1991 September	5,174.3	5,911.7	5,207.5	1,254.6	17,548.1
2000 September	5,819.9	6,848.5	5,596.3	1,406.4	19,671.2

Source: California Energy Demand 1978-2000, Staff Draft, CEC, 1979

The following table outlines the capacity additions which would be needed in the PG&E and SCE generation systems for these reasons. To assure a realistic projection, the PG&E service area is assumed to include the Sacramento Municipal Utility District (SMUD) and the SCE service area is assumed to include the city of Anaheim.

Projected Capacity Needs by 1991 (MW)

Utility	Demand Growth	Oil & Gas Displacement	Generation Retirement	Lost Purchases	Total Capacity Needed
PG&E (With SMUD)	3,781	2,418	300	512	7,011
SCE (With Anaheim)	2,729	2,834	400	641	6,604

Existing and Projected Electrical Energy Sources Mix

A varied mix of sources is used by each of the utilities to meet existing electrical energy demand in their respective service areas. The utilities also project the energy sources mix that they plan to develop in order to meet future energy needs. The existing and projected energy sources mix for each of the utilities is presented below. Also described are conservation and load management.

St. George Service Area

The area served by St. George Utilities receives 80 to 90 percent of its total electrical energy consumed from a hydroelectric source - the Colorado River Storage Project of the Water and Power Resources Service (formerly Bureau of Reclamation). The remaining 10 percent is either purchased from Utah Power and Light (UP&L), which is primarily generated by coal-fired generators in the central Utah area, or is furnished by a diesel-fired generator owned by the city of St. George. For economic reasons, energy supplied from UP&L is favored over running the city's own generator.

Existing (1979) electrical energy generation capacity and the sources in the city of St. George are summarized below. All sources are firm.

	Hydro-electric	Gas/Oil	Purchases	Total
Megawatts	24[a]	6.8	14.2	45
Load Type	Base	Peaking	Peaking	

[a]24 MW are supplied in the winter and 18 MW are supplied in the summer.

St. George City Utilities does not have a formalized energy conservation program for its customers. Periodic addresses are made each year by a utility spokesperson to various citizens' groups, local schools, etc. advising them on ways to conserve energy. However, such programs as energy audits, formal information/education, material development, etc. have not been made available.

Nevada Power Company Service Area

Around 90 percent of NPC's total electrical energy consumed is supplied by coal-fired generation. Most of the company's peaking capacity is supplied through gas or oil-fired generation.

Existing power generating capacity and energy sources of the NPC service area are summarized below. All sources are firm.

	Hydro-electric	Coal	Gas/Oil	Purchases	Total
Megawatts	100	807	553	113	1,573
Load Type	Inter-mediate	Base	Peaking, intermediate	Peaking, base	

NPC has engaged in a modest energy conservation program. An Energy Management Services department has been staffed and is responsible for performing energy audits, encouraging power consumers to upgrade the insulation in their homes, providing speakers to local groups on energy related topics, distributing some conservation literature, etc. NPC has initiated a program of selling insulation blankets for water heaters to the public, and sponsors several media advertising campaigns each year on energy conservation and related topics. Other more active conservation efforts in which the company has engaged have been pilot load management projects in which a limited number of private home air conditioners are switched off for selected lengths of time during periods of peak demand.

PG&E and SCE Service Areas

The California utilities utilize a varied mix of energy sources to meet the demand for electricity in their service areas. The current generating capacity and that projected for 1990 of each of the energy sources in this mix are presented in tables 3-4 and 3-5 for PG&E and SCE respectively. (Note: this information was only available for 1990).

A program of both mandatory and utility initiated conservation and load management practices is included in each of the utilities' resource plan. PG&E's current conservation and load management programs include: weatherization of single family homes, energy awareness programs, solar heating and cooling systems, industrial and commercial energy audits, and voltage regulation programs. In addition, PG&E is doing research to find new and cost-effective methods of conservation and load management and has identified several areas of potential energy savings including: no-interest loans for retrofitting insulation or the installment of solar energy technology, passive solar technology, integrated appliance technologies, heat pump applications, waste heat recovery, and lighting efficiency. SCE's current conservation and load management practices include residential and non-residential measures, public awareness programs, streetlight conversion, industrial and commercial energy audits, and voltage reductions. SCE is also researching to find new methods of conservation and load management practices (SCE and PG&E, 1979).

TABLE 3-4

PG&E Service Area Existing and Projected Electrical Energy Sources Mix (Capacity MW)

Source	1980	1990	1980-1990 Capacity Change
Oil and Gas Steam	7,712	7,712	0
Co-generation	179	1,100	921
Geothermal	663	1,909	1,246
Nuclear	875	3,065	2,190
Purchases (Pacific NW)	1,400	1,000	-400
Hydroelectric (Adverse Year)	5,325	6,885	1,560
Wind (Firm Capacity)[a]	0	27	27
Total Existing	16,154	21,698	5,544

Source: Proponents' Environmental Assessment, SCE and PG&E, 1979, as modified in PG&E testimony for CPUC Hearings for Certificate of Public Convenience and Necessity

[a]Installed capacity of wind energy sources is 82 MW

TABLE 3-5

SCE Service Area Existing and Projected Electrical Energy Sources Mix
(Capacity MW)

Source	1979	1990	1979-1990 Capacity Change
Hydroelectric	842	1,073	231
Oil and Gas	10,305	11,803	1,498
Coal	1,631	3,050	1,419
Nuclear	349	2,671	2,322
Geothermal	0	158	158
Other	0	106	106
Purchases	1,944	2,369	425
Area Total	15,071	21,230	6,159

Source: Proponents' Environmental Assessment, SCE and PG&E, 1979, as modified with the testimony of S.P. Barrett, Senior Engineer - SCE, CPUC Hearings for Certificate of Public Convenience and Necessity, April 29, 1980

Existing Legislation and Incentives Favoring Conservation and the Development of Alternative Resources

There are a number of Federal and State laws, tax credits, low interest loans, building codes, etc. which are designed as mandates or incentives to conserve energy and develop nonconventional energy sources. Federal and State legislation and incentives which apply in each of the utilities' service areas are described below.

Federal Legislation and Incentives

In 1978 Congress enacted the five-part National Energy Act. The Powerplant and Industrial Fuel Use Act is intended to halt the construction of new powerplants dependent on oil and gas, and to phase out the use of gas as a utility fuel by 1990. President Carter has proposed amending this law to require that by 1990, the use of oil is cut in half, compared to the recent past use. The other four acts contain several measures that will help to accelerate the development of alternative energy sources and improve energy efficiency:

The National Energy Conservation Policy Act mandates the utilities to provide residential customers with energy audits to identify applicable conservation and solar measures, and provide contracting and financial assistance for their implementation. The Act extends the existing program of weatherization grants to low-income homes, and creates loan programs for conservation and solar energy. It also sets up a program of grant assistance for improving the energy efficiency of schools and hospitals, and for auditing local public buildings.

The Energy Tax Act authorizes tax credits of 15 percent of cost (up to $300) of installing insulation, caulking, and other energy conservation materials. Additionally, there are credits for renewable energy source equipment such as geothermal, wind energy systems, and solar heating systems. Homeowners may take a 30-percent credit on the first $2,000 invested and a 20-percent credit for the next $8,000 up to a maximum of $2,200. The Act also provides tax incentives for industry to develop geothermal energy and produce geopressured natural gas, as well as business tax credits for conservation and alternative energy use equipment.

The Natural Gas Policy Act incorporates the previously uncontrolled intrastate gas markets into the controlled interstate market, and provides for phased deregulation of the price of new gas supplies by 1985. Gas from certain high price sources will be decontrolled earlier, and the Act has provisions requiring those incremental costs to be passed on only to large industrial and utility users, while maintaining a controlled price for residential and commercial users.

The Public Utility Regulatory Policies Act requires state regulatory bodies and publicly owned utilities to consider 11 voluntary rate design standards--including time-of-day, seasonal, interruptible, and lifeline rates, the prohibition of declining block rates, and the consideration of cost-of-service pricing. The Act also establishes a loan program to aid development of small hydroelectric facilities, and authorizes Federal rules requiring utilities to buy or sell electricity at just and reasonable rates from qualified industrial cogeneration facilities and from individuals or organizations employing nonconventional energy sources that use wind and geothermal technologies.

A number of initiatives currently under discussion in Congress would go well beyond the provisions of the 1978 Acts. The most important of these actions hinge on passage of a "windfall profits" tax on the increased revenues resulting from decontrol of domestic oil production. This tax would provide revenues to fund a substantial program for developing derived fuels and to underwrite additional conservation and solar incentives. Some of the tax revenues would also assist lower income families in meeting their energy needs (California's Energy Challenge: The Next 20 Years, Staff Draft, CEC, 1979).

State of Utah (City of St. George Service Area)

Utah Tax Credit. On January 30, 1980 the Utah State tax credit program became law. The program allows a 10-percent credit on active or passive solar systems, wind systems, and hydroelectric systems, up to a maximum of $1,000 for homeowners and $3,000 for owners of commercial establishments. The law is retroactive to July 1, 1977 and will expire if not renewed on July 1, 1985.

Utah Energy Code. On January 1, 1978 the State of Utah adopted an energy code to establish minimum standards of construction to address the problem of energy conservation. The intent of the code is to regulate the design of building envelopes for adequate thermal resistance, low air leakage, and selection of efficient mechanical, electrical, and lighting systems. The goal of the code is the effective use of energy in new building construction. The code also establishes guidelines and requirements related to remodeling existing buildings, but excludes mobile homes from compliance.

State of Nevada (Nevada Power Company Service Area)

Nevada Tax Credit. Since 1977 the State of Nevada has offered property tax relief to homeowners who have solar, wind, or geothermal heating and cooling systems. (Nevada has no individual income tax.) The assessed value of a residential property employing such a system is compared with the assessed value without it, and a portion (which varies by tax assessor) of the difference is allowed up to a maximum of $2,000 as a tax credit.

Nevada Energy Code. Nevada promulgated energy conservation standards for new building construction in January 1978. The code allows compliance to follow any of three paths for design:

1. A systems approach for the entire building and its energy using subsystems which may utilize nondepletable energy sources;

2. A component performance approach for various building elements and mechanical systems; or

3. Specified acceptable practice.

There are no guidelines or requirements to comply with the code for existing buildings undergoing remodeling. Mobile homes are not covered under the code.

State of California (PG&E and SCE Service Areas)

California has led the other States and the nation in its response to the energy problem. The State of California Legislature has established a basic direction for change by declaring it to be State policy:

> "To use a range of measures to reduce the wasteful, uneconomic and unnecessary uses of energy, thereby reducing the rate of growth of energy consumption, prudently conserving energy resources, and assuring statewide environmental, public safety, and land use goals; and
>
> To use conservation and alternative energy resources to the maximum extent feasible" (California's Energy Challenge: The Next 20 Years, Staff Draft, CEC, 1979).

The Legislature has enacted among others the following legislation:

AB 1512 Requires the CEC to establish solar energy equipment standards and prepare information to encourage use of passive solar design features in buildings.

AB 1558 Increases the solar income tax credit to 55 percent of the acquisition cost of a solar energy system.

SB 373 Makes loans available to finance solar energy systems in reconstruction of dwellings destroyed by disasters.

AB 2321 Prohibits vegetation from blocking sunlight access on solar collector surface during daylight hours.

AB 3247 Requires the CPUC to investigate methods to finance solar energy systems for utility customers.

AB 2644 Expedites certification of geothermal powerplants.

AB 2976 Requires the California Energy Commission to implement a State wind program oriented toward testing and demonstrating the most effective wind technology.

AB 3046 Requires the Energy Commission to conduct a Statewide competition to select outstanding examples of residential architecture that incorporate passive solar and energy-conserving design features.

AB 3250 A comprehensive "solar rights" bill to require subdivision maps to provide, to the maximum extent feasible, for the future use of passive solar; requires consideration of passive solar design in new subdivisions; and allows the cost of obtaining a solar easement to be deducted as part of the solar tax credit.

AB 3324	Required Energy Commission to develop a plan for maximum feasible solar implementation in the State by the year 1990.
AB 3539	Requires the Energy Commission to develop a program to promote and increase the use of energy surveys and to ensure the qualtiy of cost effectiveness of energy surveys to the public.
AB 3623	Expands and makes more efficient the application of the 55-percent solar tax credit; authorizes a tax credit for wind and allows builders to pass on credit to home buyers.
SB 1805	Expedites the powerplant siting procedures for geothermal and cogeneration projects.
SB 2003	Establishes that the Energy Commission's review of an application for certification of a powerplant site and related facility is the functional equivalent of the environmental impact report process.
AB 524	Eases permit procedures for cogeneration and resource recovery projects.
AB 900	Authorizes the Energy Commission to make loans to schools, hospitals, public care institutions, and local government for financing energy conservation projects.

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED AND ALTERNATIVE ACTIONS

INTRODUCTION

This chapter of the environmental impact statement (EIS) forms the scientific and analytic basis for comparing the proposed and alternative actions. Discussions of the proposed and alternative actions in this chapter include: (1) direct and indirect effects on the environment and their significance; (2) possible conflicts with the objectives of Federal, regional, State, local, and Indian tribe land use plans, policies, and controls for the areas concerned; (3) natural or depletable resource requirements and conservation potential; and (4) energy efficiency.

Impacts to the following environmental elements would be brought about unavoidably through the implementation of any one or parts of Alternatives 1 through 5: climate, fugitive dust, topography and geology, paleontology, minerals development, soils, and commonly occurring vegetation and wildlife. However, these are considered to be of minor concern (Scoping, Chapter 1) and are analyzed in less detail than those elements of major concern.

Environmental elements of major concern (Scoping, Chapter 1) which require in-depth analysis of impacts are: air quality related values (including visibility), water resources, threatened and endangered animal and plant species, cultural resources (including archaeologic, ethnographic, and historic values), recreation and aesthetic values (including visual impairment), changes in land use (including wilderness), and socioeconomics. Significant impacts to these environmental elements are analyzed on a component basis for each of the alternatives later in this chapter.

Some of the impacts of a proposed action may be unavoidably adverse, implying that the standard operating procedures and mitigating measures as described in Chapter 2 cannot be successfully applied to entirely prevent adverse environmental consequences (residual impacts).

There may also be an irreversible/irretrievable commitment of resources through the implementation of certain project components. These are commitments of resources that would be consumed, destroyed, or lost through the construction and operation activities should an alternative be implemented.

The use of resources for the short-term (here considered to be the project life of the proposed or alternative actions [40 years]) are examined for their effects on the maintenance and enhancement of long-term productivity (the period following the life of the project).

ASSUMPTIONS AND ANALYSES GUIDELINES

In the analyses of the alternatives it is assumed that:

1. Impact analyses are centered primarily on the construction and operation of the proposed powerplants, coal transportation systems, and the

electrical transmission systems. Impact analyses for the three coal sources are summarized and referenced from previously published EISs (Scoping, Chapter 1).

2. Any one or parts of the proposed and alternative actions could be included in the eventual selection of the preferred alternative(s); therefore, significant impacts of each alternative are analyzed equally indepth. Because some of the alternative components are identical in size, function, or design, the environmental impacts associated with their construction and/or operation would also be similar or identical. Although the impact analyses may seem redundant for these alternatives and components, it is necessary to present equal and comprehensive analyses as required under the Council on Environmental Quality implementing regulations of the National Environmental Policy Act of 1969.

3. The analyses of the impacts are based on the changes that would occur to the affected (existing) environment through the implementation of any one or parts of the proposed alternatives. Analyses include the type, cause, location, duration, and significance of the impacts.

4. Analyses of impacts are limited to the scope as described in Chapter 1, Scope of the EIS.

5. The application of standard operating procedures (as listed in Appendix 6) is considered inherent throughout the analyses of impacts to the affected environment. Mitigating measures specific to an alternative (Chapter 2) are considered inherent throughout the analysis of that specific alternative. Only those actions which would significantly impact the affected environment over and above standard operating procedures and mitigating measures are analyzed.

6. Impacts to State and private lands are not treated separately in the analyses; however, it is assumed that impacts would be similar to those identified on adjacent public lands.

7. Where insufficient data exists to make a realistic analysis of environmental impacts, either a "worst case" situation is assumed or the lack of data is noted in the text.

8. Where project components and/or areas have been previously studied, relative data is summarized, consolidated, or simply referenced to those previously published studies.

9. Energy efficiency, although not an environmental element, is used as a tool in the analysis of the alternatives.

IMPACTS OF MINOR CONCERN

Climate

The impacts of powerplant emissions on local and regional climatic patterns is not known. Investigations tend to support theories that emissions could increase the probability of precipitation in affected areas and could mix with atmospheric moisture to form acid rains, affecting terrestrial ecosystems (Geophysical Research Letters, Parungo et al., 1978; Pueschel et al., 1978).

Fugitive Dust

Almost all surface disturbing activities produce varying amounts of dust, depending upon the soil moisture conditions and the action taking place. While the severity and duration of any potential impact is difficult to project, fugitive dust should not be a significant problem. The one exception would be fugitive dust associated with surface mining activities. Where a significant impact could occur, it is discussed in the appropriate Air Quality sections.

Topography and Geology

Activities of underground and surface mining would permanently alter the local topography in affected mining permit areas. The severity of surface disturbance would depend on the character of the existing topography. Subsidence would occur on undermined lands, causing a change in present surface water runoff and erosion characteristics. The severity of disturbance would depend on the thickness of coal removed, the thickness of overburden, and the method of extraction. Existing topography would be replaced by a series of highwalls and spoil piles during surface mining activities. Disturbed lands would be reclaimed under Office of Surface Mining Reclamation and Enforcement (OSM) regulations (30 CFR, Parts 211 and 700), but highwalls and spoil piles could only be smoothed to acceptable and not pre-existing contours. Residual scars would be left on the landscape from the excavation of borrow materials for construction of powerplants, the water project, the coal slurry pipeline, and electrical transmission lines.

Seismic disturbances would not be expected to reach an intensity that would adversely affect the operation of various alternative components (e.g., powerplants and the water project dam).

Paleontological Resources

Paleontological resources would be unavoidably destroyed or altered in some areas of construction and coal mining. Construction and mining activities could also have the beneficial impact of uncovering valuable fossils, which would add knowledge to the geology of the affected area.

Minerals Development

With the exception of those in Warner Valley, no other known economically locatable or leasable minerals of significance would be precluded from development with the implementation of any one or parts of the alternatives. Oil and gas minerals, if found at the Harry Allen or Warner Valley powerplant sites, could be recovered by directional drilling at some extra expense. Removing lands from mineral location under the general mining laws would have an impact for the 40-year life of the project in Warner Valley, where there has been considerable claim staking for uranium, silver, and copper, but little exploration activity. If prices of these minerals would increase, additional interest could be expected. Should the Warner Valley powerplant or water project be implemented, present claims would have to be settled at fair market prices (U.S. Mining Laws, 43 CFR, Part 3800). After the projects would have completed their usefulness and would be decommissioned, the lands could be reopened for mineral entry.

Soils

An acceleration of soil erosion would be associated with construction and mining activities. The clearing of vegetation, borrowing, and excavating would result in a loss of soil productivity and increased sedimentation of streams. Accelerated soil erosion rates would range from an annual rate of 12.8 tons per acre in the Mojave Desert region, to as much as 23.8 tons per acre on affected land in the central Utah coal mining region. Productivity would increase and sedimentation would decrease as lands would be reclaimed, vegetation reestablished, and slopes stabilized.

Commonly Occurring Vegetation

The clearing of common vegetation would occur unavoidably during the construction of any one or parts of the alternatives. Loss of vegetation on affected lands would result in accelerated erosion of soils and the reduction of wildlife habitat. In especially arid regions such as the Mojave Desert, affected areas would require up to 100 years to recover to pre-existing vegetation densities, even after reclamation and reseeding. The amount of vegetation that would be disturbed during construction and mining activities would range from as little as 16,030 acres under Alternative 4, to as much as 36,981 acres under Alternative 1 for the life of the project.

Commonly Occurring Wildlife

Wildlife would generally be affected in two ways: (1) the direct loss of wildlife and wildlife habitat associated with construction and mining activities, and (2) population reduction of local game and nongame species due to an increase in hunting pressure, illegal shooting, and wildlife harassment associated with increases in local human population related to project development. Wildlife populations should recover to pre-existing levels in the long term (after 40 years). Disturbance to wildlife habitat would range from as little as 16,030 acres under Alternative 4, to as much as 36,981 acres under Alternative 1 for the life of the project.

ALTERNATIVE 1: IMPACTS OF MAJOR CONCERN

The implementation of the applicants' proposed action would involve the following major components: coal mining in the Alton coal fields of southwestern Utah; construction and operation of two pipelines to slurry pulverized coal from the Alton coal preparation plant to the Warner Valley and Harry Allen powerplants; construction and operation of a 500-MW powerplant at the Warner Valley site in southwestern Utah; construction of the Warner Valley water project in conjunction with the powerplant; construction and operation of a 2,000-MW powerplant at the Harry Allen site in Dry Lake, Nevada; and construction of a transmission system to send electricity from the powerplants to the service areas of the city of St. George, Nevada Power Company (NPC), Southern California Edison Company (SCE), and Pacific Gas and Electric Company (PG&E).

Air Quality

It is recognized that high levels of air pollution cause human illness and even death. To prevent the occurrence of injurious pollution levels, the Environmental Protection Agency (EPA) as directed by the Clean Air Act (as amended August 1977) has established the National Ambient Air Quality Standards (NAAQS) for particulate matter, sulfur dioxide (SO_2), ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), non-methane hydrocarbons, and lead (Pb). Compliance with these standards is designed to protect human health and welfare. EPA has also established the Prevention of Significant Deterioration (PSD) regulations for SO_2 and particulate matter. These standards are more stringent than NAAQS and compliance is designed to accommodate moderate, well-controlled growth, while protecting air quality values.

The cumulative effects on health caused by long-term exposure to low levels of air pollution are not definite; however, " . . . some positive but not conclusive statistical evidence shows that current and expected future concentrations of coal related pollutants may be dangerous to human health" (Congress of the United States, 1979). While a specific judgement regarding the applicants' proposed development cannot be made, it seems likely that there would be some risk to health, especially to persons with lung disease. Conclusive evidence is lacking to make a precise judgement at this time.

Coal-fired powerplants release relatively large quantities of carbon dioxide (CO_2) into the atmosphere. Continued increases of atmospheric CO_2 from high levels of fossil fuel use could raise the average temperature of the earth's surface from the resulting "greenhouse effect" caused by higher atmospheric CO_2 levels. Current scientific understanding of the global carbon cycle and the possibility of CO_2 induced temperature changes is incomplete because of the controversy over the amount of atmospheric CO_2 absorbed by the oceans and the influence of flora on CO_2 levels (EPA, 1980). The effect of CO_2 releases from a single powerplant are even more uncertain, but because of small CO_2 contributions from powerplants compared to atmospheric concentrations, the impact would be expected to be minor.

Acid precipitation is another result of releases of CO_2, sulfur, and nitrogen oxides (NO_x) from emission sources, including fossil fuel burning powerplants. The environmental effects of acidic precipitation have been measured in the eastern U.S. where conditions of higher atmospheric loadings of sulfur and NO_x exist, combined with higher humidity and precipitation levels and acidic, poorly buffered soils. Similar effects have not yet been measured in the more arid low humidity southwest, which has lower population and industrial development, and more alkaline, highly buffered soils. In these areas, the first effective measurements of acid rain effects will undoubtedly occur in higher elevation alpine areas with heavier snow accumulations and lower plant forms (which are efficient accumulators), and in soils and lakes already low in pH. Although the contribution to acid precipitation of a single project such as the Allen Warner Valley (AWV) Energy System would be small and probably immeasurable, it would add to the total cumulative effect which would at some point become significant if uncontrolled.

Before construction could begin on the Harry Allen and Warner Valley powerplants, the proponents must obtain construction permits from the States of Utah and Nevada and PSD permits from EPA Regions VIII and IX. These permits are issued only if the proponents show that all applicable State and Federal air quality standards and regulations (shown in table 4-1) are met. At present, the proponents have not filed complete permit applications with either the States of Nevada or Utah, or the EPA (EPA, 1979; personal communication, Utah Bureau of Air Quality [BAQ] Feb. 1980; Nevada Department of Environmental Protection [DEP], Feb. 1980; and EPA Regions VIII and IX, Feb. 1980).

The air quality (including visibility) impacts from the AWV Energy System on the mandatory Class I areas of Zion and Bryce Canyon National Parks and the Class II areas of the proposed powerplants and mine sites have been analyzed (EPA, 1979; Warner Valley, Environmental Research and Technology (ERT), 1977; Harry Allen, ERT, 1977; NPC, 1975; Development of Coal Resources in Southern Utah [SU], U.S. Department of the Interior [USDI], 1979). Additional analyses of the air quality impacts and visual intrusion studies of the Alton coal mining operation on Bryce Canyon National Park are being prepared jointly by the OSM, National Park Service (NPS), Bureau of Land Management (BLM), and EPA, and in a separate study by Utah International Inc. (UII), proponent of the Alton mine. The results of these studies are expected in June 1980. NPS has prepared a report and visual simulations of the estimated visibility impact on Zion National Park that would result from the Warner Valley powerplant (Appendix 11). Plume tracer release studies have been conducted by NPC at both the Harry Allen and Warner Valley plant sites in response to EPA's request for additional meteorological and plume behavior data as input to the PSD permit review. This data was submitted to EPA in late May 1980. These additional studies will be included in EPA's review of the PSD permit application for approval or denial of the AWV Energy System. This final action is required by the Clean Air Act (as amended August 1977). In addition, the Secretary of the Interior may recommend to Congress that the Paiute Primitive Area (Arizona) be designated a Class I area for air quality and visibility protection. If such a recommendation is made in the absence of any action by Congress, the State would have the sole authority for redesignation (Section 164d, Clean Air Act). The State of Nevada DEP has recommended that the Valley of Fire State Park be designated Class I. This recommendation was denied by the Nevada State Environmental Commission. However, the Nevada DEP still considers the park to be a potential Class I area, and recommends that the park be designated Class I at a later date. Therefore, the Paiute Primitive Area and Valley of Fire State Park have been considered as potential Class I areas in the air quality and visibility impact analyses. The results of the available analyses are presented in this EIS.

Coal Mining in the Alton Coal Field

The SU document (1979) indicates that the surface mining of coal from the Alton coal fields would not be expected to violate any State or Federal air quality standards or regulations for particulate matter in either the immediate mining area or in Bryce Canyon or Zion National Parks. The maximum estimated ground level concentrations calculated in this study are presented in table 4-2. It should be noted that these impact estimates were done without the benefit of a detailed mining plan, a necessary element in an intensive analytical treatment of potential air quality impacts from the mining operations.

TABLE 4-1

State and Federal Air Quality Standards and Regulations
(Expressed in Micrograms Per Cubic Meter)

	Sulfur Dioxide (SO_2)			Suspended Particulate Matter		Nitrogen Dioxide (NO_2)
	Annual	24-Hour	3-Hour	Annual	24-Hour	Annual
NATIONAL AMBIENT AIR QUALITY STANDARDS						
Primary[a]	80	365	.....	75	260	100
Secondary[b]	...	...	1,300	60	150	100
Wyoming	60	260	1,300	60	150	100
SIGNIFICANT DETERIORATION						
Class I	2	5	25	5	10	N/A
Class II	20	91	512	19	37	N/A
Class III	40	182	700	37	75	N/A
NEW SOURCE PERFORMANCE STANDARDS						
	1.2 lb SO_2 per 10^6 Btu heat input and 90-percent scrubber efficiency.			0.03 lb particulate matter per 10^6 Btu heat input.		If sub-bitiminous coal: 0.5 lb NO_2 per 10^6 Btu heat input. If bituminous coal: 0.6 lb NO_2 per 10^6 Btu heat input.

[a]For the protection of human health.
[b]For the protection of human welfare (aesthetics, plants, etc.).

NOTE: At present, the Utah and Nevada State air quality standards are the same as the Federal standards.

N/A = not applicable
Btu = British thermal units
lb = pound

TABLE 4-2

Estimated Air Quality Impacts from Particulate Matter from the Alton Coal Mine

Component	Estimated Particulate Concentration[a] Annual ($\mu g/m^3$)	Estimated Particulate Concentration[a] 24-Hour ($\mu g/m^3$)	Estimated Impact In Bryce Canyon National Park Annual ($\mu g/m^3$)	Estimated Impact In Bryce Canyon National Park 24-Hour ($\mu g/m^3$)	Estimated Impact In Zion National Park
Alton Coal Mine[b]	10	10	1	1	Negligible

Source: Development of Coal Resources in Southern Utah, USDI, 1979

[a]Uncontrolled fugitive and mining dust.
[b]These concentrations show that the largest impact would be from year-round vehicular traffic on unpaved roads.

NOTE: $\mu g/m^3$ = micrograms per cubic meter

At present, OSM, BLM, EPA, and NPS are preparing studies on the potential air quality impacts and visual intrusions which could occur with the development of coal resources in the Alton coal fields. UII is also conducting a study on those potential impacts. These studies are being performed in order to address the air quality visibility and visual intrusion impact allegations in a petition (Environmental Defense Fund et al., 1979) to OSM to declare certain lands in the vicinity of Bryce Canyon National Park as unsuitable for coal mining. The results of these studies are expected to be available in June 1980.

In the SU document (1979), visibility calculations made from background particulate matter concentrations were compared with calculations from coal mine particulate concentrations to estimate the visibility reduction that would occur at Bryce Canyon National Park. These calculations estimated a visual range reduction from an average of 87 to 85 miles, a 2.3-percent reduction. This estimate is based on 24-hour particulate matter concentration calculations. Possible worst-case impacts associated with shorter duration particulate matter concentrations (i.e., 3-hour or 1-hour concentrations) were not calculated. In another study (done for the NPS), a visual range reduction from 125 miles to 106 miles was calculated. If a smaller particle size distribution assumption was used, the visual range reduction could be as much as 45 miles (64 percent) (Environmental Defense Fund et al., 1979). NPS is presently studying the significance of potential impacts to air quality related values (including visibility) in Bryce Canyon National Park in the joint OSM, NPS, BLM, EPA study identified above. The present policy of NPS regarding visibility impairment is to protect the scenic values of Class I areas from any adverse impairment at human levels of perception.

Studies conducted for coal developments in the western U.S. show that increases in pollution levels of particulate matter, SO_2, NO_2, hydrocarbons, CO, and O_3 can be expected from population growth associated with coal mining operations (EPA, 1977). The area around the Alton coal fields has very good air quality, with the exception of occasionally high windblown dust levels (Development of Coal Resources in Central Utah [CU], USDI, 1979). Based on these two studies, the increases in pollutant levels due to the growth in the Alton area when added to the already low background levels would not be expected to violate the NAAQS.

Construction and Operation of the 2,000-MW Harry Allen and 500-MW Warner Valley Powerplants

There have been five separate air quality modeling analyses performed to estimate the air quality impact of the Warner Valley powerplant on the mandatory Class I area of Zion National Park, the potential Class I area of the Paiute Primitive Area, and Class II areas surrounding the plant. There have been four separate air quality modeling analyses performed to estimate the air quality impacts of the Harry Allen powerplant on the potential Class I areas of the Paiute Primitive Area and the Valley of Fire State Park, and on the Class II areas surrounding the plant. These analyses have been done over a period of time and used different meteorological, emissions, and/or dispersion assumptions. Therefore, the concentration estimates from each of these modeling studies differ. There has also been a change in the New Source Performance Standards (NSPS) emission limitations and other air quality constraints as a result of the Clean Air Act (as amended August 1977) since some of the studies were completed. EPA Region VIII has also recently completed a study which defined the Best Available Control Technology (BACT) for the Warner Valley powerplant . Therefore, in order to give a basis with which to compare the concentration estimates of the individual modeling studies and to bring the studies in line with current legal requirements, the concentration estimates in table 4-3 have been ratioed using the following emissions ratings which are consistent with NSPS and application of BACT:

	Harry Allen (tons per day)	Warner Valley (tons per day)
SO_2	40.80	10.38
Particulate matter	8.16	2.04
NO_x	136.22	34.30

Since the BACT for the Harry Allen powerplant has not been determined, the BACT for the Warner Valley powerplant is assumed to apply to the Harry Allen plant also.

Particulate Matter. As shown in table 4-3, neither the Harry Allen nor the Warner Valley powerplants stack emissions would cause NAAQS or the PSD increment limitations for particulate matter to be exceeded.

Studies by Radian (1980) indicate that PSD Class I increments in the Paiute Primitive Area and Valley of Fire State Park potential Class I areas would not be exceeded when considering only the particulate emissions from the Harry Allen or Warner Valley powerplants (noncumulative).

Sulfur Dioxide (SO_2). Initial studies show that emissions of SO_2 from the Harry Allen and Warner Valley powerplants may cause violations of the PSD Class II SO_2 increments (EPA, 1978). In addition, the PSD Class I increment at Zion National Park may be exceeded by the Warner Valley powerplant (table 4-3). These estimates were based on modeling conducted by EPA Regions VIII and IX and ERT using the Valley Model. NPC is currently responding to EPA requirements for additional meteorological studies and dispersion model evaluations related to the PSD permit review. Tracer release studies were conducted by NPC in January 1980 to further evaluate meteorological conditions and plume behavior around the two powerplants. The results of these studies were presented in EPA Region VIII on May 15 and Region IX on May 19, 1980. EPA Regions VIII and IX are reviewing the results.

Studies by Radian (1980) indicate that the PSD Class I increments in the potential Class I area of the Paiute Primitive Area would not be exceeded by the Harry Allen powerplant. Class I SO_2 increments in the Valley of Fire State Park potential Class I area would be exceeded by the Harry Allen powerplant. The estimated concentrations are presented in table 4-3.

Nitrogen Oxides (NO_x). Emissions of NO_x from the AWV Energy System would not violate NAAQS (table 4-3). There are no PSD regulations pertaining to incremental limitations for NO_x at this time, but the impacts on

TABLE 4-3

Estimated Air Quality Impacts Due to Emissions from the Proposed 2,000-MW Harry Allen and 500-MW Warner Valley Powerplants

	Estimated Concentration ($\mu g/m^3$)					Nitrogen
	Sulfur Dioxide (SO_2)			Particulate Matter		Oxide (NO_x)
	Annual	24-hour	3-hour	Annual	24-hour	Annual
Warner Valley Powerplant						
Class II						
EPA Reg. VIII	a	120.0	a	a	a	a
ERT	7.3	115.0	379.7	1.5	11.6	23.7
Stearns-Roger	1.6	71.2	108.0	0.2	7.2	5.3
State of Utah	14.0	52.0	a	0.9	3.9	a
Class I						
Zion National Park						
EPA	a	9.0	a	a	a	a
ERT	a	a	3.2	a	a	a
Stearns-Roger	0.1	5.0	7.7	.01	0.5	0.4
Paiute Primitive Area						
Radian	<2.0	<3.8	<15.8	<5.0	<10.0	a
Valley of Fire State Park						
Radian	a	a	a	a	a	a
Harry Allen Powerplant						
Class II						
EPA Reg. IX	a	316.1	a	a	a	a
ERT	2.9	21.4	250.9	0.3	1.9	13.6
Bechtel	2.0	92.0	307.0	0.9	9.3	9.8
Class I						
Paiute Primitive Area						
Radian	<2.0	<0.2	<1.0	<5.0	<10.0	a
Valley of Fire State Park						
Radian	2.3	16.6	130.0	0.5	3.3	a

Source: EPA Region VIII letter dated October 23, 1979 from Robert L. Duprey, Director, Air and Hazardous Materials Division to John Arlidge, NPC
Warner Valley, ERT, 1977
Harry Allen, ERT, 1977
NPC, 1975
Modeling Summaries received in Cedar City District Office from EPA Region IX, February 27, 1978

[a]Not calculated.

NOTE: These concentration estimates have been normalized to reflect application of BACT emission controls and compliance with NSPS.

$\mu g/m^3$ = micrograms per cubic meter

atmospheric discoloration and visibility caused by NO_2 emissions would be regulated in Class I areas. These impacts are discussed in the Visibility section of this chapter.

Ozone (O_3, Photochemical Oxidants). There has been concern in recent years about O_3 production from powerplants. O_3 concentrations in powerplant plumes have been found to be lower than ambient levels near the point of emission. O_3 concentrations in the plumes increase to approximately ambient levels far downwind. In urban plumes with higher hydrocarbon concentrations, the O_3 concentration can increase downwind. Even in such situations, the net increase in O_3 has been found to be less than about 10 percent above ambient levels (SU, 1979). Studies by Radian (1980) indicate that O_3 levels from the Harry Allen or Warner Valley powerplants would not cause violations of the O_3 standard.

Plume Opacity. Federal NSPS for particulate matter (Federal Register, Vol. 44, No. 113) specify a limitation of 20-percent plume opacity. Particulate concentrations of fly ash from the stack would be about 0.012 grains per actual cubic foot (0.027 grams per cubic meter) assuming maximum load, worst grade coal, and electrostatic precipitation operating at 99.5-percent efficiency.

Studies conducted for NPC by Stearns-Roger, Inc. and Bechtel Corporation indicate that under normal operating conditions the plumes from the proposed Harry Allen and Warner Valley powerplants would be barely visible at the stack (NPC, 1975). However, during startup operations before the electrostatic precipitators would be able to reach operating efficiency, and during upset conditions, the plume could be highly visible at the stack. Based on operating experience with other utilities, these conditions would be expected to occur infrequently and must be reported within 24 hours of occurrence to the appropriate State BAQ.

Trace Elements. The proposed Harry Allen and Warner Valley powerplants would emit a variety of trace elements into the atmosphere during powerplant operation. At present there are no air quality regulations or standards which limit the trace element emissions from powerplants. Pathways by which trace elements are distributed through the environment are complex and poorly defined, and the long-term accumulation of trace elements from powerplants is not well known.

Maximum ground-level concentrations of trace elements for the proposed Harry Allen and Warner Valley powerplants have been calculated. Generally, calculated concentrations would be below measured background levels, and would not be expected to be significant over the life of the project. These calculations, along with estimated emission rates of trace elements, are presented in tables 1, 2, 3, and 4 of Appendix 12.

The U.S. Fish and Wildlife Service (USFWS) biological opinion of 1978 (Appendix 13) specifies a concern about possible toxic buildups in the environment near the proposed Harry Allen powerplant. In this biological opinion, USFWS indicates that BLM should require the applicants to set up a monitoring program to detect trace elements near the proposed plant site.

Radioactive Nuclides. Radioactive materials are present in any coal, and certain amounts of radioactive nuclides would be emitted from the stack. Maximum ground level exposure from the Allen and Warner Valley plant emissions would fall well below the standards for general public exposure set by the Atomic Energy Commission (now U.S. Department of Energy) (NPC, 1975). The impact of the Harry Allen and Warner Valley powerplants on short-term radioactive nuclide levels would not be considered significant and the impact over the long-term life of the project is not known.

Condensed Water Plumes. Condensation of water vapor emitted from the powerplant stacks and cooling towers would produce a visible plume for a distance downwind from the plant. The length of the Warner Valley stack plume would exceed 500 feet only 25 percent of the time. The length of the cooling tower plume would exceed 500 feet less than 5 percent of the time. The height of the cooling tower plume would be greater than 500 feet less than 20 percent of the time (NPC, 1975).

The stack plume length from the Harry Allen plant would exceed 400 feet approximately 30 percent of the time. Depending on the number of units in operation, plumes longer than 1 mile could be visible between 1 and 5 percent of the time. Cooling tower plumes longer than 100 feet downwind would occur about 22 percent of the time. Plumes longer than 1,000 feet would occur only about 1 percent of the time. The height of the visible cooling tower plumes would exceed 500 feet less than 20 percent of the time and would exceed 1,000 feet less than 1 percent of the time (NPC, 1975).

Because of the distance from major roads, the direction of the prevailing winds, and the arid environment, impacts to motorists from icing and fogging of highways by the cooling tower plumes from the Harry Allen and Warner Valley powerplants would be minimal.

Secondary Pollutants. Gaseous emissions from coal-fired powerplants are carried by atmospheric transport and undergo chemical transformation to form new pollutants (Wilson, 1976). SO_2 may be converted to sulfate aerosols (particulates) and NO_2 may undergo reactions to form nitrate aerosols. Sulfate and nitrate aerosols may travel hundreds of miles and cause air quality degradation. Both sulfate and nitrate particles tend to be small, between 0.2 and 2 microns in size. In the arid southwest, aerosols of this size may be suspended in the air for days before they are removed by natural processes such as wet or dry deposition on soil or vegetation.

The major impacts from these secondary pollutants would be visibility impairment, which is addressed in the following section.

Visibility. Visibility impacts from powerplant plumes are caused by particulates (fly ash), secondary pollutants (sulfates, nitrates), water, and NO_2. These impacts are generally in the form of (1) reduction in visual range, and (2) visibility of the plume itself (plume blight).

The significance of a visibility impairment has been defined by EPA as: ". . . impairment which, in the judgement of the administrator, compromises the visibility value of the mandatory Class I area" (EPA proposed visibility regulations, 40 CFR, Part 51). In the case of the mandatory Class I area of Zion National Park, NPS, in coordination with EPA's PSD permit review, will determine whether the potential visibility impact from the Warner Valley powerplant would be adverse. It is the policy of NPS to protect the scenic values of Class I areas from any adverse visual impairment at human levels of perception (letter from William J. Whalen, Director NPS, to David Hawkins, EPA, Assistant Administrator, Air, Noise, Radiation, April 1979). If the Paiute Primitive Area or the Valley of Fire State Park would be designated Class I, the responsible land manager (BLM or the State of Nevada respectively) would have to determine whether this degree of impairment would be adverse to the air quality related values of this area. This would, in turn, depend upon EPA's visibility regulations, expected in November 1980.

Harry Allen Powerplant

Studies conducted by Radian (1980) indicate that a plume from the Harry Allen plant could occasionally cause perceptible visual impairment when the ambient visual range would exceed 90 to 125 miles. On infrequent occasions when necessary wind conditions for transporting the plume between an observer in the Paiute Primitive Area and distant vistas would be coupled with stable meteorological conditions at plume level, visual impairment might be perceptible, with ambient visual ranges as low as 60 to 75 miles. This worst-case condition would be estimated to cause a 5-percent reduction in visual range (Radian, 1980). Cramer et al. (1978) have indicated that a reduction in visual range of 5 to 10 percent would be a noticeable reduction. Under neutral and stable meteorological conditions, this reduction in visual range would be 2 to 3 percent (Radian, 1980).

The plume travel time, under stable conditions, to the point of maximum visibility impact (line of sight from the Paiute Primitive Area to the Mormon Mountains) would be approximately 5.5 hours (Radian, 1980). Upper air data from Las Vegas and Desert Rock, Nevada indicates that occurrences of stable conditions in the plume environment persisting longer than a few hours are infrequent (Holzworth, 1979).

These three findings (a 5-percent reduction in visual range under stable atmospheric conditions, an approximate 5.5-hour plume travel time, and the infrequent occurrence of plumes in the stable layer for more than a few hours), indicate that the visilibity impact from the Harry Allen plant on the Paiute Primitive Area would be small. The relative significance of these impacts, however, must be determined by BLM (the land manager for the Paiute Primitive Area) if the area is designated Class I.

The plume from the Harry Allen plant would be estimated to cause perceptible impairment of the vistas from the Valley of Fire State Park when ambient visibility would be greater than 60 miles for stable meteorological conditions, and greater than about 90 miles for neutral atmospheric conditions (Radian, 1980). Because of the plume travel time (approximately 3 hours), relatively low levels of reduction in visual range expected, and the infrequent occurrence of stable conditions in the plume environment, the impact of the Harry Allen plant on visibility in the Valley of Fire State Park would be expected to be small. The relative significance of the impacts must be determined by the State of Nevada.

For most of the vistas from the Paiute Primitive Area and Valley of Fire State Park, on those occasions when a plume from the Harry Allen plant would be transported through an observer's field of view, the plume from the existing Reid Gardner powerplant and the Las Vegas urban plume would also be transported through the same area. Under these conditions, the plume from the Harry Allen plant could intermingle with the urban and Reid Gardner plumes to cause further reductions of visual range (Radian, 1980).

Radian chose not to model the most critical case (that of an observer in the Paiute Primitive Area or Valley of Fire State Park looking along the axis of the powerplant plume) because of the uncertainties of using the Gaussian-based visibility models.

Warner Valley Powerplant

Cross plume visual impairment in the Paiute Primitive Area due to the Warner Valley plant could be expected only when the necessary wind and stable plume level meteorological conditions would occur during extremely clear conditions (ambient visibility greater than 210 miles) (Radian, 1980). These conditions, when they exist, would be estimated to cause a 2-percent reduction in visual range (Radian, 1980). Using the definition of Cramer et al. (1978) of a noticeable reduction to be 5 to 10 percent, this impact would not be noticeable. It should be noted that the most critical case (that of an observer in the Paiute Primitive Area looking down the Warner Valley plume centerline) could not be modeled satisfactorily with a Gaussian-based visibility model.

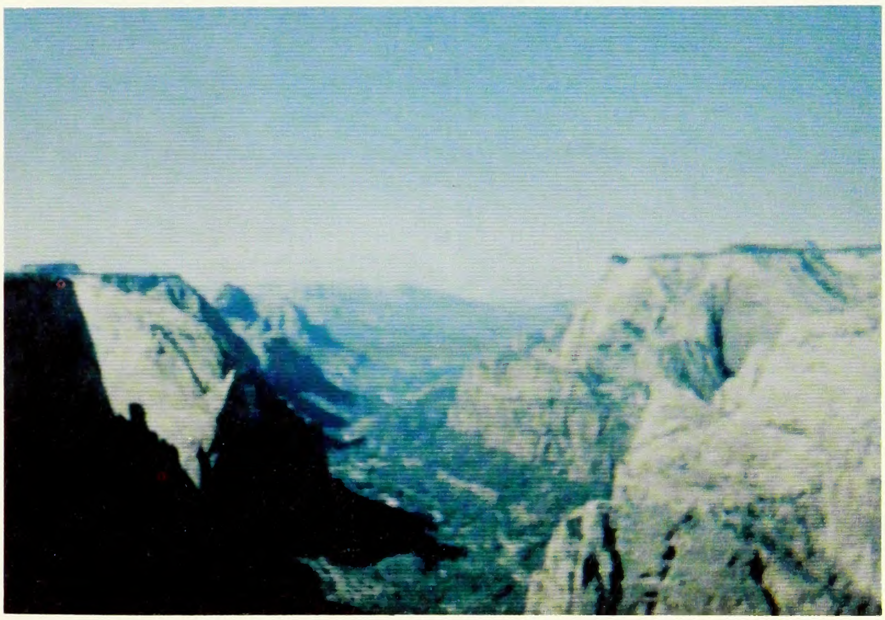
A brown haze or yellow atmospheric discoloration has been observed from other coal-fired powerplants. This condition occurs under generally stable atmospheric conditions in the fall and winter or in the early mornings of spring and summer (Cramer et al., 1978). Based on these observations, a similar condition could be expected at the Harry Allen and Warner Valley powerplants.

From telephotometer measurements made from July to November 1979 (EPA/Environmental Monitoring and Support Laboratory letter, 1980) the visibility resource in Zion National Park exceeded 125 kilometers (kms) 95 percent of the time. NPS has sponsored a study of the potential impacts of the proposed Warner Valley powerplant plume on visibility in and around Zion National Park (Williams, 1980). If stable conditions occur with wind flowing from south-southwest at low wind speed, it would be possible that the plume from the powerplant may be visible from some points in the park.

In order to provide a meaningful representation of the potential impacts, simulated photographs were prepared (figs. 4-1 and 4-2). The study describes the results of application of the simulated photograph technique to the case of Warner Valley powerplant impacts on visibility at Zion National Park. The Los Alamos Scientific Laboratory (LASL) visibility system developed by Williams et al. (1979; 1980) was used to model dispersion, atmospheric chemical transformation, and radiative transfer of emissions from the Warner Valley powerplant. The modeling results were then displayed using a computer-simulated photograph technique. Two scenes were selected which could be potentially impacted by the Warner Valley powerplant. The scenes, Observation Point (figs. 4-1 and 4-3) and Watchman Point (figs. 4-2 and 4-4), are near park headquarters above the Virgin River. Observation Point is elevated with respect to the valley floor and was selected to illustrate potential

PHOTOGRAPH BY NATIONAL PARK SERVICE

EXISTING SITUATION

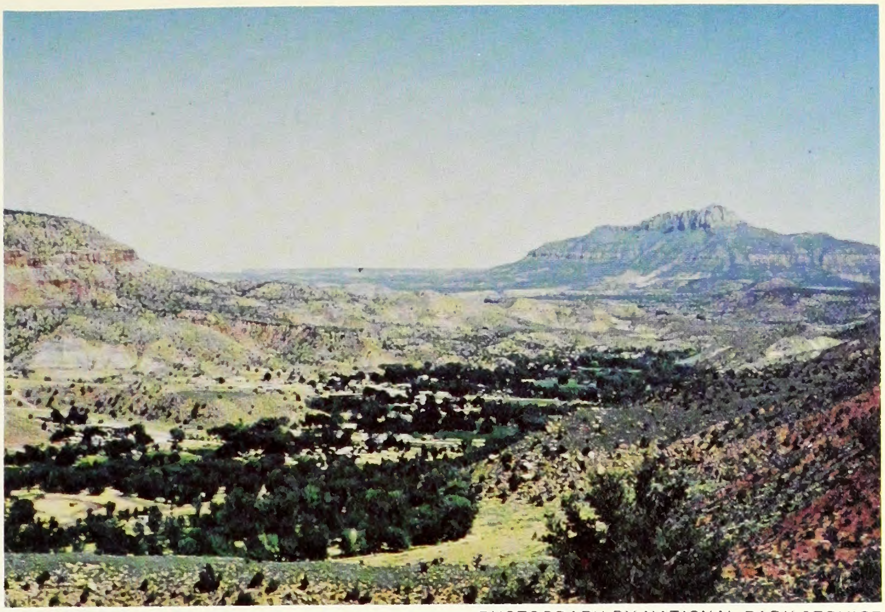


VISUAL SIMULATION BY NATIONAL PARK SERVICE

IMPACTS ON VISIBILITY
(SIMULATED PHOTOGRAPH)

FIGURE 4-1

SIMULATION OF IMPACTS ON VISIBILITY FROM OBSERVATION POINT, ZION NATIONAL PARK



PHOTOGRAPH BY NATIONAL PARK SERVICE

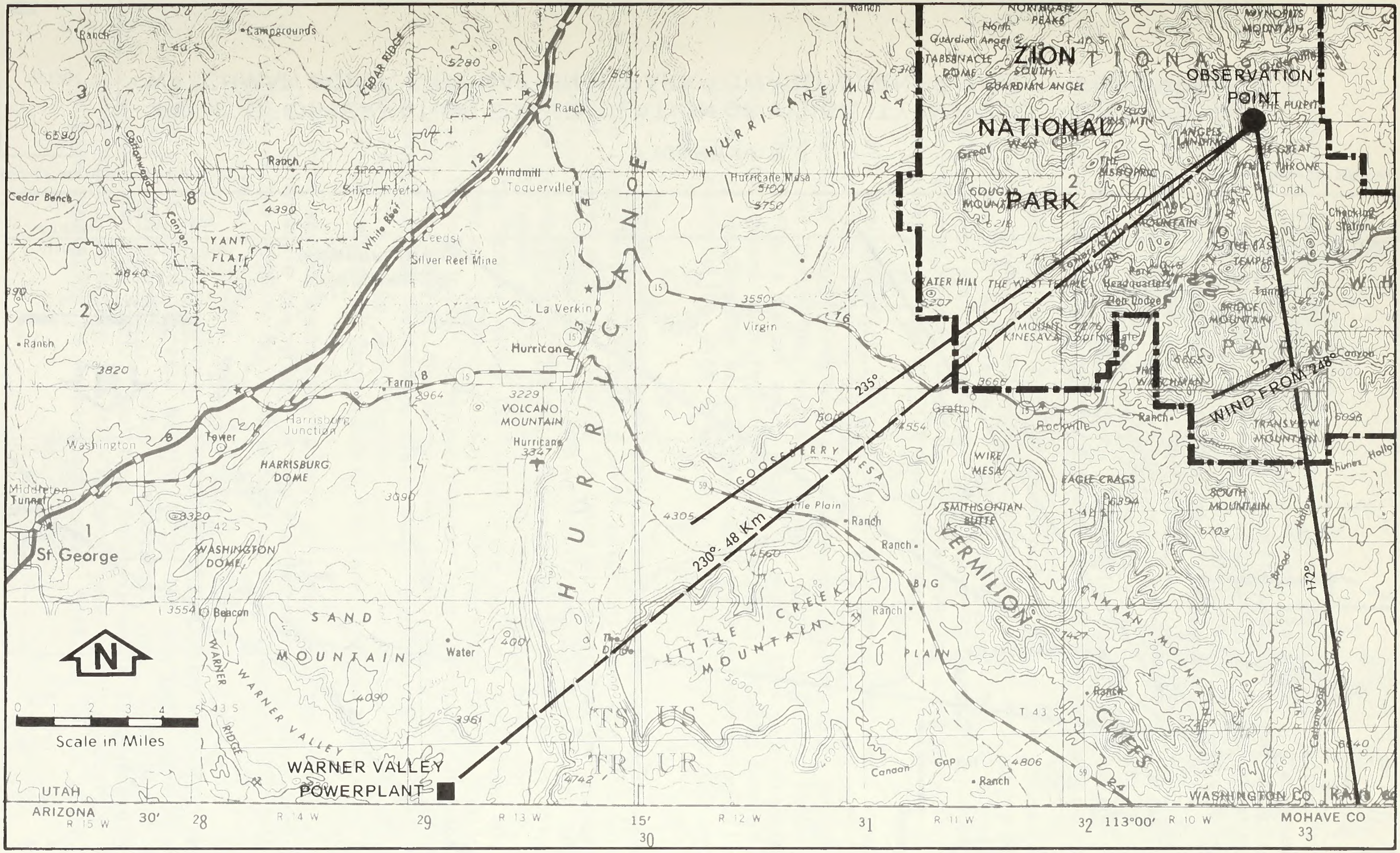
EXISTING SITUATION

VISUAL SIMULATION BY NATIONAL PARK SERVICE

IMPACTS ON VISIBILITY
(SIMULATED PHOTOGRAPH)

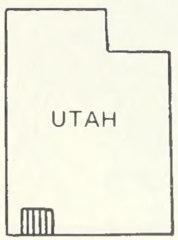
FIGURE 4-2

SIMULATION OF IMPACTS ON VISIBILITY FROM WATCHMAN POINT, ZION NATIONAL PARK



SOURCE: NATIONAL PARK SERVICE

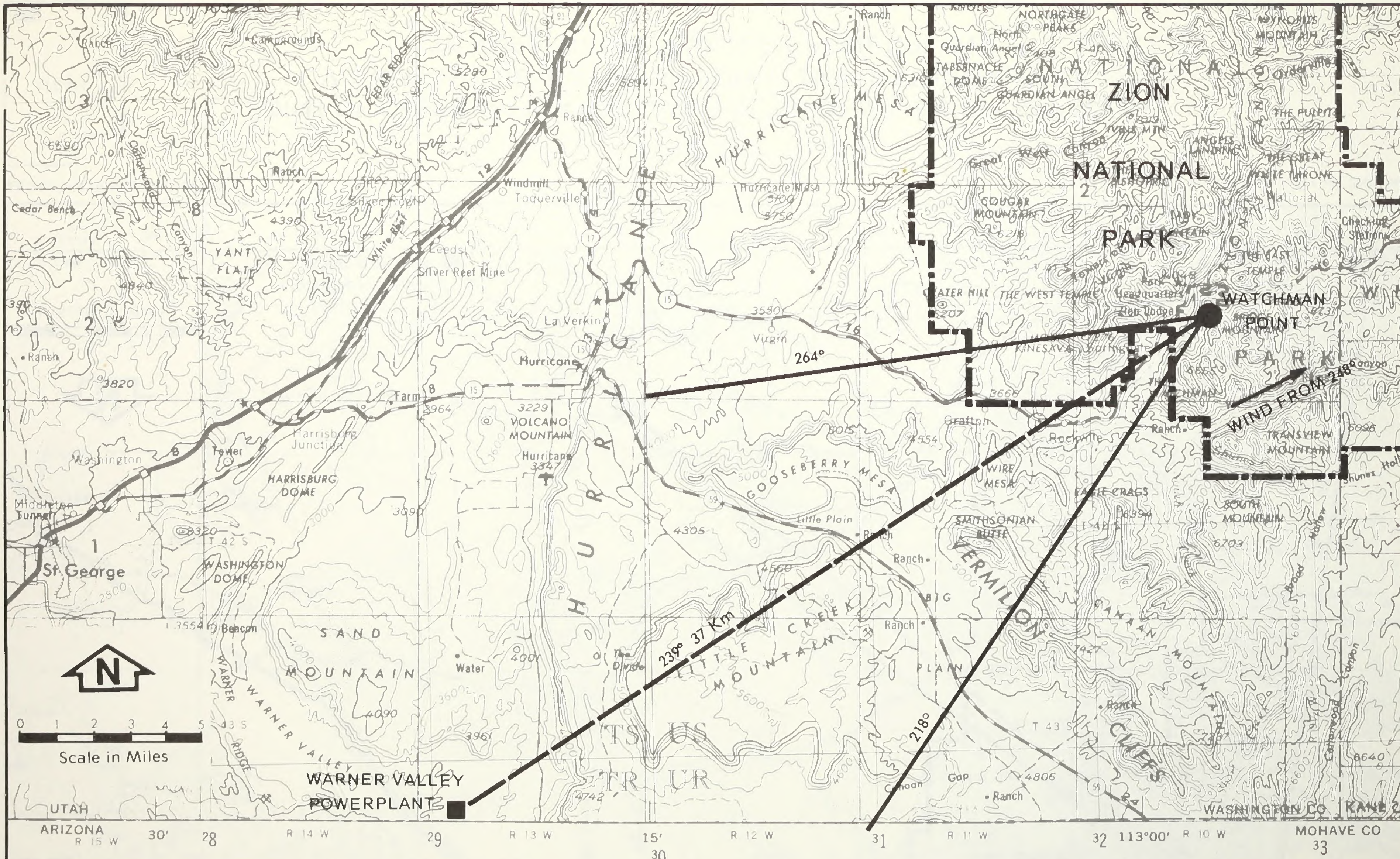
NOTE: Contour Interval 200 Feet



Locator Map

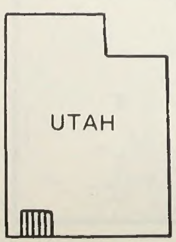
FIGURE 4-3

POINT OF OBSERVATION FOR SIMULATION OF VISIBILITY IMPACTS — VIEW FROM OBSERVATION POINT, ZION NATIONAL PARK TOWARD WARNER VALLEY POWERPLANT



SOURCE: NATIONAL PARK SERVICE

NOTE: Contour Interval 200 Feet



Locator Map

FIGURE 4-4

POINT OF OBSERVATION FOR SIMULATION OF VISIBILITY IMPACTS — VIEW FROM WATCHMAN POINT, ZION NATIONAL PARK TOWARD WARNER VALLEY POWERPLANT visibility impairment as seen against local terrain features. Watchman Point is closer to the valley floor and allows visualizing the potential plume against both the horizon and local terrain features. Photographs of each of the scenes were taken to provide base slides for the computer-simulated photograph technique. In the model simulation, the plume was assumed to rise to a stable layer height sufficient to clear terrain obstacles. In the cases of Observation Point and Watchman Point, light winds were presumed to carry the pollutants in the general direction of the observer. A more detailed discussion of the base photographs, assumed meteorological conditions, observer position, viewing angles, sun angle, powerplant operating conditions, and light scattering properties of the pollutants is given in Appendix 11.

The simulated magnitude of plume blight (under the assumed conditions) which would produce a well defined plume are shown in figures 4-1 and 4-2. The frequency of occurrence of the assumed conditions is not known. Additional studies and analyses may become available before printing the final EIS which could be used to define the frequency of occurrence of plume blight from observation points in Zion National Park.

NPS must judge if the proposed source emissions would have an adverse impact on the visibility at the park. The adverse impact will be judged on the basis of the interference with management, protection, preservation, and enjoyment of the values of Zion National Park, including interference with the the visitor's visual experience. In making this determination, NPS will take into account such factors as the frequency, extent, time of occurrence, intensity, and duration of the impairment. The determination will be made by NPS in coordination with EPA during completion of the PSD permit review process.

Cumulative Impacts. Emissions from the operation of the Harry Allen powerplant could combine with emissions from the Reid Gardner powerplant located at Moapa, Nevada to cause increased ambient pollutant concentrations. EPA has notified NPC of its intent to approve the addition of a 250-MW fourth unit to the Reid Gardner plant. Addition of this unit would bring this plant within 97 percent of the 24-hour NAAQS for SO_2 and 84 percent of the 24-hour NAAQS for particulate matter. Unit four would also use up 75 percent of the 24-hour Class II PSD increment for SO_2 and 19 percent of the particulate matter increment (letter from EPA to NPC, November 5, 1979). In order to construct the Harry Allen plant, NPC must show compliance with the NAAQS and PSD increments alone and in combination with other sources in the area, i.e., the Reid Garnder plant. EPA Region IX is assessing these cumulative impacts as part of their PSD permit review process.

There are no known developments proposed near the Warner Valley powerplant which would use up part of the PSD increments or otherwise cause violations of the NAAQS to occur when combined with concentrations from the Warner Valley plant.

Population Growth. The peak construction workforce for the Harry Allen plant would increase population in the Las Vegas area by less than 2 percent (Socioeconomics, Centaur Associates, Inc., 1980). The air quality impacts from this small population increase would be negligible. The peak construction workforce for the Warner Valley plant would be expected to increase population in Washington County, Utah, by about 8,000 people (33 percent). This population increase would generate increased emissions of air pollutants. However, studies sponsored by EPA (1977) show that the increased emissions from growth of this magnitude would not be expected to violate the NAAQS.

Nonattainment Area of Las Vegas. Violations of the NAAQS for particulate matter, CO, and O_3 have been measured in the Las Vegas Air Quality Maintenance Area. The area has therefore been classified nonattainment for the three pollutants.

The impacts from the Harry Allen powerplant on ambient concentrations of total suspended particulates and CO in the Las Vegas nonattainment area would be expected to be minor - less than one-half the values identified by EPA as significant (Federal Register, Vol. 43, No. 118). Significance values have not been established for O_3. However, an evaluation of meteorological conditions associated with historically high O_3 episodes, and a comparison of emissions and calculated ambient concentrations of reactive hydrocarbons and NO_x (O_3 precursors in the photochemical process) with existing emissions of these pollutants in the nonattainment area, indicate that peak O_3 concentrations would not be increased (Radian, 1980).

Construction and Operation of the Alton Coal Preparation Plant and Pipeline

No significant impacts would result from these components.

Water Resources

Major components which would bring about significant impacts to water resources under this alternative would include: the Alton coal mine and coal preparation facility; a coal slurry pipeline system; the Warner Valley water project; construction of the Harry Allen powerplant; and the diversion of effluent from Las Vegas Wash to the powerplant. Water requirements for mining and coal slurry preparation in the Alton coal fields would be about 10,000 acre-feet per year when averaged over the life of the project.

Mining in the Alton Coal Field

General impacts of surface coal mining on water quality and quantity in the Alton fields have been addressed in SU (1979) and in EMRIA Report No. 4 (BLM et al., USDI, 1975). Essentially, these impacts would be those associated with overburden removal and replacement, mining and ancillary facilities and wastes, and reduction or alteration of spring and stream flows due to ground water pumping. The following is a summary of these impacts.

Removing and replacing the overburden during surface mining activities would contaminate ground water from increased leaching of disturbed material because total dissolved-solids (TDS) concentrations could increase two or more times and a high concentration of nitrate in overburden material indicates that water in saturated overburden could become nitrate contaminated and unsuitable for human consumption. Sulfur content of the coal is generally less than 1 percent and acid formation would probably not occur. If acid would be produced from sulfur in the refuse, bicarbonate concentrations in water would buffer the pH to acceptable limits (pH of 6.0-7.5).

Contaminated ground water would probably be restricted to the vicinity of the mine because little water movement would be expected through the replaced overburden (SU, 1979). Aquifer properties of the mine backfill would probably be poor and though the fill may become saturated, it would be too poorly sorted to produce good well yields. Present aquifer characteristics also appear to be poor (Hydrologic Evaluation, U.S. Geological Survey [USGS], USDI, 1979), so the net change may be slight.

Accelerated erosion and associated reductions in water quality and quantity would occur on an undetermined acreage depending on the location of surface and subsurface mining and ancillary facilities. Erodibility of the soils varies widely over the area (EMIRA, USDI, 1975). Both surface and subsurface water quality and quantity would be adversely affected on 10,154 acres of the mining permit area.

As many as 22 springs in their present location and condition could be altered by surface mining, depending on the mining plan. The combined flow of the springs averages about 100 to 150 acre-feet of water per year. Water originally discharging from these springs may discharge from other areas on the same watershed.

Erosion and sediment yield to streams would be accelerated by surface mining. Sediment loads would be expected to increase in Kanab, Thompson, and Skutumpah Creeks, and Meadow Canyon Wash (Paria River Watershed). The sediment load passing from the mine area could create maintenance problems of sedimentation at downstream irrigation diversions and canals. In addition, increased sedimentation may occur in stream channels directly below the mine site, perhaps into lower Kanab Creek and Johnson Wash.

Increased sediment yields would occur from exposed soils between the time of disturbance and reclamation. Higher sediment yields would be expected if additional water would be introduced into stream channels from diversions around the mining area, runoff from new mine roads, or possibly from dewatering of the overburden or coalbeds. This would result in erosion of stream channel banks or beds, particularly where water would be introduced continuously into channels that were formerly dry most of the time. Increases in sediment yield would be temporary in areas where reclamation efforts would be successful, but reclamation may be hampered by the lack of topsoil, poor physical and chemical soil characteristics, and the variability of precipitation (EMRIA, USDI, 1975).

Water in and above the mined coal beds would be removed during the mining process by pumping or simply by gravity drainage. The quantity and quality of the water in these beds has not been sufficiently defined to be analyzed quantitatively (Hydrologic Evaluation, USDI, 1979). The total quantity of water may be between 6,000 and 10,000 acre-feet (SU, 1979). The quality of the water in five samples from the Dakota and Tropic geologic formations (in which the coal beds lie) ranged from 444 to 2,760 milligrams per liter (mg/ℓ) of TDS. It is possible that the salinity may vary significantly from one area to another. The salinity of ground water intercepted by surface mining could be twice the salinity of the nearest drainage. Releasing this poorer quality water to the surface drainage could increase the salinity of the streamflow. The resulting flow and salinity would depend on the actual amount and quality of the added ground water, values which cannot be accurately identified at the present time. The impacts of such a situation are unknown.

An undetermined amount of subsidence could occur in areas of underground mining. Depending on the area, this may result in alterations in streamflow. The extent of this damage cannot be quantified. The Surface Mining Control and Reclamation Act of 1977 (PL 95-87) provides guidance and mitigation designed to protect alluvial valley floors in coal mining areas. OSM, in conjunction with BLM, will delineate the alluvial valley floors in the Alton area during investigations which will be used as a basis in the unsuitability determination for the Alton coal fields.

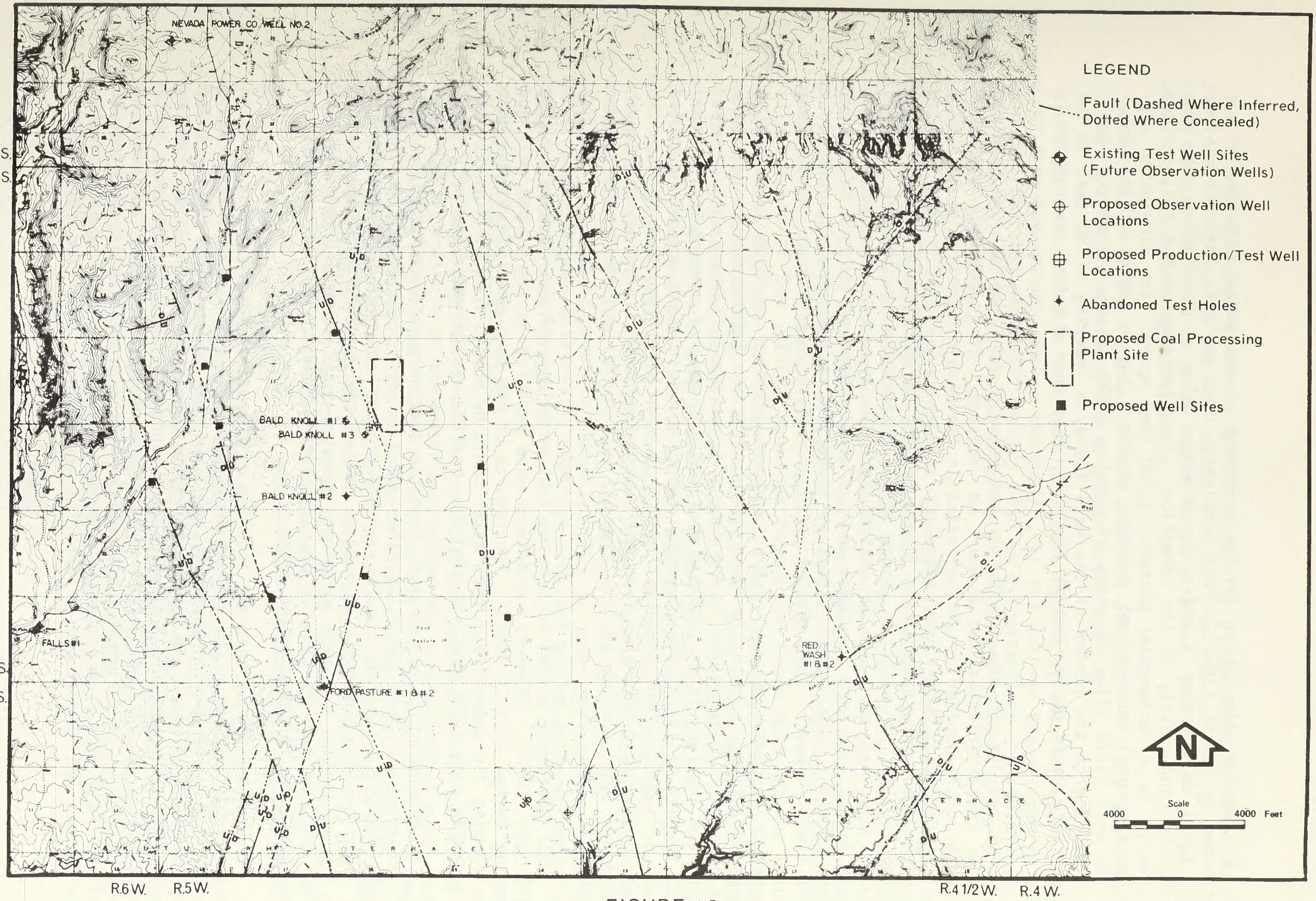
Ground Water Pumping for Coal Slurry

The applicants propose to obtain water from 13 deep wells (1,100 to 1,500 feet) in the Navajo Sandstone Formation to be used for the slurry of mined and processed coal. The proposed locations of the wells are within 3 miles of the plant site at Bald Knoll (figure 4-5). Only six of the wells would be pumped simultaneously at full production, two would be standby, and five would be unused or used as monitoring wells.

Impacts of Pumping. Using a specific yield of 0.04 and a saturated thickness of 1,100 feet (Chapter 3, Water Resources), the maximum ground water available to wells by lowering the potentiometric surface to the base of the upper member of the Navajo Formation would be 28,160 acre-feet per square mile. Assuming that this saturated thickness and specific yield are constant for the Navajo Formation within a 3-mile radius of the plant site, over 780,000 acre-feet of water would be available beneath this area. This compares with a total need of about 339,000 acre-feet during the entire life of the project.

The foregoing calculation of available water is based on the assumption that the specific yield and saturated thickness would remain constant over the well field area. Unfortunately, the test wells in the Alton area that provide information on water table elevation are relatively close together (within 2,000 feet) and no reliable measurements of saturated thickness are available for proposed well sites at a greater distance from the plant site. The numerous faults in the area as mapped by Goode (1973) could cause localized increases or decreases in saturated thickness. In addition, the saturated thickness of the Navajo Formation decreases rapidly to the south because the water table is apparently much flatter than the dip of the base of the upper member. More test drilling showing the saturated thickness in all directions from Bald Knoll, but particulatly to the south, would be necessary before accurate estimates of storage could be made.

The real issue regarding the proposed Navajo ground water withdrawals is not the amount of water available, but whether pumping would affect existing or pending water rights. To determine this, an estimate of the areal extent of the cone of depression due to pumping in the Navajo Formation would have to be made. To accurately determine the extent of water table drawdown, a long-term pumping test using strategically placed observation wells would have to be conducted. No such test has been conducted to date by the applicant.



NOTE: Contour Interval 100 Feet

FIGURE 4-5

TEST WELLS AND PRODUCTION WELL SITES IN THE VICINITY OF THE PROPOSED COAL PREPARATION PLANT

A computer simulation of the proposed ground water withdrawals was performed by Guisti (1977). This simulation used geologic information from Bald Knoll Well Number 1 and a conservative value of 0.5 feet per day for hydraulic conductivity of the formation. The simulated well field included six wells in a rectangular pattern, 3,000 feet apart. The simulation predicted a several hundred-foot drawdown within a 2-mile radius of the center of the well field after 35 years of pumping 6,000 gallons per minute (gpm). At 5 miles from the center of the well field, a lowering of 30 feet in the water table would occur; and at 10 miles, less than a 1-foot lowering would occur.

The results of the simulation demonstrate only one set of possible aquifer characteristics and assumed no recharge. It is possible that much more favorable aquifer conditions exist in the Navajo Formation beneath Bald Knoll. Cordova (1978) found hydraulic conductivities of 2.1 feet per day based on laboratory samples and 5 feet per day based on field tests in Washington County. In addition, Goode (1966) estimated a recharge of at least 30,000 acre-feet per year in western Kane County. Both of these factors would reduce long-term drawdowns and the areal extent of the cone of depression. However, the actual effect of these factors cannot be quantified at this time. However, this simulation did not take into account the numerous faults around Bald Knoll as mapped by Goode (1973), and if these faults penetrate into the aquifer, hydraulic conductivities could be increased in these directions. Presently there is insufficient information to determine the extent of these faults in the Navajo Formation. If the faults do penetrate the aquifer, it is probable that the influence of pumping would extend much farther in the strike direction (north to south) than across the faults (east to west). This potential effect is especially important because the nearest sources discharging from the Navajo Formation lie in Johnson Canyon and Kanab Creek, south of the proposed well field, and could have reduced discharges (fig. 3-2).

UII performed a limited pumping test on Bald Knoll Well Number 3 during 1978 (UII, 1979). However, drawdowns were measured in the pumped well and pumping lasted only 10 hours. The results of the test are inconclusive, but the pumping did demonstrate that water could be pumped from the formation at a moderate rate (270 gpm) and that the quality of the water was very good.

No determination can be made from the available information to conclude if interference would occur to other existing or potential aquifer users. Under the worst possible conditions, the cone of depression could extend 10 to 15 miles in a southerly direction. Water tables could be lowered enough to dry up springs or cause additional pumping costs to well operators. The time required for the cone of depression to extend this distance cannot be determined due to insufficient data.

Figure 4-5 illustrates the location of the wells in surrounding areas in relation to the test wells at Bald Knoll where the proposed well field would be located. The two northernmost wells in the canyon would be the first sources to be affected and would receive the greatest drawdown if the cone of depression extends beyond 7 miles. Other sources to the south of these wells are probably in the Lamb Point Tongue of the Navajo Sandstone, and would be less likely to be affected, particularly if the project wells would not be drilled into this lower member. However, the presence of a ground water divide has not been shown by drilling and is only theorized (UII, 1979).

Springs in Kanab Creek in the vicinity of Big Lake might be affected if the cone of depression extends beyond 9 miles from the well field. For the Kanab city wells in Three Lakes Canyon to be affected, the cone of depression would have to extend beyond 12 miles.

Springs in Dixie National Forest could be affected if there would be a loss in hydrostatic pressure due to ground water pumping.

It is also possible that no significant impacts to existing users would occur from the ground water withdrawals. If the average transmissivity and saturated thickness are sufficiently high in all directions from Bald Knoll, then measurable effects from pumping may not reach the nearest source during the life of the project.

Role of Utah State Engineer. In 1964, UII filed applications with the Utah State Engineer for the appropriation of ground water for seven areas situated between Alton and Kanab. (UII has now concentrated its proposed water development to a single area within a 3-mile radius of Bald Knoll). To this date, the State Engineer has not approved any applications, and existing applications are presently listed as "Pending - Not Approved" (personal communication, Utah State Engineer, November 20, 1979).

The Area Engineer in Cedar City has indicated that approval of the application cannot be made if there is known or even suspected interference with existing approved water rights (Appendix 14). In addition, there are a number of other approved applications for ground water that have not yet been completely developed and it is not known what effect these proposed developments would have on existing water supplies. It was indicated that without test pumping data from a developed well field, it would be impossible for the State Engineer's Office to complete an analysis of the situation. Consequently, the burden of proof is placed upon UII to show, by long-term pumping tests on a developed well field, that its proposed ground water withdrawals would not affect existing aquifer users.

Warner Valley Water Project

The analyses of the Warner Valley water project consist of two components: (1) an analysis of the reservoir system and proposed water uses, and (2) an analysis of the effects of diversions and the subsequent flow regime of the Virgin River below the proposed diversion site. Both analyses are based on simulated flows for the years 1940 through 1975 which were prepared by Dr. Norm Stauffer, Utah Division of Water Resources (December 5, 1979). The simulation assumed construction of the Kolob Water Project which would annually transfer 6,500 acre-feet from the Virgin River to Cedar City, Utah. In the absence of this project, the additional 6,500 acre-feet of water could increase the proposed reservoir yield.

Based on the simulation, approximately 56,100 acre-feet would be diverted annually at the proposed Hurricane diversion site. Of this, 37,700 acre-feet would be routed to the proposed Warner Valley reservoir. The remainder (18,400 acre-feet) would satisfy existing water rights in the Hurricane and LaVerkin areas. Estimated annual losses due to evaporation and seepage would reduce the diverted 37,700 acre-feet to a reservoir average annual yield of 32,600 acre-feet. According to the Utah Division of Water Resources

(Stauffer, December 5, 1979), this would be the average amount of water that would be available for allocation each year.

The actual yields as predicted by the simulation, however, would vary between 16,000 and 63,000 acre-feet due to fluctuations in yearly precipitation. Since the average annual yield predicted by the simulation is 32,600 acre-feet, it appears unlikely that the 49,400 acre-foot annual delivery schedule as proposed by the Washington County Water Conservancy District (table 2-3) would be realized.

According to NPC (1975), the proposed Warner Valley powerplant (500 MW) would use an average of about 5,830 acre-feet per year from the reservoir. However, up to 10,000 acre-feet per year could be used, depending on climatic conditions, coal burn rates, and consumer electricity demand. An additional 8,000 acre-feet per year would be used for supplemental irrigation on presently irrigated land in Washington County.

Therefore, of the 32,600 acre-foot average annual yield of the reservoir, only 14,600 acre-feet would be available to meet potential uses (table 2-3; fig. 2-7). This analysis assumes that the powerplant would consumptively use 10,000 acre-feet of water annually and that the dead storage volume of 5,000 acre-feet would be stored the first year the available water supply would exceed the two firm commitments (Note: if the average powerplant requirement of 5,830 acre-feet is used to compute the water supply available for potential uses, an average of 18,770 acre-feet would be available annually).

Based on 14,600 acre-feet available annually and a Utah State Division of Health requirement of 800 gallons per day per connection on an average annual basis, approximately 16,300 new domestic water connections could be available to the Washington County area. This would correspond to approximately 41,000 new residents if 2.5 persons/per hook up is assumed. (Note: corresponding figures for the 18,770 acre-foot yield would be approximately 20,900 new connections or 52,250 new residents). These are rough estimates only and do not take into account treatment and transportation losses, etc.

Table 4-4 lists present available supply and projected baseline water requirements for the communities with proposed uses. From this table it does not appear likely that the additional reservoir water supply available (14,600 acre-feet) would be used for domestic purposes before the year 2000, especially if full treatment would be required (see Reservoir Water Quality and Quantity below). Perhaps other interim uses such as fisheries or recreation could be developed to utilize this available capacity, but no specific plans have been proposed.

Reservoir Water Quality and Quantity

Water quality in the proposed Warner Valley reservoir was projected in a study by BLM (Gebhardt, 1977). Average TDS would range between 500 and 600 mg/ℓ depending on evaporation and the influence of the geologic formations underlying the reservoir. Apparently, TDS would be the only chemical parameter exceeding State of Utah recommended drinking water standards. The water would be of poorer quality than the ground water sources from which the city of St. George presently obtains culinary water. According to the State of Utah Department of Social Services, Division of Health (1975), the water

TABLE 4-4

Present Water Supply and Projected Water Requirements
(Expressed in Million Gallons Per Day)

City	Present System Supply Capacity	Projected Water Requirements 1980	2020
St. George and Bloomington	14.057	4.926	10.987
Ivins	0.585	0.199	0.444
Santa Clara	1.103	0.327	0.730
Washington	[a] 1.8	1.009	2.251

Source: Centaur Associates, Inc., 1980

[a] This capacity should satisfy demands through the year 2000.

from the reservoir would require full treatment before it could be used as a culinary source. This would include flocculation, sedimentation, filtration, and disinfection.

Turbidity levels in the reservoir would be seasonal. Turbidity would be low during summer months, but high during the winter and early spring when the reservoir would receive most of the inflow from the Virgin River. In addition, a combination of the inflow regime, drawdowns of the magnitudes listed above, and local climatic conditions would cause water temperatures and related dissolved gases to fluctuate seasonally. Therefore, recommended temperature and dissolved oxygen limits for warm water fish could be exceeded occasionally and fisheries potential could be limited (Thurston et al., 1979).

Based on 7 years of sediment data collected at the Hurricane gaging station and quantitative analysis procedures used by Vaughn Hansen Associates (Endangered Fish, 1977), approximately 265,000 tons of sediment would be diverted annually under the proposed diversion schedule. Of this, about 20 to 25 percent would be returned to the river by the proposed vortex sediment ejector system (Endangered Fish, Vaughn Hansen Associates, 1977). Of the remaining 212,000 tons, approximately 20 percent would be deposited on irrigated farm lands near Hurricane, and the remaining 170,000 tons would flow into the Warner Valley reservoir. At this rate, the reservoir's 5,000 acre-foot dead storage capacity would be filled in 50 to 60 years. Continued sedimentation beyond this date would reduce usable storage capacity of the reservoir.

Based on the computer simulation, the storage in the reservoir would fall below 20,000 acre-feet about 5 of every 35 years. Storage would fall below 10,000 acre-feet about 1 of every 35 years. These low storage conditions would apparently only occur following 2 or more consecutive years of low flow in the Virgin River (below 90,000 acre-feet per year near Virgin).

A 20,000 acre-foot storage level corresponds to about 60 feet of drawdown from maximum storage, and to a 325-acre surface area, or about 45 percent of the maximum surface area of 750 acres (Bingham Engineering, 1977). These conditions would adversely affect recreation and fisheries potential by occasionally dry docking boat launch ramps, destroying spawning habitat, and creating large mud flats (due to the large amount of fine sediment diverted into the reservoir). Drawdowns are based on the applicants' proposed delivery schedule (table 2-3).

Reservoir Safety

Failure of the proposed Warner Valley dam would result in a flood wave and flow at least as damaging as a standard project flood. This magnitude flood was identified by the Army Corps of Engineers (Virgin River and Fort Pierce Wash Floodplain Study, U.S. Department of Defense, 1973). The flood wave from the reservoir would likely destroy or greatly damage numerous homes in the Bloomington area and would destroy or damage four bridges on the Virgin River above the narrows. A breaching study for the Warner Valley dam, conducted by the Bureau of Reclamation in July 1977 showed that outlet works of the proposed dam would successfully pass a 100-year flood event without overtopping or failure (Gebhardt, 1977).

New springs may occur on the west side of Warner Ridge as a result of the reservoir. Water could move through the Shinarump member of the Chinle Formation and issue from the Moenkopi Formation (Bingham Engineering, 1977). These springs would discharge on adjacent public lands and would ultimately empty into the Virgin River. The likelihood or extent of the flow of these springs cannot be estimated.

Effects on the Virgin River System

Impacts to the Virgin River system below the diversion will be analyzed by river segments. Table 4-5 lists pre and postproject median flows, again based on a computer simulation by Utah Division of Water Resources (Stauffer, February 5, 1980).

The State of Nevada wishes to enter negotiations with the State of Utah on their proposed Virgin River water compact. Such a compact could result in modifications to the Warner Valley water project and proposed diversion and delivery schedules. The State of Utah has, to date, declined to enter into negotiations.

Hurricane Diversion to St. George-Washington Fields Canal. Based on the computer simulation, average annual flows bypassing the proposed Hurricane-Warner Valley diversion would be about 61,000 acre-feet. This would reduce the annual flow bypassing the diversion by about 38 percent. Median flows bypassing the diversion would be reduced by more than half during the winter and spring (table 4-5).

Of the 265,000 tons of sediment diverted (yearly average), the desilting works would be expected to return about 53,000 tons of sediment to the river. This sediment would be carried downstream by the remaining 61,000 acre-feet of water passing the diversion. In addition, flows with the highest concentrations of sediment (greater than 20,000 mg/ℓ), would be allowed to pass the new diversion. Consequently, the average annual suspended sediment concentration below the proposed diversion would increase by much as 80 percent per year (from 11.97 tons to 21.52 tons per acre-foot of water). The net effect of the diversion and desilting works would be to decrease the total load carried by the river by about 6 percent and increase downstream concentrations of suspended sediment perhaps by as much as 80 percent per year.

CP National Utilities Company presently diverts 40 cubic feet per second (ft^3/s) when available at the LaVerkin diversion for hydroelectric power generation for the town of LaVerkin, Utah. The proposed diversions for the water project would not reduce the present 40 ft^3/s diverted for the powerplant, but would preclude CP National plans for expansion of the powerplant use of the present 40 ft^3/s diversion to their existing diversion right of 100 ft^3/s.

With CP National continuing to divert 40 ft^3/s for hydroelectric power generation, and the Warner Valley water project diversion, the river would be expected to be dry from the LaVerkin diversion to LaVerkin Springs about 30 to 40 percent of the time, including some winter and spring months of dryer years. By comparison, preproject, no-flow conditions below the LaVerkin diversion probably occur about 10 to 20 percent of the time of an average flow year and are almost completely restricted to summer months.

TABLE 4-5

Median Flows of Virgin River at Selected Sites
(Expressed in Cubic Feet Per Second)

	At Virgin, Utah	Below Hurricane Diversion	Hurricane Gaging Station	Below Washington Fields Diversion	Before Confluence With Santa Clara River	At Littlefield, Arizona
Preproject						
October	110	65	90	20	55	115
November	125	125	140	100	160	170
December	135	135	160	120	190	200
January	135	135	175	135	215	210
February	130	130	175	165	220	205
March	180	180	205	135	240	215
April	200	150	230	95	205	245
May	190	140	190	0	155	170
June	90	40	75	0	45	70
July	85	45	85	5	25	150
August	105	65	110	40	45	150
September	95	55	75	10	25	95
Applicants' Proposal						
October	110	45	75	5	60	[a]120
November	125	60	70	30	85	95
December	135	45	70	30	85	95
January	135	40	85	45	95	90
February	130	40	85	45	95	80
March	180	80	105	65	120	95
April	200	75	125	35	105	145
May	190	70	105	15	95	110
June	90	40	75	1	80	105
July	85	45	85	5	65	190
August	105	40	90	20	60	165
September	95	45	75	10	50	120
USFWS Proposal						
October	110	45	75	5	55	[a]115
November	125	100	110	70	120	130
December	135	85	110	70	120	130
January	135	70	110	70	115	110
February	130	70	110	70	115	100
March	180	100	110	65	120	95
April	200	80	130	75	105	145
May	190	85	125	15	100	115
June	90	40	75	5	65	90
July	85	40	80	5	45	170
August	105	40	90	20	45	150
September	95	40	70	10	35	105

Source: Simulations by Dr. Norm Stauffer, Utah Division of Water Resources, 1980.

[a]Estimations of Littlefield flows are based on preproject accretions between Bloomington and Littlefield Springs, Arizona.

LaVerkin Springs, about 2 miles downstream from the LaVerkin powerplant diversion, would add 11 ft^3/s yearlong and would consequently be for much of the year the only source of flow 1 mile downstream to the powerplant inflow.

Average water quality would be impaired below LaVerkin Springs because of the decrease in flow available to dilute the highly saline LaVerkin Springs flow. TDS concentrations would range from 900 to 9,600 mg/ℓ yearlong down to the powerplant and would probably average 9,600 mg/ℓ about 30 to 40 percent of the time. At the powerplant return flow, dilution by 40 ft^3/s would reduce the annual average to about 1,550 mg/ℓ, an increase of about 400 mg/ℓ over preproject conditions.

Between the LaVerkin Springs and the Hurricane gaging station, the median inflows from tributaries, agricultural return flows, and ground water would be estimated to be about 20 ft^3/s from June to December, and 40 ft^3/s from January through May.

The resulting median flows at the postproject Hurricane gaging station would be estimated to range from 70 to 125 ft^3/s yearlong, with flows over 100 ft^3/s during the spring (table 4-5). Low flows during summer months would not be changed significantly since additional water would not be diverted at the proposed Hurricane-Warner Valley diversion under these conditions.

Based on the available data, it appears that average salinities near the Hurricane gaging station would increase approximately 175 mg/ℓ annually, from 1,150 to 1,325 mg/ℓ. Salinity is inversely related to flows; generally the higher the flow the lower the salinity because of the effect of flow on dilution of the LaVerkin Springs water (208 Water Quality Study, Vaughn Hansen Associates, 1977). The increase in salinity may cause the remaining flows in the river to be less suitable for irrigation water at the St. George - Washington Fields diversion. However, impacts to these users may be negligible or slight during summer months since high quality reservoir releases would supplement water diversions from the river. The net effect may be an improvement of irrigation water for use in the St. George - Washington Fields areas.

The impact of the increased sediment concentrations on downstream water users would probably be minimal. While the remaining water in the river would be carrying more sediment on the average, concentrations would generally be well below 10,000 mg/ℓ and would not be prohibitive for diversion for agriculture. In addition, the new diversion would probably not increase the frequency of flows with extremely high concentrations of suspended sediment greater than 20,000 mg/ℓ, which generally would not be diverted for irrigation.

St. George - Washington Fields Diversion To Bloomington. Following construction of the project, nearly all flows from May through October would be diverted at the St. George-Washington Fields diversion. Median flows bypassing this diversion would be reduced by half or more during June through October and reduced by two-thirds from November through May. This assumes that the Washington Fields Canal Company would divert up to 95 ft^3/s during the summer and from 40 to 70 ft^3/s during the winter and spring.

Flows bypassing the diversion would generally be less than 35 ft^3/s most of the year, except for the spring months when flows could exceed 45 ft^3/s about half the time.

Flows would increase downstream from ground water influx and irrigation return flows to where postproject flows generally would be expected to be greater than 50 ft^3/s year round at Bloomington. The median flow would be expected to increase, and possibly double during the summer months because of increased return flow from reservoir releases. Winter and spring flows, however, would be reduced by about one-half (table 4-5).

Salinity concentrations below the St. George-Washington Fields diversion would be increased further from present irrigation return flows, although specific TDS values are unknown. This effect would be greatest during the summer months. The total flow and water quality of the Virgin River below the diversion are partially attributable to ground water accretions, generally of poor water quality (208 Water Quality Study, Vaughn Hansen Associates, 1977). Whether or not the supplemental irrigation would alter the existing ground water component (quality or quantity) is unknown.

Average annual flow would be expected to be reduced by at least 21,000 acre-feet at Bloomington (table 4-6). This figure is based on the calculations of consumptive use for each of the proposed uses of the water project assuming the following:

1. Reservoir seepage and annual losses of 5,200 acre-feet would not be returned to the river (Stauffer, February 5, 1980).

2. Powerplant consumption would be 10,000 acre-feet per year.

3. Municipal and industrial losses would be about 40 percent of the reservoir water intended for those purposes (5,800 acre-feet). The remainder (8,800 acre-feet) would be returned to the river.

4. Since 8,000 acre-feet of water have been identified for supplemental irrigation needs on existing irrigated acreage, no significant increase in agricultural consumptive use would occur. The supplemental irrigation may increase ground water influx into the Virgin River system, but the probability or magnitude of this situation is unknown. If a significant increase in irrigation would occur, replacing proposed municipal and industrial uses, the total consumptive loss to the Virgin River system could be greater because of the greater consumptive use efficiency of irrigation, approximately 55 percent compared to 40 percent (208 Water Quality Study, Vaughn Hansen Associates, 1977).

Bloomington, Utah To Lake Mead, Nevada. The Virgin River loses an average 51 ft^3/s to infiltration above the Virgin River Gorge. If the flow at Bloomington would be less than the infiltration capacity, then no water would enter the gorge and the river would be dry to Littlefield Springs.

Summer flows at Littlefield, Arizona would be augmented with releases from the proposed reservoir and return flow. Median flows may increase by 5 to 40 ft^3/s during the summer but may be reduced by 60 to 125 ft^3/s from November to May.

TABLE 4-6

Consumptive Use of Virgin River Water as a Result of the Warner Valley Water Project

Source of Loss	Acre-Feet
Seepage, evaporation losses from reservoir and new canal	5,200
Powerplant losses	6,000
Municipal and industrial	4,000
Total consumptive use of Virgin River water as a result of the water project	15,200
Water removed from the Virgin River system by Kolob Water Development Project	6,500
Total reduction in flow expected at Bloomington including Kolob Project	21,700

If the influent reach is related to the Littlefield Spring, as evidence indicates, then it appears that the loss of recharge to the aquifer during the winter months would be offset by the newly sustained recharge during the summer months (table 4-5). However, the water recharging the aquifer would be of poorer quality than the preproject water as described previously. It is possible that ultimately the TDS concentrations in the Littlefield Springs flow would be increased in proportion to the increase in TDS experienced at the Hurricane gaging station upstream.

The expected increase in salinity would probably range from 300 to 500 mg/ℓ from November through May following construction of the project. Average salinity would be expected to decrease by 15 to 125 mg/ℓ with the increased flow expected during the summer months. These calculations were made assuming that the quality of the water coming from the upper Virgin River would be the same under postproject conditions. However, the salinity of the upper basin water would be increased as described previously due to the reduced flows and increased salinity below LaVerkin Springs, and the increased return flows (irrigation and industrial) below the St. George - Washington Fields diversion. Quantitative effects of the increased salinity on the water quality of the Virgin River near Littlefield is not known, but it is assumed that this factor would increase the projected TDS values for winter, spring, and annual flows. Although this analysis is simplistic and the results are approximate, they do illustrate the effect of decreasing both the quantity and the quality of flows reaching Littlefield during the winter and spring months. Water users below the Virgin River Gorge should not be significantly affected by the altered flow regime and water quality. Since only good quality snowmelt and peak flows are used for leaching during the spring in this area, and these flows would continue to pass the upstream diversions, no change from the present situation would be expected. In addition, when lower quality winter flows would be diverted, they would be used primarily to sluice sediment out of canals. Additional water could be available during summer months due to increased irrigation return flow below the St. George - Washington Fields diversion. Primary crops grown in this region are alfalfa, grain, and some silage (personal communication, Dee Hughes, former President of Mesquite Canal Company, January 23, 1980).

Dry Lake, Nevada and Las Vegas Wash

Construction of the Harry Allen powerplant would require diversion dikes along two washes within the plant site, around the settling and storage ponds, and a flood control structure to protect the old highway frontage road. These structures and the reduction of 1,850 acres of playa (20 percent) for the plant site would combine to raise the surface water elevation of a potential 50-year flood to the 1,985-foot contour line, approximately 8.5 feet higher than what would be expected under present conditions. This would result in increased maintenance problems for the existing transmission lines (located at the eastern edge of the playa), which would be standing in 15 feet of water. Flood waters would stand for a longer perid of time, thus increasing flood duration and compounding related impacts. Flooding of the old highway frontage road (and access to the town of Dry Lake) should be eliminated by the construction of the proposed flood control structures.

The Harry Allen powerplant at Dry Lake, Nevada would require an average 24.5 million gallons per day (mgd) of effluent from the Clark County Advanced

Wastewater Treatment (AWT) Plant for cooling purposes when the powerplant would reach full production capacity. Under peak load basis, up to 48 mgd could be required. However, impacts of the 24.5 mgd effluent transfer to the Allen plant instead of Las Vegas Wash would be minimal, since growth in Clark County is expected to contribute an additional 30 mgd of new effluent by the mid-1990s (personal communication, Jim Parrott, March 21, 1980). Thus, the present discharge of approximately 66 mgd into the Las Vegas Wash would not be changed significantly, and adverse impacts would be avoided.

Wetlands and Floodplains

Executive Orders 11990 and 11988 require that Federal agencies give special consideration to the protection of wetlands and avoid locating structures or facilities that can be damaged by floodwaters within a 100-year floodplain.

The following project facilities are evaluated in terms of their probability for affecting wetlands and floodplains.

Coal Sources. The possible impacts to wetlands and floodplains from future coal development is not clearly understood because the actual areas to be mined and mining methods have not yet been identified by the mining operator(s) in a mine plan. Such information will be made available by the mining operator to OSM as a part of the mining plan approval process. A mining plan must be approved by OSM before mining could occur.

Alton Coal Preparation Plant Site. No wetlands occur in this area. Present information indicates that the site is not located within a 100-year floodplain.

Coal Slurry Pipeline(s). The coal slurry pipeline would make seven subsurface crossings of major washes and streams. Construction and burial of the pipeline would disturb approximately 10 acres of wetlands or floodplains. Significant long-term disturbance would not be anticipated since the pipeline would be buried below the stream or wash scour line and disturbed surfaces would be revegetated.

Warner Valley Powerplant. No wetlands occur on this site. Present information indicates that the site is not located within a 100-year floodplain.

Warner Valley Water Project. The proposed water diversion of the Virgin River would have some effect on downstream wetlands as present river flows would be reduced by 56,100 acre-feet per year. The major area of effect would be between the point of diversion and the point where irrigation and other use return flows would reenter the Virgin River (a distance of approximately 29 miles). Beyond this point, wetlands would be affected by the anticipated consumptive water use of 21,000 acre-feet per year. The significance of these effects has not yet been determined; however, consultation with USFWS has been initiated in accordance with the Fish and Wildlife Coordination Act (as amended 1958) to determine the significance as related to fish and wildlife. This coordination effort will identify potential mitigating activities that would lessen wetland impacts.

Approximately 750 acres of land within the 100-year floodplains of several washes in the northern portion of Warner Valley, Utah would be utilized in the proposed water project development. Most of the affected lands (720 acres) would be inundated by the water proposed for impoundment. The proposed reservoir would have the effect of turning these existing floodplains into a permanent body of water. The result would be beneficial because flood flows to the Virgin River would be reduced (impounded).

Harry Allen Powerplant. The proposed powerplant would be located within the normal floodplain of Dry Lake playa. Proposed dikes would protect the plant from flooding during a 50-year flood event. As noted previously, approximately 1,850 acres would be removed from the existing playa, which would have the effect of raising flood levels by about 8.5 feet above natural levels in the remaining portions of the playa. The potential for flooding of the powerplant site by a 100-year flood event has not yet been determined.

Electrical Transmission System. Eight identified flood hazard zones would be crossed by transmission lines. Although the actual amount of land that would be involved is unknown, it would probably be quite small, since the lines would span the river channels whenever possible.

Vegetation: Species of Concern

Several species of concern in the States affected (listed in Appendix 7) could be adversely impacted by the various components of this alternative. Although not expected to be great, the significance of such impacts is unknown due to the lack of actual on-ground information. According to standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM is consulting with USFWS in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Consultation is expected to be completed for the final EIS.

Alton Coal Field

NPS has expressed concern that revegetation of coal-mined lands south of Bryce Canyon National Park could introduce plants not native to the area. Should this occur, it would be possible that these introduced plant species could eventually become established within the park, thereby altering its natural character.

Warner Valley Powerplant and Water Project

On December 28, 1979, official consultation with USFWS was initiated concerning endangered plants according to Section 7 of the Endangered Species Act (as amended 1978). At that time USFWS indicated that three endangered plants (*Echinocereus englemannii* var. *purpureus*, *Pediocactus sileri*, and *Arctomecon humilis*) could possibly occur within the project area (Appendix 15). A biological assessment on these plants was completed by BLM (1980) and transmitted to USFWS. The biological assessment indicates a "no effect" determination for *Echinocereus englemannii* var. *purpureus* and an "adverse effect" determination for *Pediocactus sileri* and *Arctomecon humilis*. An official biological opinion from USFWS on these two plant species is expected in July 1980.

According to the BLM biological assessment, two endangered species would be impacted with the construction of the Warner Valley powerplant and water project. A sparse population of 80 to 100 individuals of the endangered Siler pincushion cactus (Pediocactus sileri) would be lost due to the construction of the solid waste disposal areas over their habitat. According to the BLM biological assessment, although endangered, the loss of 80 to 100 individuals of the cactus would represent less than 1 percent of their total number and habitat.

Because of the location of dwarf bearclaw poppy (Arctomecon humilis) habitat near existing roads between St. George and the proposed Warner Valley plant and water project sites (fig. 3-6), one of the two existing populations of this plant would be adversely impacted from accelerated population growth and road use associated with the construction and operation of the powerplant and water project. Even with restricted access, numbers of the plant would be run over by off-road vehicle (ORV) recreationists or lost to collectors. According to the BLM biological assessment, the area to be affected by the construction and operation of the powerplant and water project represents the only known habitat of the dwarf bearclaw poppy. Therefore, project-related growth and activities would cause further endangerment of the species.

Coal Slurry Pipeline

The dwarf bearclaw poppy (Arctomecon humilis) and the siler pincushion cactus (Pediocactus sileri) would also be adversely affected by the construction of the coal slurry pipeline near the city of St. George. The BLM biological assessment idicates that while individual plants may be destroyed, neither species as a whole would be significantly affected.

Wildlife: Species of Concern

Several wildlife species of concern could be adversely impacted by the various components of this alternative in the affected States (Appendix 8). Although not expected to be great, the significance of such impacts is unknown due to the lack of on-ground information. According to standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM is consulting with USFWS on these species in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Consultation is expected to be completed for the final EIS.

Coal Slurry Pipeline and Electrical Transmission System

The desert tortoise (Gopherus agassizi), currently proposed for endangered status in Utah and protected in the States of Arizona, Nevada, and California, could be adversely impacted during construction of the proposed coal slurryline and electrical transmission system due to vehicle/animal collisions and human capture during construction on as many as 12,684 acres of potential habitat (fig. 3-6). The result could be reductions in local populations of the tortoise.

In accordance with Section 7 of the Endangered Species Act (as amended 1978), BLM is consulting with USFWS on the desert tortoise (letter dated March 5, 1980) and a biological assessment analyzing the effects of the project on the tortoise was prepared (1980). USFWS will issue an informal opinion concerning the desert tortoise in July 1980 which could have a bearing on the final design or routing of the pipeline and transmission system. According to the assessment, impacts to tortoise populations in Utah would not be significant because the routes proposed for the construction of the coal slurry pipeline and transmission lines would lie essentially south of an area proposed as critical habitat by USFWS.

Warner Valley Water Project

The Warner Valley water project as previously proposed by the applicants (1975), would have diverted up to 160 ft^3/s while allowing at least a minimum flow of 40 ft^3/s to bypass the diversion in order to meet downstream water rights. In response to this proposed project and after consultation with BLM in accordance with Section 7 of the Endangered Species Act (as amended 1978), USFWS issued an official biological opinion (1978) stating that: "It is our opinion that the Warner Valley [water] project as now proposed will be likely to jeopardize the continued existence of the endangered woundfin minnow [Plagopterus argentissimus] by adversely modifying its present habitat in the Virgin River. This habitat is considered essential for survival of the species and has been proposed for designation as 'critical habitat', as provided for by the Endangered Species Act of 1973, in the Federal Register, Vol. 42, No. 211, November 2, 1977" (Appendix 13). USFWS also recommended in their opinion a minimum flow criterion of 70 ft^3/s for the months of July through October and 110 ft^3/s for all other months as recorded at the Hurricane gaging station in order to protect the habitat of the woundfin minnow.

In response to the biological opinion, the Washington County Water Conservancy District submitted a redesigned diversion schedule for the water project. The Warner Valley water project as redesigned by the applicant would divert water from the Virgin River at a rate of up to 160 ft^3/s, but would allow at least a minimum flow of 40 ft^3/s to bypass the diversion during the months of October to February, 90 ft^3/s from March to June, and 80 ft^3/s from July to September (letter to the BLM Cedar City District Office from Washington County Water Conservancy District, October 31, 1979).

It is the position of USFWS that any diversion of the Virgin River that would not permit the flow criterion (as mentioned above) would not be considered compatible with the protection of this endangered fish until a revised biological opinion is issued.

BLM reinitiated consultation with USFWS in order to consider the redesigned water project. USFWS is currently in the process of reviewing the redesigned diversion schedule and will issue a revised biological opinion in September 1980.

According to a report prepared by Drs. James Deacon and Paul Holden (1977), the proposed endangered Virgin River roundtail chub (Gila Robusta seminuda) would also be adversely affected by proposed diversions of the Virgin River associated with the operation of the water project. In accordance with Section 7 of the Endangered Species Act (as amended 1978), BLM is consulting with USFWS on the roundtail chub (letter dated March 5, 1980). BLM prepared a biological assessment on the fish (1980) recognizing that the water project as currently proposed would adversely impact its habitat.

USFWS is in the process of investigating the habitat and flow requirements of the roundtail chub and will issue an opinion to be included with the official biological opinion on the woundfin minnow in September 1980.

The primary adverse impacts to the woundfin minnow and roundtail chub would be attributed to reduced flows in the Virgin River. Reduced flows downstream from the proposed water project diversion would adversely affect these fishes by reducing their populations and habitat downriver to the Virgin River narrows (fig. 4-6). Secondary impacts to the fishes associated with stream flow alterations would be changes in water quality (increased salinity), temperature (changes in critical biological temperatures), the possible introduction of exotic fish species into the reservoir, and outfalls which could lead to competition and possible reduction or extinction of the woundfin minnow (USFWS, USDI, 1978; BLM Biological Assessment, USDI, 1980).

Archaeology, Ethnology, and History: Cultural Resources

Since inventories are not complete, this analysis contains estimates of varying exactness relevant to the amount of resource that would be adversely impacted by various project components. Where data is incomplete, inconclusive, or simply nonexistent, average densities of 15 sites per section (840 acres), or one site per 5 miles of linear distance (transmission lines, pipelines) is assumed and incorporated in the analysis of impacts. It is further assumed that 95 percent or more of these sites will be archaeological (rather than historical), and that 75 percent or more will be found to be of National Register of Historic Places caliber under the criteria that they ". . . have yielded, or may be likely to yield, information important in prehistory . . . " (36 CFR, Part 60).

Also, due to the lack of a complete data base, this document does not demonstrate full compliance with procedures outlined in 36 CFR, Part 800, "Protection of Historic and Cultural Properties." It is the intention of BLM to comply with these procedures following approval of an alternative. This intent is documented by the nature and substance of the standard operating procedures developed and included in Appendix 6 and by the provisions of the "Memorandums of Understanding" developed with the State Historic Preservation Officers (SHPO) of the States involved with the project (Appendix 16).

Alton Coal Fields

An estimated 238 sites would be adversely impacted during mining activities on 10,154 acres of mining permit area at Alton. Of the total 238 sites, at least 180 would probably be of National Register caliber. Increased population pressure could lead to increased vandalism of some local sites. No significant historical properties are presently known in the Alton fields.

Coal Slurry Pipeline

According to Fowler (Vol. 3, 1975), 53 archaeological sites were encountered within or adjacent to the pipeline study corridor. An estimated 15 of these sites would be adversely impacted by construction activities. At least 12 of these sites would probably be of National Register caliber. An inestimable number of unknown (buried) sites could also be impacted. A

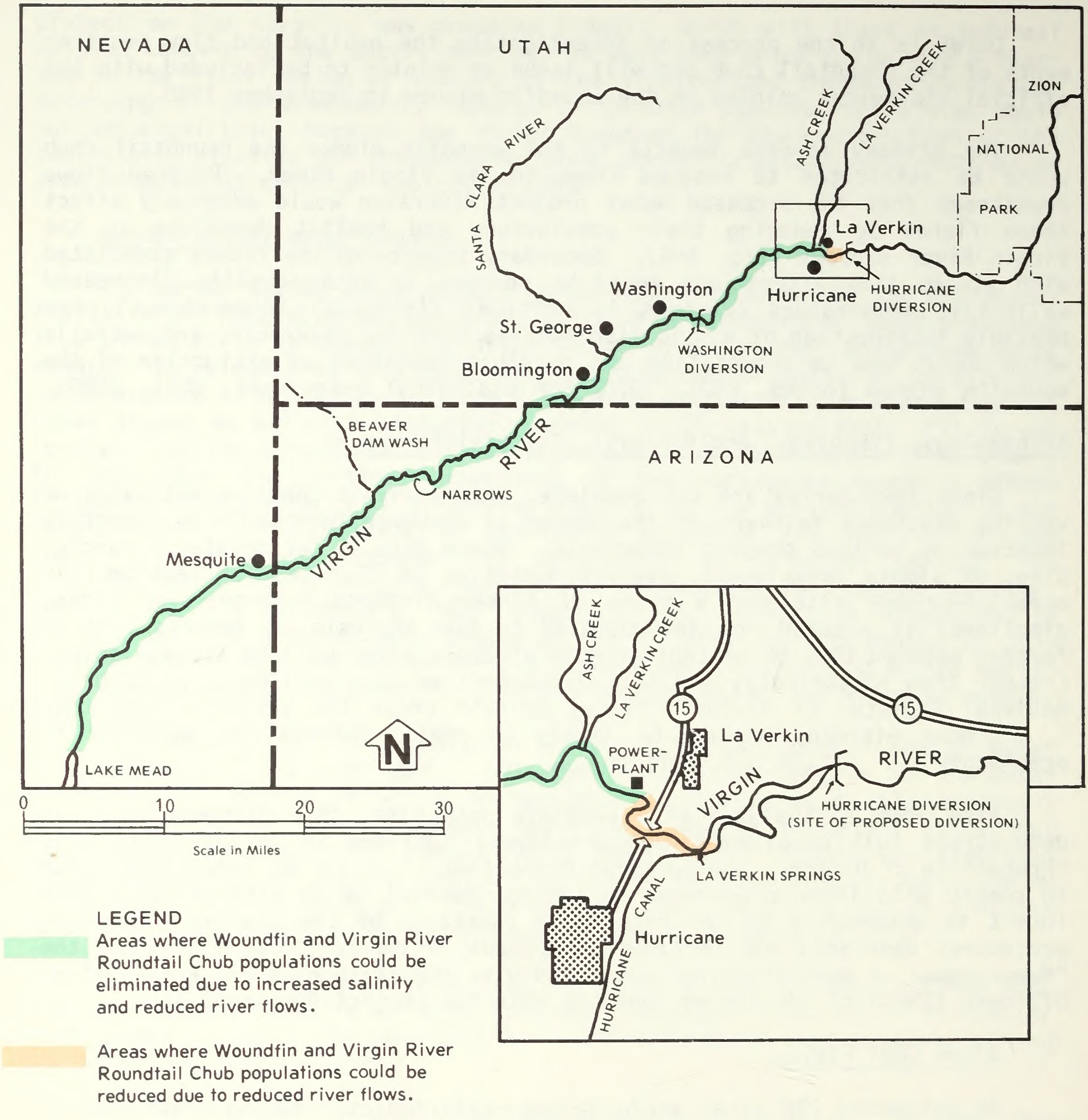


FIGURE 4-6

WOUNDFIN AND ROUNDTAIL CHUB HABITAT AFFECTED BY PROPOSED DIVERSIONS OF THE VIRGIN RIVER

1,000-acre easement for maintenance access would be maintained throughout the life of the project. The balance of archaeological sites would be subject to secondary adverse impacts of vandalism because of increased access to the sites.

Construction of the slurryline would temporarily impact visitation to the Fort Pierce National Register Property, which lies just 0.25 mile south of the proposed route in Warner Valley (fig 2-5). It is assumed that no further impact would occur after construction because the site was recently stabilized and upgraded to accommodate substantially more use than what it is presently experiencing.

Construction and operation of the slurryline would impact the Honeymoon Trail, which is nominated to the National Register (fig. 2-5). The slurry-line would be constructed some 1,500 to 4,000 feet north of the Honeymoon Trail where it descends the Hurricane Cliffs. Construction would alter the existing landscape character, leaving permanent scars adjacent to portions of the trail which lie east of the cliffs, due to cut and fill operations. Construction of a microwave station, air strip, and valve station at the top of the Hurricane Cliffs would alter the existing landscape and visual character of the area through which the trail passes.

Because the Honeymoon Trail can be traveled by ORV vehicles and is the only point at which the Hurricane Cliffs can be descended for at least 12 miles, construction crews would be inclined to utilize the trail as a construction access road. Such use could destroy some of the dry lain rock walls along the trail.

<u>Harry Allen Powerplant</u>

No known cultural resources would be adversely impacted with construction or operation of the powerplant (Brooks, 1976; NPC, 1975).

<u>Warner Valley Powerplant</u>

Construction of the powerplant would destroy eight known archaeological sites (Thompson and Thompson, 1976). These sites have not been submitted for determination of eligibility, but five or six would probably meet National Register criteria.

The Dominguez-Escalante and Honeymoon Trails would be impacted by the construction and operation of the powerplant (fig. 2-5). The proposed right-of-way boundaries of the powerplant would place the facility over portions of these historic trails. The powerplant would conflict with a NPS proposal to add the Warner Valley portion of the Dominguez-Escalante Trail to the National Historic and Scenic Trails System. The route of the Honeymoon Trail from the Hurricane Cliffs to St. George is essentially the same as what is known as the Temple Trail.

<u>Warner Valley Water Project</u>

No known archaeological sites would be impacted by construction and operation of the water project.

The proposed diversion structure to be built on the Virgin River would, as designed, cause the destruction of the Hurricane Canal/Diversion, a system built by early Mormon settlers to divert waters of the river to their Hurricane fields for irrigation purposes. The Hurricane Diversion structure and 6.5 miles of the canal have recently been listed on the National Register of Historic Places. Construction of the proposed diversion and canal structure needed to feed water to the proposed reservoir would destroy the historic diversion structure as well as occupy portions of its canal for channeling waters to the reservoir (Washington County Water Conservancy District, 1975).

Electrical Transmission System

Construction of the transmission system could adversely impact archaeological sites on 11,434 acres of right-of-way. Segments of the transmission system are considered separately because of their geographical distribution.

Spry to Alton. The nature and extent of the cultural resources along the Spry to Alton corridor are poorly known and it is difficult to qualify or quantify significant impacts. However, an estimated 17 sites would be impacted, including at least 13 that may be of National Register caliber.

Warner to St. George. The proposed corridor from the Warner plant to St. George has not yet been surveyed. Exact surveying and alignment would determine whether or not any cultural resources would be involved. An estimated three sites would be impacted, two of which would probably be of National Register caliber.

Warner to Pecos. Portions of this corridor have been surveyed for cultural resource values but no significant archaeological sites were located (Turner et al., 1975). Certain segments paralleling the Navajo-McCullough transmission line have yet to be surveyed. An estimated 24 sites would be impacted, including an estimated 18 sites probably of National Register caliber.

Allen to Eldorado. The segment from the Harry Allen plant to the Eldorado substation has not yet been inventoried, although some portions of the Navajo-McCullough transmission line (which the proposed line would parallel) have been inventoried with negative results (Turner et al., 1975). An estimated 10 sites would be impacted, seven or eight of which would probably be of National Register caliber.

Western Transmission System. The number of potential archaeological sites that would be adversely impacted due to construction activities along the Western Transmission System from the Eldorado substation in southern Nevada to Lugo, California are estimated by alternative corridors (Barker et al., 1979). The Memorandum of Understanding signed by BLM and the State of California for the Intermountain Power Project (IPP) (Appendix 16) is also considered to apply to the alternative corridors of the Western Transmission System for the AWV Energy System until such time that a project-specific memorandum can be negotiated.

Interstate 15. An estimated 14 sites would be impacted along this alternative route, 10 or more of which may be of National Register caliber.

Eldorado-Lugo. An estimated 17 sites would be impacted, at least 13 of which may be of National Register caliber.

Victorville-McCullough. An estimated 17 sites would be impacted, 11 of which are possibly of National Register caliber.

Highway 66. An estimated 12 sites would be impacted, at least 10 of which are possibly of National Register caliber.

A microwave communication site associated with the transmission system would be constructed on Spirit Mountain in southern Nevada. This mountain is an area of ethnographic importance (Cultural Resources, Chapter 3). In compliance with American Indian Religious Freedom Act (PL 95-341), consultation was initiated and is ongoing with regional Indian tribal authorities.

Recreation and Aesthetics

Alton Coal Field

Mining activities would generate dust, noise, and air pollutants, which could impact aesthetic and recreational values in nearby Bryce Canyon National Park by reducing air quality and visibility for the life of the project (Air Quality section of this alternative). Blasting at the mine could permanently alter the delicate erosional features in Bryce Canyon (OSM in cooperation with NPS will conduct blasting tests at Alton in the summer of 1980 to determine the significance of these impacts).

Approximately 8 miles of the extreme eastern portion of the Alton coal fields which are proposed for development by the applicants are visible from Yovimpa Point in Bryce Canyon National Park. During the life of the mine, 35 to 500 acres would appear to the viewer as cleared, raw earth at any one time. Mining and related activities would be evident from observation points on the southern rim of the Paunsaugunt Plateau and especially for more than 300,000 annual visitors to Yovimpa Point in Bryce Canyon National Park (total visitation at Bryce Canyon was nearly 700,000 for the same year; NPS, USDI, 1979). Modifications to line, form, color, and textural elements of the pre-existing landscape would occur during mining and reclamation. Initially, pinyon-juniper woodlands and stands of big sagebrush would be removed from the area prior to strip mining. While active mining continues and during the early stages of reclamation, the lease area would be a major intrusion on the landscape as viewed from Yovimpa Point. Mining facilities and activities would definitely alter the visual quality of the area and would not meet Visual Resource Management (VRM) Class IV objectives (Appendix 9) until mining and reclamation would be completed. After reclamation of the strip-mined area, the landscape should appear as an extension of the existing modifications, although topographic modifications could be permanent (SU, 1979).

Planned construction at Bryce Canyon National Park in fiscal year 1980 includes the upgrading of the nature trail and development of a viewpoint on the Promontory, which is higher in elevation and further east than Yovimpa Point. The Alton mine area would be a greater visual intrusion from this point; however, fewer park visitors will take the time and effort to reach this view area.

Coal Slurry Pipeline

Areas in VRM Class II (construction should not be evident), III (construction may be evident), and IV (construction may be very evident) would be crossed by the proposed slurryline. VRM objectives could not be met in the White Cliffs area (Class II) near Upper Kanab Creek, at the Hurricane Cliffs (Class II), and on the Beaver Dam Mountains (Class II) where construction on steep terrain would require notching and cutting, which would drastically alter the local natural topography and would result in a loss of scenic quality. Otherwise the slurryline would appear to the observer as a linear scar that would disappear with distance.

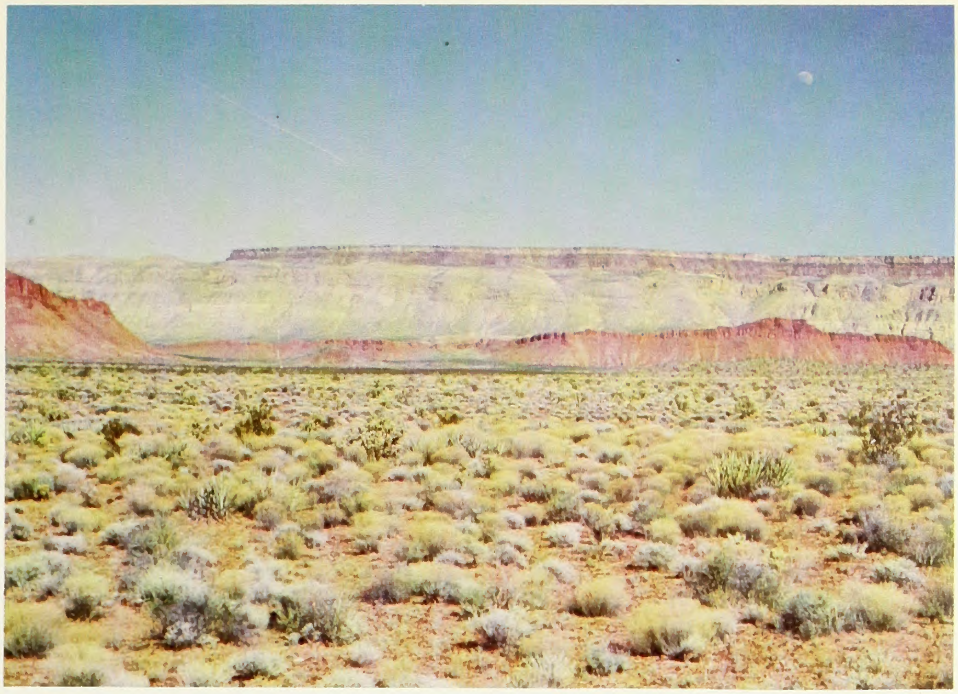
Warner Valley Powerplant

Visual resources in the St. George Basin would be adversely impacted with the actual presence of the powerplant and facilities. They would detract from the natural beauty of the surrounding landscape and would not meet VRM Class IV designations in the upper Warner Valley for the life of the project (fig. 4-7). The present aesthetic character of the basin would be further impacted by powerplant emissions. During stable air conditions (30 percent of the time), emissions would be chemically altered and could create a gray to yellowish-brown haze which would obstruct the viewer's perception of surrounding natural features and could decrease visual range in Zion National Park which lies approximately 20 miles northeast of the proposed powerplant site (Air Quality section of this alternative). Degradation of the visual resource would impact the recreational resources of hiking, sightseeing, etc.

Warner Valley Water Project

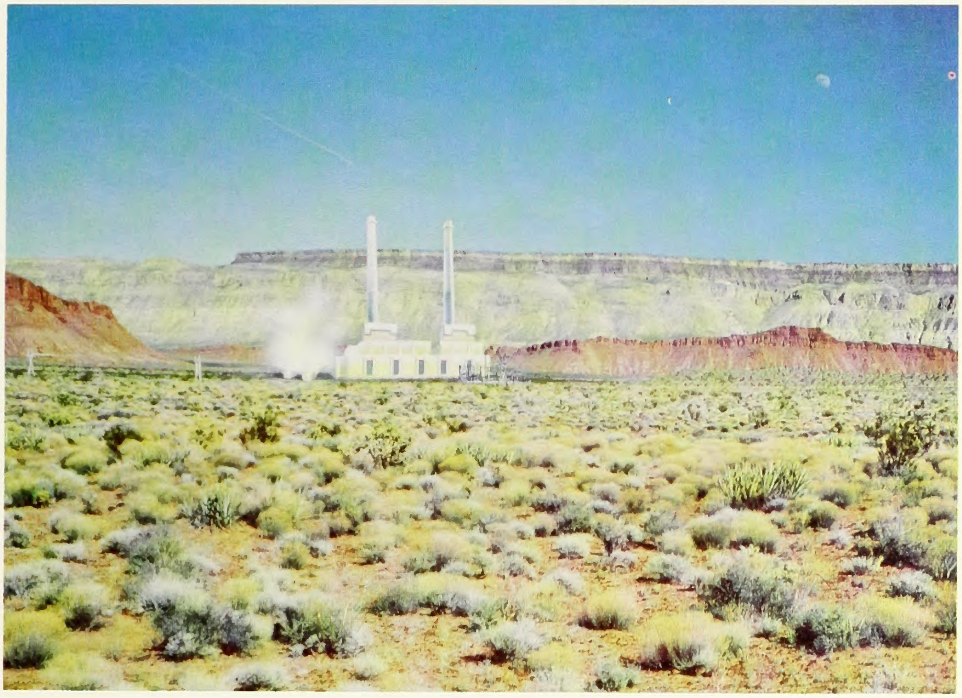
The water project would have a positive impact on the visual and recreational resources of Warner Valley. The reservoir would create contrasting scenery in an otherwise arid setting in northern Warner Valley. Increased visual sensitivity due to an anticipated influx of recreationists would change current VRM Class III and IV in the area to Class II.

The 750-acre reservoir would create opportunities for water-oriented recreational activities such as boating, swimming, and fishing (fig. 4-8). Visitor use would increase at the reservoir site with recreationists primarily coming from the Cedar City and St. George, Utah and Las Vegas, Nevada areas. Recreational activities would be adversely affected when the reservoir storage capacity would fall below 20,000 acre-feet, corresponding to a 60-foot drawdown from the maximum storage level. A 60-foot drawdown would reduce reservoir surface area from 750 to 325 acres, exposing borrow areas and mud flats around the periphery of the reservoir (fig. 4-9). The mud flats would diminish the area's aesthetic appeal and dry dock boat launching facilities. Developed swimming areas would become unsuitable due to large expanses of mud between the beaches and the water. The 60-foot drawdown could reduce the reservoir's sport fishing potential by exposing spawning areas, which would result in reduced fish populations. Based on computer simulations, such a drawdown could occur 5 of every 35 years (Water Resources section, Chapter 4).



PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

EXISTING SITUATION



VISUAL SIMULATION BY BUREAU OF LAND MANAGEMENT

SIMULATED PHOTOGRAPH

FIGURE 4-7

VISUAL SIMULATION OF 500-MW WARNER VALLEY POWERPLANT

FIGURE 4-8

VISUAL SIMULATION OF THE PROPOSED
WARNER VALLEY RESERVOIR - FULL
(55,000 Acre-Feet)

FIGURE 4-9

VISUAL SIMULATION OF THE PROPOSED
WARNER VALLEY RESERVOIR - 60-FOOT DRAWDOWN
(20,000 Acre-Feet)

Harry Allen Powerplant

The construction of the powerplant would definitely detract from the natural visual character of the site for the life of the project. Presence of the plant and facilities would prevent the area from meeting VRM Class IV objectives. The powerplant emissions and plume would affect visual and recreational resources depending on weather conditions (Air Quality section). Visual quality would be reduced for sightseers, especially where Interstate Highway 15 passes within 1 mile of the proposed plant site (fig. 4-10).

Electrical Transmission System

Impacts to be expected to recreation within the transmission system would be associated primarily with the construction of corridor access roads on 11,434 acres of right-of-way. These roads would permit increased access to previously inaccessible areas, causing an increase in ORV use with an associated destruction of vegetation, disturbance to wildlife habitat, and littering.

Visual resources would be impacted with the presence of tower structures and transmission lines, which would detract from the surrounding scenery. The severity of detraction would depend on the placement of towers, orientation of lines, location of the observer, and the azimuth of the sun. These impacts would continue for the life of the project until lines would be dismantled. Specific visual impact areas for each of the transmission systems are indicated below. Figures 3-8 and 3-9 indicate the location of each segment and its VRM rating. Where more than one line would be routed down a corridor, a "crowding" effect would further detract from visual resource quality.

Spry to Alton. The proposed 84-mile Spry to Alton transmission line would pass through essentially rural and forest settings. Much of this land is of low visual quality and not unique. The line would generally be compatible with these environments except in the higher elevations of pinyon-juniper woodlands. The wooden transmission structures would not readily fade from view at greater distances and would cause the primary impact to visual resources (Garkane Power Association, 1979).

Warner to St. George. The proposed 138-kilovolt (kV) Warner to St. George transmission line would be highly visible from Warner Valley and Sand Mountain because the free-standing single wooden poles would not readily fade from view. The transmission route would pass through VRM Class IV areas in Warner Valley and Class II areas around the city of Washington, Utah, resulting in a loss of existing scenic quality.

Warner to Pecos. Impacts to existing visual resources would be minor because the Warner to Pecos line would parallel the existing Navajo-McCullough and Reid Gardner-Pecos corridors for most of its route. The route would, however, further detract from the surrounding landscape's visual quality with the addition of another transmission line.

Allen to Eldorado. The proposed Allen to Eldorado lines would parallel existing transmission lines for approximately 43 of its 48 miles. Visual impacts along the existing corridor would be minor. The greatest

PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

EXISTING SITUATION

VISUAL SIMULATION BY BUREAU OF LAND MANAGEMENT

SIMULATED PHOTOGRAPH

FIGURE 4-10

VISUAL SIMULATION OF 2,000-MW HARRY ALLEN POWERPLANT

visual impacts would occur along the 5 miles of newly constructed transmission lines, especially where they would cross Interstate 15 (SCE and PG&E, 1979).

Western Transmission System. These transmission corridor alternatives are discussed separately below.

Interstate Highway 15. Much of the environment through which the corridor would pass is of moderate to low visual resource and is not unique. A 138-kV line presently occupies the proposed route. Some major visible impacts could be expected in the vicinity of East Cronese Dry Lake, Cronese Valley, Dry Soda Lake, Halloran Springs, Ivanpah Valley, and the proposed East Mojave National Park. Impacts to the visual resource would also be noticeable when the lines would pass through the cities of Baker, Midway, Yermo, and Victorville, although cultural developments already detract from the surrounding landscape (SCE and PG&E, 1979).

Eldorado - Lugo. Visual impacts would occur in the following areas which are considered high in scenic value: Pisgah Crater, Cinder Cone Natural Area, the Cadiz Mountains, and the proposed East Mojave National Park. The view from the residential and subdivision areas of northwest Victorville would also be impacted. Several major transmission lines already degrade the scenic resource along this corridor. The addition of one or more lines would further detract from the surrounding landscape (SCE and PG&E, 1979).

Victorville - McCullough. Moderate visual impacts would occur on Daggett Ridge, Roach Lake, the McCullough Mountains, and the proposed East Mojave National Park. High visual impacts would be expected at Red Pass Lake, Silver Lake, Shadow Valley, and the Clark Mountains. Visual impacts would be mainly associated with the visibility of towers and conductors. Several major lines already degrade local visual quality. The placement of additional transmission lines would further impact the visual resources (SCE and PG&E, 1979).

Highway 66. The major portion of this alternative corridor is presently without transmission lines. The placement of the lines would cause a new intrusion on the landscape with subsequent visual resource degradation. Significant visual impacts would occur during construction, operation, and maintenance, especially in the following scenic areas: Pisgah Crater, Amboy Crater National Landmark, and the communities of Ludlow and Amboy (SCE and PG&E, 1979).

Land Use, Land Use Plans and Controls

The distribution of land ownership for lands affected under this alternative is described in table 2-2. Present land use would be changed on affected acreage during the 40-year life of the project as indicated below. After decommissioning, these areas would be available for other uses or would revert to pre-existing land uses.

Component	Acres Affected	Present Land Use	Project Use
Alton Coal Field	8,328	Range, Wildlife	Surface and underground mining
Coal Preparation Plant	1,826	Range, Cropland	Heavy industrial
Warner Valley Powerplant	4,295	Range, Recreation	Heavy industrial
Warner Valley Water Project	2,993	Range, Recreation	Reservoir, recreation
Harry Allen Powerplant	5,887	Recreation, Wildlife	Heavy industrial
Coal Slurry Pipeline	2,218	Range, Recreation, Wildlife	No change on unfenced right-of-way (temporary impact during construction); 1,000 acres of maintained easement
Electrical Transmission System	11,434	Range, Recreation, Wildlife	No change on unfenced right-of-way (temporary impact during construction); 423 acres of maintained access roads

Alton Coal Field

The principal impacts to land use, and land use plans and controls are described in SU, 1979. Lands under coal leases proposed for development are currently zoned by the Kane County Planning Commission as "agricultural", under which mining is not permitted and "forest and recreation", under which underground mining is permitted but surface mining is conditionally permitted only after the approval by the planning commission (personal communication, Robert Russell, Kane County Commissioner, November 19, 1979). The planning commission is attempting at present to change the zoning for the entire lease area to "multiple use", which would permit conditional surface mining. This change in land use zoning would require public approval (personal communication, Robert Houston, Kane County Commissioner, February 4, 1980).

Coal Slurry Pipeline

A description of land ownership and proposed pipeline crossing of lands is available in Allen-Warner Valley Energy System: Environmental Assessment, Vol. 2 (NPC, 1975).

The routing of the pipeline as proposed would impact the following intensive wilderness inventory units within Utah and Arizona (fig. 3-9): Upper Kanab Creek (UT-040-255), East Mesa (UT-040-135; AZ-1-72), Cottonwood

Canyon ((UT-040-138; AZ-1-71), and Quail Draw (UT-040-134; AZ-1-73). As described in Chapter 3 (Land Uses, Land Use Plans and Controls) these areas are currently managed under an "interim policy" by BLM so as not to impair their suitability for preservation as wilderness (Federal Land Policy and Management Act of 1976). Under interim management, the granting of rights-of-way for the proposed slurryline would be prohibited. Should these areas be determined to lack wilderness characteristics by the respective BLM State Directors, then they would be dropped from the wilderness inventory and interim management.

If either a House bill (HR 5584 October 1, 1979) or a similar Senate bill introduced in Congress to provide trust lands for the Moapa Band-Paiute Indians in Nevada are passed, conflicts with the proposed slurryline rights-of-way could occur and the granting of rights-of-way would be subject to tribal authority. The House bill has provisions that would grant the land subject to existing rights-of-way, but the Senate bill does not.

Warner Valley Powerplant

The construction and operation of the powerplant would necessitate a change in zoning from open space to the heavy industrial category. The zoning change would have to be approved by the Washington County Planning Commission.

The proposed powerplant site would conflict with a portion of the BLM Cottonwood Canyon intensive wilderness inventory unit (UT-040-138; fig. 3-9). As described for the preceding component, the affected area is currently managed under an interim policy that prohibits the granting of rights-of-way.

There would be no other significant conflicts with State, county, or BLM administered (public) land use plans or controls.

Warner Valley Water Project

Zoning changes by the Washington County Commission would be required for the acreage affected by the construction and operation of the project. Land use on 1,240 acres of public land and 320 acres of State land would have to be changed from its present multiple-use management category to a municipal-industrial based primary use reservoir with secondary agricultural use. Land use on 960 acres of land adjacent to the proposed reservoir would change from multiple use to recreational use.

According to the applicant, 8,000 acre-feet of water would be the annual projected agricultural use (for a supplemental water supply for 8,930 presently irrigated acres). With 10,000 acre-feet per year to go to electrical energy production at the Warner Valley powerplant, the balance of 31,000 acre-feet would be available to surrounding communities for municipal and industrial uses (memorandum from Rudger McArthur, Secretary-Treasurer, Washington County Water Conservancy District, December 6, 1979). This would have the effect of encouraging future residential and industrial growth in the communities affected, which could require the re-evaluation of current land use plans and controls in Washington County.

Harry Allen Powerplant

Approximately 5,886 acres of public land would change from the present multiple-use status to single use/heavy industrial under the BLM Virgin Valley Planning Unit in the Caliente Resource Area of Nevada (Mangement Framework Plan, BLM, USDI, 1974). A zoning change for 5,886 acres from the present rural open category to the heavy industrial category would have to be approved by the Clark County Comprehensive Planning and Environmental Commission with public participation.

The applicants would have to secure a right-of-way to route the Clark County AWT pipeline across a portion of Nellis Air Force Base in southern Nevada. A right-of-way could be issued by the Air Force if the action would not interfere with the mission of the base, and if the action would be for the good of the public (personal communication, Barbara Hein, Real Estate Specialist, Nellis Air Force Base, April 30, 1980).

Electrical Transmission System

Approximately 11,434 acres of rights-of-way and easements would be required for the construction of the transmission system. No conflicts with local, State, or Federal government land use plans or controls would be expected with the construction and operation of the Spry to Alton, Warner to St. George, or Allen to Eldorado transmission lines.

Because of actual land use and land use planning, only a few specified corridors would be used for the routing of transmission lines. Problems of transmission line crowding would occur near the Rainbow Gardens area, in Eldorado Valley, and through the McCullough Pass in southern Nevada, and in the Interstate 15, Eldorado-Lugo, or the Victorville-McCullough alternative corridors of the Western Transmission System in southern California. The crowding of these corridors would preclude or otherwise impact other existing or potential land uses for the same area. Problems could also arise in the limitation or preclusion of future transmission line routings.

Warner to Pecos. The proposed Warner to Pecos transmission corridor could be in conflict with one of two bills which have been introduced in Congress that would provide trust lands for the Moapa Band-Paiute Indians near Moapa, Nevada. The House bill (HR 5584) would grant lands subject to existing rights-of-way but the Senate bill would not. Should one of the bills pass in Congress, the granting of rights-of-way would be subject to tribal authority.

The applicants would have to secure a right-of-way to route the line across a portion of Nellis Air Force Base in southern Nevada. The base would grant a right-of-way as long as the action would not interfere with the mission of the base, and if the action would be for the good of the public.

Western Transmission System. The route of this proposed transmission system would run through southern California. It could be in conflict with the final California Desert Conservation Area Plan, which was published in draft form by BLM in February 1980, subject to change pending public comment.

All four alternative corridors would, as proposed, conflict with BLM Wilderness Study Areas in southern California (fig. 3-8). As discussed in Chapter 3 (Land Uses), these areas are managed under an interim policy so as not to impair their suitability for preservation as wilderness. The granting of rights-of-way in these areas is prohibited (Federal Land Policy and Management Act of 1976). Interim management of these areas will continue until a decision is made to recommend (or not recommend) them to Congress for designation as Wilderness Areas. A proposed microwave communication site atop Clipper Mountain, west of Essex, California would also conflict with a Wilderness Study Area.

Interstate 15. This alternative route would cross a very small portion of Wilderness Study Area 206 which abuts an existing transmission corridor 4 miles south of Yermo.

Eldorado - Lugo. This alternative route would cross Wilderness Study Areas 238B, 243, 244, 245, 249, 250, 251, 251a, 252, and 266.

Highway 66. This alternative route would cross Wilderness Study Area 304A.

Victorville - McCullough. This alternative route would cross Wilderness Study Areas 206, 221A, 222A, 222, 225, 225A, 228, and 242.

Socioeconomics

Major socioeconomic impacts generated by the project components would be primarily caused by population surges during construction phases. After construction of various facilities, population changes would be expected to level out and growth rates would be expected to return to more normal levels. With the exception of the Alton mine complex, the operational work forces would be considerably smaller than those required during construction, so most impacts would be of a temporary nature. Those impacts which would occur would primarily affect the infrastructural services of the affected communities and counties. All data used in the following sections is derived from detailed information contained in tables in Appendix 17. As noted in Chapter 3, local officials of Kane and Washington Counties consider the projected baseline population figure to be too low and the consequent impacts to be considered less than indicated.

Impacts to Kane County and Its Communities

Project components which would affect Kane County and its communities would be: the construction and operation of the Alton mine complex; and two coal slurrylines.

Population. Kane County communities would be expected to receive significant increases in their base populations. The most dramatic changes in population would occur between 1980 and 1985, attributable primarily to temporary construction workers on the slurryline and an influx of miners for the Alton mine. According to Centaur Associates, Inc. (Socioeconomics, 1980), annual growth rates between 1980 and 1985 (table 1 in Appendix 17) in the communities would be approximately:

Alton	31 percent per year
Glendale	68 percent per year
Kanab	8 percent per year
Orderville	41 percent per year
Countywide	12 percent per year

According to local planning documents (Five County Association of Governments, 1976), around 14 to 15-percent growth rates are the maximum that communities could absorb without major deterioration in services that municipalities must provide. It is obvious that most of the smaller Kane County communities would experience extreme problems in controlling growth and in providing services for projected increases in their populations.

Employment and Income. Implementation of this alternative would effect major changes in countywide employment characteristics. Aside from the obvious upsurge in the mining and construction sectors, other support-oriented sectors would also be affected significantly. Primary among these, especially after the initial construction period, would be TCU (transportation, communications, and utilities), trade, FIRE (finance, insurance, and real estate), services, and government (table 2, Appendix 17). Mining would move from a position of virtually no employment in the county to being its leading employer. Between 1980 and 1985, mining employment would go from 0 to around 510. In the period 1985-1990, such employment would increase an additional 65 percent to 840. With positive impacts to employment, there would be reciprocal impacts to incomes and earnings as shown in the following:

Type of Employment	In Thousands of 1977 Dollars 1985	1990	1995	2000	2020
Temporary Construction	3,294.9	0	0	0	0
Operating	13,147.1	23,446.9	30,520.8	35,810.1	35,457.0
Indirect	3,831.7	5,078.0	6,961.8	6,962.5	8,801.9
TOTAL	20,228.7	28,524.9	37,482.6	42,782.6	45,258.9

Source: Socioeconomics, Centaur Associates, Inc., 1980

Services. The provision of basic services in Kane County communities would be affected by this alternative, especially during the period 1980-1985. Kanab would probably be the most affected because it is the county's largest population center. Police and fire protection would have to be increased almost immediately (tables 3 and 4 in Appendix 17). By 1985, the entire county would be experiencing shortages in such areas as water supply, sewage disposal, the school system (which in many cases is already experiencing chronic over-crowding), and health care services (see tables 5, 6, 7, and 8 in Appendix 17). After the initial 1980-1985 growth period, populations should stabilize to more normal growth patterns and any additional infrastructural needs should be more readily accommodated.

Tax Base. Based on the Kane County taxing formula (Utah Industrial Development Division, 1978), there is a countywide average assessment of 9.8

percent and a mill rate of 59 mills. This could generate an estimated increase of some $2,014,600 in annual tax revenues from the project components in Kane County. Also, depending on coal tonnage recovered each year at the Alton mine, the county could receive as much as $790,000 annually in Federal royalities.

Quality of Life. Since this alternative would generate rapid increases in population in some portions of the county, it would be expected that some major infrastructural problems would result, especially during the early stages of the project. It could also be anticipated that if the sociological makeup of the "newcomers" is substantially different from the existing relatively homogeneous base population, friction between the two groups could result. Therefore, a decline in general quality of life would be expected during the initial stages of the project. As infrastructural problems become resolved and various subgroups become acclimated to one another, the quality of life problems should be alleviated.

Conclusion. While providing increased employment and income opportunities in the county, this alternative would probably generate some very major infrastructural and sociological problems. Increased incomes and expanded tax bases would be very beneficial for the county, but would have to offset added loads in such areas as law enforcement, sewage treatment, education, health care, etc. Also, there are a number of Federally funded programs designed to at least partially offset the impacts to energy impacted communities. A collection of descriptions of these programs has been compiled by the Mountain Plains Federal Regional Council entitled Federal Assistance for Energy Impacted Communities and is available through the Federal Regional Council Energy Impact Office, Federal Building, 1961 Stout Street, Denver, Colorado 80294. An equity between such benefits and burdens would, however, probably not be achieved rapidly enough to displace anticipated initial impacts. To help offset such timing differences between the "costs" and "benefits" of the project, there are a variety of State laws which provide for such actions as prefinancing of public services, revenue sharing, resolving taxing imbalances, prepayment of taxes, and other sources of public improvement financing. Descriptions of these laws are contained in a memo from the State of Utah Department of Community and Economic Development (Appendix 18).

Impacts to Washington County and Its Communities

Project components which would directly affect Washington County and its communities would be: the Warner Valley coal-fired powerplant; the Warner Valley and Harry Allen coal slurrylines; and the Warner Valley water project.

Population. Except for the St. George/Bloomington area, most communities in Washington County are experiencing only mild growth rates in their base populations. With the implementation of this alternative, quite substantial increases in these populations would be expected, especially for such areas as St. George, Washington, and Hurricane. Annual expected community growth rates for the period 1980-1985 (table 9 in Appendix 17) would be:

Community	Annual Overall Growth Rate	Attributable to Project
Hurricane	8 percent	6 percent
Ivins	10 percent	7 percent
LaVerkin	9 percent	6 percent
Leeds	8 percent	6 percent
St. George	14 percent	11 percent
Santa Clara	9 percent	5 percent
Toquerville	8 percent	5 percent
Washington	11 percent	8 percent
Countywide	11 percent	8 percent

Employment and Income. Overall employment within the county would be expected to increase significantly with the implementation of this alternative. Direct project oriented employment in the county would create over 1,000 jobs during the construction phase. During the operational phase of the project, direct plus indirect employment would range from around 575 to 675 jobs over the long term. The figures below display the distribution of estimated employment impacts (numbers of new jobs) over the project life:

Type of Employment	1985	1990	1995	2000	2020
Temporary Construction	922	0	0	0	0
Operating					
Warner Valley Powerplant	100	100	100	100	100
Slurry Pipeline	10	10	10	10	10
Warner Valley Water Project	0	3	3	3	3
Indirect	1,212	458	529	553	562
TOTAL	2,244	571	642	666	675

Employment sectors most markedly affected by these increases would be construction (temporarily), utilities, trade, services, and government (table 10 in Appendix 17). Over the long term, utilities, trade, services, and government would be the sectors most benefitted by the project. The above increases in employment would also be felt in increased earnings in the county, especially through 1985. Total increased earnings (both direct and indirect) would be estimated to total nearly $30 million (in 1977 dollars). After the construction period, added project related incomes would be estimated to level off to about $8.5 million per year and eventually rise to a little over $11 million per year (table 11 in Appendix 17).

Services. The impacts of this alternative on basic services in Washington County would be significant. Project oriented impacts would be most concentrated in the St. George area, but would also affect other communities such as those in the Hurricane area. As with Kane County, the most pronounced impacts would occur during the initial growth period of 1980-1985 and would then stabilize at more normal levels. Fire protection and water supplies would tend to be the least affected services in the county, while police protection and education are already near or at their capacities and would have to be substantially expanded to accommodate increased populations (tables 12,13,14,and 15 in Appendix 17). Other problem areas would include sewage disposal countywide, but especially in the Hurricane area where an existing and chronic problem would probably reach the breakdown point.

Tax Base. Based on Washington County taxing formulas (Utah Industrial Development Divison, 1978), there is a countywide average assessment of 12.96 percent and a mill rate of 78 mills. This could generate an estimated $5.8 million in increased annual tax revenues from project components in Washington County. Over the long term, such revenues could be extremely beneficial to the county, but would probably not be available during initial construction phases to displace anticipated socioeconomic impacts to the area.

Quality of Life. The initial stages of this alternative would precipitate some localized infrastructural problems in the county, but long-term increases in economic activity would be expected to regain any losses. Therefore, after construction would be completed, the temporary socioeconomic inconveniences would be resolved to the satisfaction of most residents.

Conclusion. This alternative would provide Washington County with additional population and economic growth, although the growth during the construction period could generate some housing and sewage disposal problems in some of the affected communities. Expansion of the county's tax base should eventually relieve such problems, although some short-term deficiencies would probably be incurred.

Impacts to Clark County and Its Communities

Project components which would directly affect the county and its communities would be: the 2,000-MW coal-fired powerplant at the Harry Allen site; the AWT plant; the coal slurryline; and the electrical transmission system.

Population. Increases in population during the construction phase in the Las Vegas Valley area would be expected to rise above baseline levels by about 9,000. This figure includes construction workers and their families and additional secondary employment. Incremental population changes during the operational phase would be around 1,076 persons. In total, the incremental change would be less than 2 percent over the baseline and would not be likely to generate significant negative impacts in the Las Vegas Valley area.

Employment and Income. The table below shows the projected employment (number of jobs) impacts of this alternative throughout Clark County.

Type of Employment	1985	1990	1995	2000	2020
Temporary Construction	1,566	0	0	0	0
Operating					
Harry Allen Powerplant	55	219	219	219	219
Indirect	1,783	241	241	241	241
TOTAL	3,404	460	460	460	460

Source: Socioeconomics, Centaur Associates, Inc., 1980

Income/Earnings. The table below shows the projected impacts to incomes of this alternative in Clark County.

	In Thousands of 1977 Dollars				
Type of Employment	1985	1990	1995	2000	2020
Temporary Construction	35,083.1	0	0	0	0
Operating	1,174.5	5,163.4	5,700.6	6,347.1	6,347.1
Indirect	26,305.7	3,815.6	4,309.9	5,072.9	5,090.1
TOTAL	62,563.3	8,979.0	10,010.5	11,420.0	11,438.0

Source: Socioeconomics, Centaur Associates, Inc., 1980

Services. With existing relatively high population growth rates in the Las Vegas Valley area, any added influence by this alternative on area growth would probably not likely be distinguishable from the existing trends. This conclusion is drawn from two major points. First, at the maximum, the area population would be increased by only 1 to 2 percent above current rates of growth under this alternative and then only temporarily during the construction phase. This could act to aggravate any existing problems to some extent but would not be likely to generate new ones. The second condition is that population projections used to estimate impacts were based on the assumption that impacts would be in terms of new populations moving into the area to fill the project created jobs. The more probable occurrence however, would be that many of these jobs would be filled from within the Las Vegas area labor pool and might not then result in additional inflows of people.

From these two points of view, the conclusion would be that impacts from this alternative on the abilities of Las Vegas Valley municipalities to provide basic services would be minimal.

Tax Base. This alternative would have the effect of increasing the assessed valuation of the Clark County property tax base by approximately $486,720,000, or an estimated $10.96 million in increased tax revenues (assuming a levy of 2.2527 per $100 of assessed value). A portion of these revenues would, of course, be required to provide services for increases in population brought about by the project. However, it would be anticipated that a significant residual amount above and beyond that required to expand services would be left over.

Quality of Life. The basic character of the Las Vegas Valley area, dominated by the gaming and entertainment industry, would not be significantly affected by this alternative. It would be possible that some existing infrastructural problems in the area could be aggravated by projected population increases, but probably not by a significant degree. On the whole, it would not be anticipated that the quality of life in the Las Vegas Valley area would be markedly changed by this alternative.

Conclusion. Since high population growth rates already exist in the Las Vegas Valley area and since there is a large diversity in employment and business activity, this alternative would not generate much impact on existing trends. The greatest impacts would occur during the construction phase of the project, but these would only yield a 1 or 2-percent increase over baseline projections and could usually be absorbed by the area quite readily. The increased tax base could be extremely beneficial, especially in view of the low level of incremental impacts on existing services that would be generated by the project.

Impacts to the Electrical Transmission System Regions

Studies addressing the impacts of the AWV and similar transmission systems (NPC, 1975; IPP, 1979; and SCE and PG&E, 1979) generally conclude that no lasting negative socioeconomic impacts would occur in Utah, Nevada, or California as a result of either the construction or operation of any of the possible transmission system routings. Most impacts would be of a very temporary nature and would be concentrated in the construction phase. These would consist of some shortages of lodging accommodations as work crews work past the various towns along the transmission line routes. It would be unlikely for such conditions to persist longer than 2 to 3 months. During such time, the affected communities would receive a temporary economic infusion in the form of purchases of food, lodging, and other services by the work crews. The basic workforce needed for construction of each route would be:

	I-15	Eldorado - Lugo	Victorville - McCullough	Route 66
Road	20	22	21	28
Foundation	73	77	75	99
Tower Erection/ Conductor Stringing	403	426	412	547
General	21	22	21	28
TOTAL	517	547	529	702

Source: SCE and PG&E, 1979

The incomes generated by this employment have been projected by the project proponents at the following amounts:

	In Thousands of 1979 Dollars			
Type of Employment	I-15	Eldorado - Lugo	Victorville - McCullough	Route 66
Roads	$ 467	$ 514	$ 486	$ 654
Foundation	2,200	2,321	2,261	2,984
Tower Erection/ Conductor Stringing	12,662	13,385	12,945	17,187
General	1,155	1,211	1,155	1,541
Total	$16,484	$17,431	$16,847	$22,366

Source: SCE and PG&E, 1979

Permanent operating crews would have a projected total income of $60,000 per year.

Long-term impacts would generally be derived from property tax revenues generated by the transmission system. Total estimated property tax revenues per year in constant 1979 dollars would be:

	I-15	Eldorado - Lugo	Victorville - McCullough	Route 66
Annual Property	$835,000	$873,000	$883,000	$1,016,000

Source: SCE and PG&E, 1979

These tax revenues would be spread over the entire lengths of the alternative routings and would not go to any one locality. However, with the majority of route lengths being in California, the vast proportion of these revenues would accrue there. Operational workforces would be expected to be only six persons working part-time and would therefore not be likely to generate any socioeconomic impacts of consequence.

Conventional Energy Sources Mix

Coal-fired generating capacity (2,500 MW) equal to approximately 25 million barrels of oil per year would be available for use in the service areas of NPC, SCE, PG&E, and the city of St. George, Utah. If this capacity would be utilized to reduce oil-fired generation, the electric consumer would benefit from a more stable fuel price structure and the nation would benefit from the reduction in foreign oil imports.

Energy Efficiency

This alternative would provide for an average output of 1,750 MW of electrical power (70 percent of capacity). Its energy efficiency is expressed in terms of output as a percent of input and is a factor in determining this alternative's effectiveness in converting one form of energy (resources) into another form (electricity). The energy efficiency of this alternative was computed by converting the various qualities and quantities of resource inputs into their energy equivalents, expressed in British thermal units (Btu) per year. The energy equivalents were derived for all resources required for the development of this alternative, including: capitalizations, operating and maintenance costs, materials, manpower, transportation, and fuels (including coal). Energy values contained in the coals were derived from approximate analyses of coals within the fields considered. Energy required in coal mining was developed from unpublished data collected in the preparation of SU (1979). Insofar as practical, data furnished by the applicants was used. All converted resource values (energy equivalents) were consolidated into a single expression of the average annual input of energy (Appendix 19). This figure was then compared to the output of energy that would be generated from the Harry Allen and Warner Valley powerplants as would be measured at the Lugo and Pecos substations (assuming transmission line losses).

The energy efficiency of this alternative would be 22.1 percent.

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The adverse environmental impacts of major concern which would be sustained unavoidably in the event of implementation are presented in table 4-7. Also included are the resources which would be irreversibly or irretrievably committed with the implementation of the alternative and an examination of the relationship between the short-term uses of those resources and the maintenance and enhancement of long-term productivity.

TABLE 4-7

ALTERNATIVE 1: Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship of Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources: Irreversible	Commitment of Resources: Irretrievable	Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
Air Quality	Air quality degraded by emission of the following pollutants: <u>Harry Allen Powerplant</u> - 40.8 tons per day of SO_2, 8.16 tons per day of particulate matter, 136.22 tons per day of NO_x. <u>Warner Valley Powerplant</u> - 10.38 tons per day of particulate matter, and 34.30 tons per day of NO_x.	Yes	No	No	Yes	Emissions would ultimately be removed naturally from the atmosphere or would precipitate and be deposited on the earth.
	The 24-hour PSD Class II increments for SO_2 violated at the Warner Valley and Harry Allen powerplant sites. The 24-hour PSD Class I increments for SO_2 violated at Zion National Park and Valley of Fire State Park.	Yes	No	No	Yes	See above.
	Trace elements from powerplant emissions accumulated in soil in surrounding areas.	Yes	No	No	Yes	Trace element depletion would not be complete for an unknown period of time after project life.
	Brown haze visible in the vicinity of both powerplants under certain meteorological conditions. Cooling tower plumes also visible at certain times.	Yes	No	No	Yes	Emissions would ultimately be removed naturally from the atmosphere.
Water Resources	Loss of up to 10,000 acre-feet per year from pumping of ground water from the Navajo Sandstone aquifer for use as coal slurry.	Yes	No	Project life and beyond	Yes	Recharge of the aquifer would require an unknown period of time after project life.
	Loss of natural flow in as many as 22 local springs and reduction in yields of an unknown number of wells and springs in adjacent valleys due to ground water pumping of the Navajo Sandstone aquifer at Alton; and contamination and sedimentation of surface streams due to surface strip mining of coal.	Yes	No	Project life and beyond	Yes	See above; contamination and sedimentation of surface streams would continue for an unknown period of time after project life.
	Reduction in flows of Virgin River of 37,700 acre-feet per year at the Warner Valley water project diversion.	Yes	No	Project life and beyond	Project life and beyond	Water project diversions would continue for an unknown number of years after the short-term (more than 100 years), as projected community growth would utilize continually larger quantities of water.

(continued)

TABLE 4-7 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources: Irreversible	Commitment of Resources: Irretrievable	Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
	Warner Valley diversion preclusion of up to 37,000 acre-feet of water per year from downstream use.	Yes	No	Project life and beyond	Project life and beyond	See above.
	Consumptive use of up to 22,600 acre-feet of water per year for municipal, industrial, and irrigation uses (Warner Valley water project).	Yes	No	Project life and beyond	Project life and beyond	See above.
	Increased salinity by approximately 175 mg/ℓ in the Virgin River as a result of Warner Valley water project diversion.	Yes	No	Project life and beyond	Project life and beyond	See above.
	Consumptive use of up to 10,000 acre-feet of water per year at Warner Valley powerplant.	Yes	No	Project life	Yes	Water lost to evaporation in power generation process would be eventually returned via hydrologic cycle.
	Consumptive use of an average 27,443 acre-feet of water (effluent) per year from the Clark County AWT plant at the Harry Allen powerplant.	Yes	No	Project life	Yes	See above; effluent transferred from treatment plant would be made up with increasing community growth and related increase in effluent.
	Increase in flood depth in Dry Lake playa with operation of flood control dikes around Harry Allen powerplant and facilities.	Yes	No	No	Yes	Flood levels would drop to natural levels with dismantling of powerplant and dikes.
Vegetation Species of Concern	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 7) with the construction and operation of project components.	Yes	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.
	Loss of a population of the endangered bear-claw poppy (Arctomecon humilis) related to the construction and operation of the Warner Valley powerplant and water project.	Yes	Yes	Yes	Yes	Loss of this population could lead to the extinction of the species.
Wildlife Species of Concern	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 8) with the construction and operation of project components.	Yes	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.
	Construction and operation of coal slurry pipeline and electrical transmission system disturbing up to 12,684 acres of habitat of the desert tortoise (Gopherus agassizi), a species proposed for endangered classification in Utah and protected in Arizona, Nevada, and California.	Yes	Unknown	Unknown	Yes	See above.

(continued)

TABLE 4-7 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources: Irreversible	Commitment of Resources: Irretrievable	Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
	Reduction of habitat of the endangered woundfin minnow (Plagopterus argentissimus) and the proposed endangered Virgin River roundtail chub (Gila robusta seminuda) with the diversion of Virgin River for the Warner Valley water project.	Yes	Unknown	Yes	Project life and beyond	Diversion at proposed rate would reduce habitat and subsequently the numbers of these fishes, possibly leading to their extinction.
Cultural Resources	Adverse impact to an estimated 329 archaeological sites with the construction of the various project components.	Yes	Yes	Yes	Yes	Although some information would become instantly available, construction activities would result in the alteration of sites to a point at which the information would not be available for future investigation.
	Adverse impacts to the ethnologic importance of Spirit Mountain with the placement of a microwave communication station.	Yes	Unknown	Unknown	Yes	Placement of the microwave station could permanently disgrace the sacredness of the mountain.
	Destruction of the Hurricane Canal Diversion, (listed on the National Register) with the construction of the Warner Valley water project diversion structure and canal system.	Yes	Yes	Yes	Project life and beyond	Loss of this antiquity would be permanent.
	Alteration of the Honeymoon Trail (currently nominated for inclusion on the National Register) with the construction of the coal slurry pipeline.	Yes	Yes	Yes	Yes	Construction on steep terrain would permanently alter the natural character of the topography in the immediate area of the trail.
	Impact of construction of Warner Valley powerplant over portions of the Dominguez-Escalante Trail (being studied by NPS for inclusion in the National Historic and Scenic Trail System), and the Honeymoon Trail (nominated for inclusion on the National Register).	Yes	No	Project life	Yes	Character and use of trails would be lost in affected portions for the life of the project. After decommissioning, some construction scars would permanently alter natural character of the trails.
Recreation and Aesthetics	Adverse impact to the scenic character of the St. George Basin, Zion National Park, and Dry Lake, Nevada when visibility reduced by concentrations of stack emissions from the powerplants; also adverse impacts to local aesthetic and recreational resources.	Yes	No	Project life	Yes	Emissions would ultimately be removed naturally in the atmosphere.
	Part of the visual resource as viewed from Bryce Canyon National Park degraded with strip mining activities at the Alton coal fields.	Yes	Yes	Yes	Yes	Portions of the visual resource would be permanently altered even after reclamation.

(continued)

TABLE 4-7 (concluded)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources: Irreversible	Commitment of Resources: Irretrievable	Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
	Blasting associated with mining activities in the Alton coal field could alter or destroy the delicate erosional features in Bryce Canyon National Park.	Unknown	Yes	Yes	Yes	Destruction of erosional features would permanently degrade the recreational resource in Bryce Canyon.
	Visual resources degraded throughout the affected environment with the actual presence of powerplants and transmission lines.	Yes	No	No	Yes	Decommissioning would remove alien structures from natural environment; some residual construction scars would remain in certain areas.
Land Use	Change from present land uses to project uses on 24,752 acres.	Yes	No	No	Yes	Land could revert to previous uses in most affected areas after project life.
	Change in zoning in Kane, Washington, and Clark Counties for those areas to be occupied by the Alton coal mine, Warner Valley powerplant, and Harry Allen powerplant respectively.	Yes	No	No	Yes	Land could be rezoned for other projected uses after project life.
	Change in zoning in Washington County for area to be occupied by Warner Valley water project.	Yes	Yes	Yes	Project life and beyond	Water project would be considered a permanent fixture on the landscape.
	Violation of BLM Wilderness Study Areas in southern California with placement of Western Transmission System, and loss of wilderness character.	Yes	Unknown	Unknown	Project life and beyond	Wilderness characteristics would be lost in affected areas until restored naturally over time (if possible).
	Violation of trust lands of Moapa Band-Paiute Indians (if awarded by Congress) with construction and operation of the coal slurry pipeline and transmission system.	Yes	No	No	Yes	Granting of rights-of-way would be subject to tribal authority.
Socio-economics	Rapid population growth exceeding the abilities of local infrastructures to provide basic services in Kane and parts of Washington Counties. Quality of life adversely affected.	Yes	No	No	Yes	Growth trends would stabilize over the course of the project and would probably be reversed at the end of the project. Without appropriate planning, the "bust" portion of the "boom and bust" cycle could be experienced in some areas.
Coal Resources	A total of 312 million tons of coal mined at the Alton coal field and consumed.	Yes	Yes	Yes	Yes	Coal would be unavailable for future use.

ALTERNATIVE 2: IMPACTS OF MAJOR CONCERN

The implementation of this alternative would involve the following major components which are analyzed according to their significant impacts to the environment: coal mining in the Alton coal fields of southwestern Utah; construction and operation of a pipeline to slurry pulverized coal from the Alton coal preparation plant to the Harry Allen powerplant at Dry Lake, Nevada; the construction and operation of a 2,000-MW powerplant at the Harry Allen site in Dry Lake, Nevada; and the construction of a transmission system to send electricity from the Harry Allen powerplant to the service areas of NPC, SCE, and PG&E.

Air Quality

This alternative must comply with the applicable State and Federal air quality standards and regulations as shown in table 4-1.

Coal Mining in Alton Coal Field

USGS (SU, 1979) estimated that the mining of coal in the Alton coal fields would not violate applicable State of Utah or Federal air quality standards or regulations for particulate matter in either the immediate mining area or in Bryce Canyon or Zion National Parks. As in Alternative 1, the maximum estimated ground level concentrations of particulate matter from mining activity as calculated by USGS are presented in table 4-2. These concentration estimates were made without the benefit of a detailed mining plan.

At present, OSM, BLM, NPS, and EPA are preparing studies on the potential air quality impacts and potential visual intrusions from the development of coal resources in the Alton coal fields. UII is also conducting a study on these potential impacts. The results of these studies are expected to be available in June 1980.

The strip mining of coal at the Alton coal fields would be expected to reduce visual range in Bryce Canyon National Park by approximately 2.3 percent when mining would be at full production of 10.5 million tons per year (SU, 1979). The visibility impacts from strip mining approximately 8 million tons of coal per year under this alternative are being analyzed in the air quality analyses being conducted by OSM, NPS, EPA, and BLM.

Population increases due to mining activity would not be expected to violate air quality standards or regulations (EPA, 1977).

Construction and Operation of the 2,000-MW Harry Allen Powerplant

The following stack emissions would be expected for a 2,000-MW Harry Allen powerplant burning Alton coal:

	Harry Allen Plant (tons per day)
SO_2	40.80
Particulate matter	8.16
NO_x	136.22

TABLE 4-8

Estimated Air Quality Impacts Due to Emissions from the Proposed 2,000-MW Harry Allen Powerplant

Harry Allen Powerplant	Estimated Concentration (μg/m³): Sulfur Dioxide (SO_2) Annual	24-hour	3-hour	Particulate Matter Annual	24-hour	Nitrogen Oxide (NO_x) Annual
Class II						
EPA Reg. IX	a	316.1	a	a	a	a
ERT	2.9	21.4	250.9	0.3	1.9	13.6
Bechtel	<2.0	92.0	307.0	0.9	9.3	9.8
Class I (Radian)						
Paiute P.A.	<2.0	<0.2	<1.0	<5.0	<10.0	a
Valley of Fire	2.3	16.6	130	0.5	3.3	a

Source: Harry Allen, ERT, 1977
NPC, 1975
Modeling Summaries Completed by EPA Region IX, February 27, 1978
Radian, 1980

[a]Not calculated.

NOTE: The concentrations in this table have been normalized to reflect application of BACT and compliance with NSPS.

$\mu g/m^3$ = migrograms per cubic meter

Particulate Matter. As shown in table 4-8, the Harry Allen powerplant would not be expected to exceed the NAAQS or the PSD increments for particulate matter when considering only the Allen powerplant emissions.

Sulfur Dioxide (SO_2). Initial studies show that emissions of SO_2 from the Harry Allen powerplant would cause the PSD Class II SO_2 increments to be exceeded (EPA, 1978). These estimates were made using the EPA Valley model. On May 19, 1980, NPC submitted the results of a plume tracer study done by North American Weather consultants to EPA Region IX. EPA is currently reviewing this information. PSD increments in the potential Class I area of the Paiute Primitive Area would not be violated (Radian, 1980). The Class I increments in the potential Class I area of the Valley of Fire State Park would be exceeded (Radian, 1980). Concentration estimates (noncumulative) are presented in table 4-8.

Nitrogen Oxides (NO_x). Emissions of NO_x from the Harry Allen plant would not violate the NAAQS (table 4-8). There are no PSD regulations pertaining to NO_x at this time, but the impacts on atmospheric discoloration and visibility caused by NO_2 emissions would be regulated in Class I areas. These impacts are discussed in the Visibility section of this alternative.

Ozone (O_3, Photochemical Oxidants). There has been concern in recent years about O_3 production from powerplants. O_3 concentrations in powerplant plumes have been found to be lower than ambient levels near the point of emission. O_3 concentrations in the plume increase to approximately ambient levels far downwind. In urban plumes with higher hydrocarbon concentrations, the O_3 concentration could increase downwind. Even in such situations, the net increase in O_3 would be less than about 10 percent above ambient levels (SU, 1979), and therefore, would not be considered significant.

Plume Opacity. Federal NSPS for particulate matter (Federal Register, Vol. 44, No. 113) specify a limitation of 20-percent plume opacity. Particulate concentrations of fly ash from the stack would be about 0.012 grains per actual cubic foot (0.027 grams per cubic meter) assuming maximum load, use of worst grade coal, and an electrostatic precipitator operating at 99.5-percent efficiency.

Under normal operating conditions the plume from the proposed Harry Allen powerplant would be barely visible at the stack. However, during startup operations before the electrostatic precipitators would be able to reach operating efficiency, and during upset conditions, the plume could be highly visible.

Trace Elements. The pathways of distribution of trace elements and the long-term accumulation effects are not well known. Generally, calculated concentrations would be below measured background levels (NPC, 1975) and would not be considered significant over the life of the project (tables 1, 2, 3, and 4 of Appendix 12).

USFWS biological opinion of 1978 (Appendix 13) specifies a concern about possible toxic buildups in the environment near the proposed Harry Allen powerplant. In this biological opinion, USFWS indicates that BLM should require the applicants to set up a monitoring program to detect trace elements near the proposed powerplant site.

Radioactive Nuclides. Radioactive materials are present in any coal and certain amounts of radioactive nuclides would be emitted from the stack. Maximum ground level exposure from the Harry Allen powerplant emissions would fall well below the standards for general public exposure set by the Atomic Energy Commission (now U.S. Department of Energy) (NPC, 1975) and therefore, would not be considered significant in the short term. The impact of low level exposure over long periods of time is not known.

Condensed Water Plumes. Condensation of water vapor emitted from the powerplant stacks and cooling towers would produce a visible plume for a distance downwind from the powerplant. The stack plume from the Harry Allen powerplant would be visible for more than 400 feet approximately 30 percent of the time (NPC, 1975). Depending on the number of units in operation, plumes longer than 1 mile would be visible between 1 and 5 percent of the time. Cooling tower plumes longer than 100 feet downwind would occur about 22 percent of the time. Plumes longer than 1,000 feet would occur about 1 percent of the time. The height of the visible cooling tower plume would exceed 500 feet less than 20 percent of the time and would exceed 1,000 feet less than 1 percent of the time. Because of the distance from major roads, the direction of prevailing winds, and the arid climate, any impacts to motorists from icing and fogging of highways by the cooling tower plumes from the Harry Allen powerplant would be considered minimal.

Secondary Pollutants. The major impact from the formation of secondary pollutants (sulfates and nitrates) would be visibility impairment. The impacts of the Harry Allen powerplant on visibility are discussed in the following section.

Visibility. Visibility impacts from powerplant plumes are caused by particulates (fly ash), secondary pollutants (sulfates, nitrates), water, and NO_2. These impacts would generally be in the form of reductions in visual range and visibility of the plume itself (plume blight).

A significant visibility impairment has been defined by EPA as ". . . visibility impairment which in the judgement of the administrator, compromises the values of the mandatory Class I area" (EPA proposed visibility regulations, 40 CFR, Part 51). It is the policy of NPS to protect the scenic values of Class I areas from any adverse visual impairment at human levels of perception (letter from William J. Whalen, Director NPS, to David Hawkins, EPA, Assistant Administrator, Air, Noise, Radiation, April 1979).

The worst case visibility impairment in the Paiute Primitive Area would probably occur when stable meteorological conditions exist in the plume environment long enough (approximately 5.5 hours) for the plume from the Harry Allen powerplant to travel between the Paiute Primitive Area and the Mormon Mountains (Radian, 1980). The occurrence of this condition has been determined by Holzworth (1979) to be infrequent. When this would occur, the estimated reduction in visual range would be approximately 5 percent (Radian, 1980). Cramer et el. (1978) indicates that for a reduction in visual range to be noticeable, the reduction must be 5 to 10 percent of ambient visibility. Based on these studies, the impact of the Harry Allen powerplant on visibility of the Paiute Primitive Area would be expected to be small. The relative significance of the impact must be determined by BLM (the Federal land manager of the Paiute Primitive Area) if the area is designated Class I.

Similarly, the plume travel time from the Harry Allen powerplant (approximately 3 hours) to the vistas from the Valley of Fire State Park, coupled with the infrequent occurrence of persistent stable conditions in the plume environment, indicate that the visibility impact on vistas from the park would be small. The significance of any visibility impairment must be determined by the State of Nevada if the park is designated Class I.

A brown haze would be visible in the Harry Allen powerplant plume under certain atmospheric conditions due to NO_2 discoloration of the atmosphere.

Cumulative Impacts. The applicants must demonstrate that the impacts of the Harry Allen powerplant, in combination with any other local sources of air pollution, would meet applicable State of Nevada and Federal air quality standards and regulations before a PSD permit or construction permit could be issued.

Population Growth. The increased levels of pollution from population growth associated with the Harry Allen powerplant would not be expected to exceed State and Federal air quality standards and regulations.

Nonattainment Area of Las Vegas. The impacts of the Harry Allen powerplant on ambient concentrations of total suspended particulates and CO in the Las Vegas nonattainment area would be expected to be minor - less than one-half the values identified by EPA as significant. Significance values have not been established for O_3. However, an evaluation of meteorological conditions associated with historically high O_3 episodes, and a comparison of emissions and calculated ambient concentrations of reactive hydrocarbons and NO_x (O_3 precursors in the photochemical process) with existing emissions of these pollutants in the nonattainment area, indicate that peak O_3 concentrations would not be increased (Radian, 1980).

Construction and Operation of the Alton Coal Preparation Plant and Pipeline

No significant impacts would result from these components.

Water Resources

The major components of this alternative which would affect water resources would be: coal mining in the Alton coal field area; and the Harry Allen powerplant in Dry Lake, Nevada. Impacts of coal mining in the Alton fields have been addressed in SU (1979), EMRIA (USDI, 1975), and are further discussed in Alternative 1 of this chapter. The major impact areas would include reduction or elimination of springflow as a result of ground water pumping, disturbance of shallow ground water aquifers and backfill replacement, surface water contamination from mine wastes, and increased sedimentation on 8,488 acres of lands to be disturbed by mining. Up to 22 springs in their present location and condition (totalling between 100 and 150 acre-feet of water annually) would be altered by mining activities, depending on actual mine locations and methods (mining plan). Also, yields of wells and springs in adjacent valleys could be adversely affected by ground water pumping. Impacts due to these alterations are not presently known and would need to be specifically investigated when an updated mining plan would be submitted.

Mining backfill may contaminate shallow aquifer water quality locally by increasing salinity and nitrate concentrations. The extent of this contamination should be restricted to the area of the mine because both the backfill and present aquifer characteristics appear to be poor (SU, 1979; Hydrologic Evaluation, USDI, 1979).

Accelerated erosion in mining areas would cause an increase in sedimentation in Kanab, Thompson, and Skutumpah Creeks; and Meadow Canyon Wash, but the extent cannot be quantified at this time due to insufficient data.

Dry Lake, Nevada and Las Vegas Wash

Construction of the Harry Allen powerplant along with the necessary diversion dikes and storage and settling ponds would reduce the surface area of the Dry Lake playa by 1,850 acres. This would elevate flood levels of a potential 50-year flood by 8.5 feet above the present natural ponding elevation. This could result in increased maintenance problems for the existing transmission lines located along the eastern end of the playa. Flooding of the old highway frontage road (and access to the town of Dry Lake) should be eliminated by construction of the proposed flood control structures.

No significant impacts would be expected from the transfer of an average of 24.5 mgd of effluent from the Clark County AWT plant to the powerplant. See Alternative 1 for additional discussion.

Wetlands and Floodplains

As noted under Alternative 1, the major areas of concern would be the lack of information on possible coal development effects on wetlands and floodplains, and the proposal to locate the Harry Allen powerplant within the 50-year floodplain of the Dry Lake playa. Approximately 1,860 acres would be removed from the existing playa.

Vegetation: Species of Concern

Several vegetation species of concern could be adversely impacted with the construction and operation of the components of this alternative in the States of Utah, Arizona, Nevada, and California (Appendix 7). Although not expected to be great, the significance, duration, and character of these impacts are unknown due to the lack of on-ground information. According to standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM is consulting with USFWS on these species in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Consultation should be completed for the final EIS.

Alton Coal Field

NPS has expressed concern that revegetation of coal-mined lands south of Bryce Canyon National Park could introduce plants not native to the area. Should this occur, it would be possible that these introduced plant species could eventually become established within the park, thereby altering its natural character.

Coal Slurry Pipeline

According to a biological assessment prepared by BLM (1980), two officially listed endangered plant species, the dwarf bearclaw poppy (Arctomecon humilis) and the siler pincushion cactus (Pediocactus sileri) would be adversely affected by the construction of the coal slurry pipeline near the city of St. George. The assessment indicates that while individual plants may be destroyed, neither species as a whole would be significantly affected. These assessments have been sent to USFWS for review under Section 7 regulations of the Endangered Species Act.

Wildlife: Species of Concern

Several wildlife species of concern could be adversely impacted with the contruction and operation of the components of this alternative in the States of Utah, Arizona, Nevada, and California (Appendix 8). Although not expected to be great, the significance, duration, and character of possible impacts are unknown due to the lack of on-ground information. According to standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM is consulting with USFWS on these species in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Consultation is expected to be completed for the final EIS.

Coal Slurry Pipeline, Electrical Transmission System

The desert tortoise (Gopherus agassizi), currently proposed for USFWS listing as an endangered species in Utah, and protected in the States of Arizona, Nevada, and California, could be adversely impacted during construction of the coal slurry pipeline and electrical transmission system on 10,915 acres of habitat from the Beaver Dam Slope in southwestern Utah to southern California (fig. 3-6). Collisions with construction vehicles and human capture could result in reductions of local populations. According to a BLM biological assessment, these impacts would be significant in Utah where proposed critical habitat would essentially be avoided. As discussed in Alternative 1, BLM is consulting with USFWS on the desert tortoise. USFW will issue an informal opinion concerning the tortoise in July 1980 which could have a bearing on the final design and routing of the pipeline and transmission system.

Archaeology, Ethnology, and History: Cultural Resources

Since inventories are not complete, this analysis contains estimates of varying exactness relevant to the amount of resource that would be adversely impacted by various project components. Where data is incomplete, inconclusive, or simply nonexistent, average densities of 15 sites per section (640 acres), or one site per 5 miles of linear distance (transmission lines, pipelines) is assumed and incorporated in the analysis of impacts. It is further assumed that 95 percent or more of these sites will be archaeological (rather than historical), and that 75 percent or more will be found to be of National Register caliber under the criteria that they ". . . have yielded, or may be likely to yield, information important in prehistory . . ." (36 CFR, Part 60).

Also due to the lack of a complete data base, this document does not demonstrate full compliance with procedures outlined in 36 CFR, Part 800, "Protection of Historic and Cultural Properties." It is the intention of BLM to comply with these procedures following approval of an alternative. This intent is documented by the nature and substance of the standard operating procedures developed and included in Appendix 6 and by the provisions of the "Memorandums of Understanding" developed with the SHPOs of the States involved with the project (Appendix 16).

Alton Coal Fields

An estimated 200 sites would be adversely impacted during mining activities on 8,488 acres of mining permit area at Alton. Of the total 238 sites, at least 180 would probably be of National Register caliber. Increased population pressure could lead to increased vandalism of some local sites. No significant historical properties are presently known in the Alton fields.

Coal Slurry Pipeline

According to Fowler (Vol. 3, 1975), 53 archaeological sites were encountered within or adjacent to the pipeline study corridor. An estimated 15 of these sites would be adversely impacted by construction activities. At least 12 of these sites would probably be of National Register caliber. An inestimable number of unknown (buried) sites could also be impacted. A 1,000-acre easement for maintenance access would be maintained throughout the life of the project. The balance of archaeological sites would be subject to secondary adverse impacts of vandalism because of increased access to the sites.

Construction of the slurryline would temporarily impact visitation to the Fort Pierce National Register Property, which lies just 0.25-mile south of the proposed route in Warner Valley (fig. 2-5). It is assumed that no further impact would occur after construction because the site was recently stabilized and upgraded to accommodate substantially more use than what it is presently experiencing.

Construction and operation of the slurryline would impact the Honeymoon Trail, which is nominated to the National Register (fig. 2-5). The slurryline would be constructed some 1,500 to 8,000 feet north of the Honeymoon Trail as it descends the Hurricane Cliffs. Construction would alter the existing landscape character leaving permanent scars adjacent to portions of the trail that lie east of the cliffs from cut and fill operations. Construction of a microwave station, air strip, and a valve station at the top of the Hurricane Cliffs would alter the existing landscape and visual character of the area through which the trail passes.

Because the Honeymoon Trail can be traveled by 4-wheel drive vehicles and is the only point at which the Hurricane Cliffs can be descended for at least 12 miles, construction crews would be inclined to utilize the trail as a construction access road. Such use could destroy some of the dry lain rock walls along the trail.

Harry Allen Powerplant

No known cultural resources would be adversely impacted with construction or operation of the powerplant (Brooks, 1976; NPC, 1975).

Electrical Transmission System

Construction of the transmission system could adversely impact archaeological sites on 9,665 acres of right-of-way. Segments of the transmission system are considered separately because of their geographical distribution.

Spry to Alton. The nature and extent of the cultural resources along the Spry to Alton corridor are poorly known and it is difficult to qualify or quantify significant impacts. However, an estimated 17 sites would be impacted, 13 of which may be of National Register caliber.

Allen to Eldorado. The segment from the Allen plant to the Eldorado substation has not yet been inventoried, although some portions of the Navajo-McCullough transmission line (which the proposed line would parallel) have been inventoried with negative results (Turner et al., 1975). An estimated 10 sites would be impacted, seven or eight of which would probably be of National Register caliber.

Western Transmission System. The number of potential archaeological sites that would be adversely impacted due to construction activities along the Western Transmission System from the Eldorado substation in southern Nevada to Lugo, California are estimated by alternative corridors (Barker et al., 1979). The Memorandum of Understanding signed by BLM and the State of California for IPP (Appendix 16) is also considered to apply to the alternative corridors of the Western Transmission System for the AWV energy system until such time that a project-specific memorandum can be negotiated.

Interstate 15. An estimated 14 sites would be impacted along this alternative route, 10 or more of which may be of National Register caliber.

Eldorado - Lugo. An estimated 17 sites would be impacted, at least 13 of which may be of National Register caliber.

Victorville - McCullough. An estimated 17 sites would be impacted, 11 of which are possibly of National Register caliber.

Highway 66. An estimated 12 sites would impacted, at least 10 of which are possibly of National Register caliber.

A microwave communication site associated with the transmission system would be constructed on Spirit Mountain in southern Nevada. This mountain is an area of ethnographic importance (Cultural Resources, Chapter 3). In compliance with American Religious Freedom Act (PL 95-341), consultation was initiated and is ongoing with regional Indian tribal authorities.

Recreation and Aesthetics

Alton Coal Field

Mining activities could impact, for the life of the project, the recreational values in Bryce Canyon National Park through reductions in visibility and the visual intrusion of the mine on the landscape as viewed from Yovimpa Point and the Promontory. Modifications to the line, form, color, and textural qualities of the characteristic landforms caused by strip mining activities would alter the visual quality of the area and would not meet VRM Class IV objectives. Mining activities would generate dust, noise, and air pollution, which could degrade recreational values in Bryce Canyon National Park (SU, 1979). Blasting associated with mining activites could damage the delicate erosional features of the park.

Coal Slurry Pipeline

The coal slurry pipeline would generally appear as a linear scar on the landscape. Construction activities would be highly visible, however, in the White Cliffs and Beaver Dam Mountains, where notching and cutting would be required on steep terrain to permit passage of the pipeline. In these areas, VRM class objectives would not be satisfied due to the permanent alteration of the natural topography (fig. 3-9).

Harry Allen Powerplant

The actual presence of the powerplant and powerplant emissions would reduce the quality of visual and recreational resources for sightseers along Interstate Highway 15. The presence of the powerplant and support facilities would not meet VRM Class III objectives (same component, Alternative 1; fig. 4-10).

Electrical Transmission System

The construction of corridor access roads within 7,388 acres of right-of-way would permit increased access to previously inaccessible areas, resulting in an increase in ORV recreational use.

Visual resources would be impacted with the erection of tower structures and transmission lines which would detract from the surrounding scenery for the life of the project. The visual disturbances created by the proposed Spry to Alton, Allen to Eldorado, and Western Transmission System corridors would be identical to those outlined in Alternative 1. The visual impacts created by the proposed Allen to Pecos transmission line are indicated below.

Allen to Pecos. Visual impacts created by the proposed Allen to Pecos transmission line would be minor since this line would parallel the existing Reid-Gardner to Pecos and Navajo-McCullough Corridors (SCE and PG&E, 1979). Placement of the line would, however, further detract from existing scenic quality.

Land Use, Land Use Plans and Controls

The distribution of land ownership for lands affected under this alternative is described in table 2-6. Present land use would be changed on affected acreage during the 40-year life of the project to the project uses indicated below. After decommissioning, these areas would be available for other uses or would revert to pre-existing land uses.

Component	Acreage Affected	Present Land Use	Project Use
Alton Coal Field	6,662	Range, Wildlife	Surface and underground mining
Coal Preparation Plant	1,826	Range, Cropland	Heavy industrial
Harry Allen Powerplant	5,887	Recreation, Wildlife	Heavy industrial
Coal Slurry Pipeline	2,218	Range, Recreation, Wildlife	No change on unfenced right-of-way (temporary impact during construction); 1,000 acre maintained easement
Electrical Transmission System	9,665	Range, Recreation, Wildlife	No change on unfenced right-of-way, (temporary impact during construction); 310 acres of maintained access roads

Alton Coal Field

An analysis of impacts to land use and land-use plans and controls is described in SU, 1979. Lands under coal leases proposed for development are currently zoned such that mining would be restricted or not permitted. Kane County officials are proposing zoning changes which would allow conditional mining on the entire lease area. Further analysis is presented in Alternative 1 for the same component.

Coal Slurry Pipeline

The pipeline as proposed would impact several BLM intensive wilderness inventory units (fig. 3-9). Additional conflicts could occur if either one of two bills introduced in Congress to provide trust lands near Moapa, Nevada for the Moapa Band-Paiute Indians would be passed.

Harry Allen Powerplant

Approximately, 5,807 acres of public land and 80 acres of private land would change status (as described in Alternative 1) and would necessitate a zoning change by Clark County officials from the present category of rural open to the heavy industrial category. Routing of the AWT pipeline across portions of Nellis Air Force Base in southern Nevada would require a separate right-of-way.

Electrical Transmission System

The impacts to land use and land use plans and controls of this alternative would be identical to those discussed in Alternative 1 for the same component except that the transmission line from Warner Valley to the Pecos substation would not be constructed. The applicants would have to secure a right-of-way to route the Allen to Pecos line across a portion of Nellis Air Force Base in southern Nevada. The base would grant a right-of-way if the action would not interfere with the mission of the base, and if the action would be for the good of the public.

Routing of the alternative corridors of the Western Transmission System could be in conflict with the final California Desert Conservation Area Plan, which was published by BLM in February 1980 in draft form, and is subject to change pending public comment. The alternative corridors would, as proposed, conflict with BLM Wilderness Study Areas in southern California (fig. 3-8).

The crowding of various transmission lines into single corridors would preclude or otherwise impact other existing or potential land uses for the same area. This crowding effect would occur near Rainbow Gardens, in Eldorado Valley, and through the McCullough Pass in southern Nevada and in the Interstate 15, Eldorado-Lugo, or Victorville-McCullough alternative corridors of the Western Transmission System in southern California. Problems may also arise in the limitation or preclusion of future transmission line routings.

Socioeconomics

Major socioeconomic impacts would include population surges from mine operations at Alton, slurryline and powerplant construction, and transmission lines construction. Such surges would place added demands on services of law enforcement, fire protection, water supplies, sewage disposal, education, and health care, which often cannot readily accommodate rapid expansions.

Impacts to Kane County and Its Communities

The socioeconomic impacts of this alternative on Kane County would be the same as discussed in Alternative 1; significant adverse impacts would result in the areas of infrastructure, services, and the quality of life.

Impacts to Washington County and Its Communities

The project components of this alternative that would affect Washington County and its communities would occur during the construction of the Alton to Harry Allen coal slurryline. There would be a temporary influx of construction workers, but little noticeable socioeconomic impact would be anticipated since current Washington County growth rates (1970 through 1977) have been nearly 6 percent per year (Utah Industrial Development Division, 1978). Also, much of the slurryline work force would originate from the Las Vegas labor pools and many such workers would commute daily from the Las Vegas area, thus reducing local impacts. However, if the peak period workforce would be located in Washington County, it would total around 230, a temporary

1-percent increase in the population which would yield no noticeable permanent socioeconomic effects. Temporary housing shortages could occur in some areas, but would probably be relieved with mobile home or motel type housing. Therefore, Washington County and its communities could be expected to absorb the short-term impacts of construction crews without major disruptions of services in the county.

Impacts to Clark County and Its Communities

The socioeconomic impacts of this alternative in Clark County would be the same as described in Alternative 1; effects would be generally favorable to the local areas.

Conventional Energy Sources Mix

Coal-fired generating capacity (2,000 MW) equal to approximately 20 million barrels of oil per year would be available for use in the service areas of NPC, SCE, and PG&E. If this capacity would be utilized to reduce oil-fired generation, the electric consumer would benefit from a more stable fuel price structure and the nation would benefit from a reduction in foreign oil imports.

Energy Efficiency

This alternative would provide for an average output of 1,400 MW of electrical power (70 percent of capacity). Its energy efficiency is expressed in terms of output as a percent of input and is a factor in determining this alternative's effectiveness in converting one form of energy (resources) into another form (electricity). The energy efficiency of this alternative was computed by deriving energy equivalents for all resource inputs and comparing the total of these equivalents on an annual basis to the energy output of the proposed Harry Allen powerplant (Appendix 19).

The energy efficiency of this alternative would be 22.1 percent.

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The adverse environmental impacts of major concern which would be sustained unavoidably in the event of implementation of this alternative are presented in table 4-9. Also included are the resources which would be irreversibly or irretrievably committed with the implementation of the alternative, and an examination of the relationship between the short-term uses of resources and the maintenance and enhancement of long-term productivity.

TABLE 4-9

ALTERNATIVE 2

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship of Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources: Irreversible	Commitment of Resources: Irretrievable	Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
Air Quality	Air quality degraded by emission of the following pollutants: Harry Allen Powerplant - 40.8 tons per day of SO_2, 8.16 tons per day of particulate matter; and 136.22 tons per day of NO_x.	Yes	No	No	Yes	Emissions would ultimately be removed naturally from the atmosphere or would precipitate and be deposited on the earth.
	The 24-hour PSD Class II increment for SO_2 violated by the Harry Allen plant. Class I increments exceeded at Valley of Fire State Park.	Yes	No	No	Yes	See above.
	Trace elements from powerplant emissions accumulated in soil in surrounding areas.	Yes	No	No	Yes	Trace element depletion would not be complete for an unknown period of time after project life.
	Brown haze visible from the powerplant under certain meteorological conditions. Cooling tower plumes visible at certain times.	Yes	No	No	Yes	Emissions would ultimately be removed naturally from the atmosphere.
Water Resources	Loss of up to 7,800 acre-feet per year from pumping of ground water from the Navajo Sandstone aquifer for use as coal slurry.	Yes	No	Project life and beyond	Yes	Recharge of the aquifer would require an unknown period of time after project life.
	Loss of natural flow in as many as 22 local springs and reduction in the yields of an unknown number of wells and springs in adjacent valleys due to ground water pumping of the Navajo Sandstone aquifer at Alton; and contamination and sedimentation of surface streams due to surface strip mining of coal.	Yes	No	Project life	Yes	See above; contamination and sedimentation of surface streams would continue for an unknown period of time after project life.
	Consumptive use of an average 27,443 acre-feet of water (effluent) per year from the Clark County AWT plant at the Harry Allen powerplant.	Yes	No	Project life	Yes	Water lost to evaporation in power generating process would eventually be returned via hydrologic cycle; effluent transferred from treatment plant would be made up with increasing community growth and related effluent increase.
	Increase in flood depth in Dry Lake playa with operation of flood control dikes around Harry Allen powerplant and facilities.	Yes	No	No	Yes	Flood levels would drop to natural levels with dismantling of powerplant and dikes.

(continued)

TABLE 4-9 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
			Irreversible	Irretrievable		
Vegetation Species of Concern	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 7) with the construction and operation of project components.	Yes	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.
Wildlife Species of Concern	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 8) with the construction and operation of project components.	Yes	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.
	Construction and operation of coal slurry pipeline and electrical transmission system disturbing up to 10,915 acres of habitat of the desert tortoise (<u>Gopherus agassizi</u>), a species proposed for endangered classification in Utah and protected in Arizona, Nevada, and California.	Yes	Unknown	Unknown	Yes	See above.
Cultural Resources	Adverse impact to an estimated 259 archaeological sites with the construction of the various project components.	Yes	Yes	Yes	Yes	Although some information would become instantly available, construction activities would result in the alteration of sites to a point at which the information would not be available for future investigation.
	Adverse impact to the ethnologic importance of Spirit Mountain with the placement of a microwave communication station.	Yes	Unknown	Unknown	Yes	Placement of the microwave station could permanently disgrace the sacredness of the mountain.
	Alteration of the Honeymoon Trail (currently nominated for inclusion on the National Register) with the construction of the coal slurry pipeline.	Yes	Yes	Yes	Yes	Construction on steep terrain would permanently alter the natural character of the topography in the immediate area of the trail.
Recreation and Aesthetics	Adverse impact to the scenic character of Dry Lake, Nevada when visibility reduced by concentrations of stack emissions from the Warner Valley powerplant; also adverse impact to local aesthetic and recreational resources.	Yes	No	Project life	Yes	Emissions would ultimately be removed naturally in the atmosphere.
	Part of the visual resource as viewed from Bryce Canyon National Park degraded with strip mining activities at the Alton coal fields.	Yes	Yes	Yes	Yes	Portions of the visual resource would be permanently altered even after reclamation.

(continued)

TABLE 4-9 (concluded)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources: Irreversible	Commitment of Resources: Irretrievable	Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
	Blasting associated with mining activities in the Alton coal field could alter or destroy the delicate erosional features in Bryce Canyon National Park.	Unknown	Yes	Yes	Yes	Destruction of erosional features would permanently degrade the recreational resource in Bryce Canyon.
	Visual resources degraded throughout the affected environment with the actual presence of powerplants and transmission lines.	Yes	No	No	Yes	Decommissioning would remove alien structures from natural environment; some residual construction scars would remain in certain areas.
Land Use	Change from present land uses to project uses on 15,685 acres.	Yes	No	No	Yes	Land could revert to previous uses in most affected areas after project life.
	Change in zoning in Kane and Clark Counties for those areas to be occupied by the Alton coal mine and the Harry Allen powerplant respectively.	Yes	No	No	Yes	Land could be rezoned for other projected uses after project life.
	Violation of BLM Wilderness Study Areas in southern California with placement of Western Transmission System, and loss of wilderness character.	Yes	Unknown	Unknown	Project life and beyond	Wilderness characteristics would be lost in affected areas until restored naturally over time (if possible).
	Violation of trust lands of Moapa Band-Paiute Indians (if awarded by Congress) with construction and operation of the coal slurry pipeline.	Yes	No	No	Yes	Granting of rights-of-way would be subject to tribal authority.
Socio-economics	Rapid population growth exceeding the abilities of local infrastructures to provide basic services in Kane County. Quality of life adversely affected.	Yes	No	No	Yes	Growth trends would stabilize over the course of the project and would probably be reversed at the end of the project. Without appropriate planning, the "bust" portion of the "boom and bust" cycle could be experienced in some areas.
Coal Resources	A total of 245 million tons of coal mined at the Alton coal field and consumed.	Yes	Yes	Yes	Yes	Coal would be unavailable for future use.

ALTERNATIVE 3: IMPACTS OF MAJOR CONCERN

The implementation of this alternative would involve the following major components which are analyzed according to their significant impacts to the environment: coal mining in the "Alton West" coal fields with coal to be trucked to the Warner Valley powerplant site; construction and operation of a 250-MW powerplant at the Warner Valley site in southwestern Utah; construction of the Warner Valley water project consisting of a diversion dam and canal works, an off-stream dam and a 55,000 acre-foot reservoir; construction and operation of a 1000-MW powerplant at the Harry Allen site in Dry Lake, Nevada; coal mining in central Utah or southwestern Wyoming; construction of a transmission system to send electricity from the powerplants to service areas of the city of St. George, NPC, SCE, and PG&E.

Air Quality

This alternative must comply with the applicable State and Federal air quality standards and regulations shown in table 4-1.

Coal Mining and Coal Transportation in the Alton, Southwestern Wyoming, and Central Utah Coal Fields

The emissions from strip mining of coal in southwestern Wyoming and in the "Alton West" lease area of the Alton coal fields, and underground mining in central Utah would not violate any applicable State or Federal air quality regulations or standards for particulate matter in the immediate area of the mines, the Class I areas of the Bridger Wilderness Area; Zion, Bryce Canyon, and Capitol Reef National Parks; and the potential Class I area of Fossil Butte National Monument (Development of Coal Resources in Southwestern Wyoming; [SW], USDI, 1978; CU, 1979; SU, 1979). This assumes that BACT would be applied to all mining activity and vehicle traffic associated with mining activity as required by OSM.

There would be no significant particulate matter impacts to air quality from the transportation of coal proposed under this alternative.

Visibility impacts from the strip mining of coal in southwestern Wyoming would be due to the increase of airborne particles. Maximum estimated visibility reductions in the mandatory Class I Bridger Wilderness Area would be less than 0.7 percent from an assumed background visibility of 40 miles. At the potential Class I area of Fossil Butte National Monument, visibility would be reduced by an estimated 8.9 percent (SW, 1978). The determination of the significance of these visibility impacts must be made by the Federal land managers responsible for these two areas. At present, this determination has not been made for the Bridger Wilderness Area. Should the State of Wyoming redesignate the Fossil Butte National Monument as a Class I area, NPS would make the significance determination. These estimates are for the operation of the whole southwestern Wyoming coal field. Since the coal mined for the Harry Allen plant would only be a portion of the total coal to be mined, the impact from mining coal for the Harry Allen plant could be less than the above estimates.

Because the increase in particulate matter concentrations at Capitol Reef National Park from mining activities would be expected to be less than the PSD Class I increments, visibility impairment in Capitol Reef would be expected to be small (CU, 1979). The significance of the visibility impairment must be determined by NPS, provided particulate matter impacts from mining are to be regulated under PSD regulations.

The strip mining of coal in the Alton West lease area of the Alton coal fields could reduce visibility in Bryce Canyon National Park, but mining activites could not be seen from Yovimpa Point or The Promontory. It should be noted, however, that this impact analysis was done without the benefit of a mining plan. As stated in Alternative 1, pollutant concentrations associated with population increases due to coal mining of Alton West would not be expected to violate air quality standards and regulations (EPA, 1977).

Construction and Operation of the 1,000-MW Harry Allen and 250-MW Warner Valley Powerplants

The air quality impacts from implementation of this alternative have not been studied using dispersion modeling. Instead, the emission rates calculated for this alternative were ratioed with emission calculations from the proponents' proposal (Alternative 1), for which dispersion modeling exists. The concentration estimates for Alternative 1 (table 4-3) were multipled by the ratio of Alternative 3/Alternative 1 emissions to arrive at approximated air quality impacts from this alternative (table 4-10). References cited in this alternative relate to the study or publication identified in Alternative 1, from which the original modeling results were drawn. Only the emissions of the powerplants were considered. The cumulative impacts of powerplant emissions with other existing polluting sources are considered separately.

The following air quality impacts would be expected from the combustion of central Utah coal (12,600 Btu per pound, 0.45 percent sulfur, 6.5 percent ash) or southwestern Wyoming coal (9,827 Btu per pound, 0.54 percent sulfur, 7.38 percent ash) at the 1,000-MW Harry Allen powerplant, and the combustion of Alton coal (8,897 Btu per pound, 0.86 percent sulfur, 7.19 percent ash) at the 250-MW Warner Valley powerplant:

Central Utah Coal	Harry Allen (1,000 MW) tons per day
SO_2	7.95
Particulate matter	1.22
NO_x	87.20

Southwestern Wyoming Coal	Harry Allen (1,000 MW) (tons per day)
SO_2	12.06
Particulate matter	1.75
NO_x	72.66

Alton Coal	Warner Valley (250 MW) (tons per day)
SO_2	5.19
Particulate matter	1.02
NO_x	17.15

TABLE 4-10

Estimated Air Quality Impacts Due to Emissions from the Proposed 1,000 MW Harry Allen Plant and 250 MW Warner Valley Plant

	Estimated Concentration (μg/m³)					Nitrogen
	Sulfur Dioxide (SO_2)			Particulate Matter		Oxide (NO_x)
	Annual	24-hour	3-hour	Annual	24-hour	Annual
Central Utah Coal Based On:						
Class II						
EPA Reg. IX	a	62.0	a	a	a	a
ERT	0.7	4.2	49.1	0.1	0.6	7.6
Bechtel	1.0	18.0	60.1	0.5	2.8	6.0
Class I						
Paiute Primitive Area	<1.0	<1.0	<1.0	<1.25	<2.5	a
Valley of Fire	0.45	3.3	25.5	0.2	1.0	a
Southwestern Wyoming Coal Based On:						
EPA Reg. IX	a	93.6	a	a	a	a
ERT	1.0	6.4	74.8	0.15	0.8	6.3
Bechtel	1.0	27.2	90.8	1.0	4.0	5.0
Class I						
Paiute Primitive Area	<1.0	<1.0	<1.0	<2.0	<4.0	a
Valley of Fire	0.7	4.9	38.5	0.22	1.4	a
Warner Valley Powerplant						
Class II						
EPA Reg. VIII	a	60.0	a	a	a	a
ERT	3.7	57.5	190.0	0.75	5.8	11.9
Stearns-Roger	0.8	34.0	35.6	0.1	3.6	2.7
State of Utah	7.0	26.0	a	0.45	1.95	a
Class I						
Zion National Park						
EPA	a	4.5	a	a	a	a
ERT	a	a	1.6	a	a	a
Stearns-Roger	0.05	2.5	3.9	0.005	0.075	0.2
Paiute Primitive Area						
Radian	<1.0	<1.9	<7.9	<2.5	<5.0	a
Valley of Fire	a	a	a	a	a	a

Sources: EPA Region VIII letter dated October 23, 1979 from Robert L. Duprey, Director, Air and Hazardous Materials Division, to John Arlidge, NPC
Warner Valley, ERT, 1977
Harry Allen, ERT, 1977
NPC, 1975
Modeling Summaries received in Cedar City District Office from EPA Region IX, October 16, 1979
Radian, 1980

[a]Not calculated.

Note: These concentration estimates have been normalized to reflect application of BACT emission controls and compliance with NSPS.

μg/m³ = micrograms per cubic meter

These emissions would comply with NSPS and BACT (as determined by EPA Region VIII for the Warner Valley plant).

Particulate Matter. Based on the ratio of emission rates from this alternative and Alternative 1, and interpolating modeling done by EPA (1979); Harry Allen, Warner Valley, ERT (1977); and NPC (1975), burning of Alton coal at a 250-MW Warner Valley powerplant, and burning southwestern Wyoming or central Utah coal at the 1,000-MW Harry Allen powerplant would not violate any State of Nevada or Federal air quality standards or regulations for particulate matter (table 4-10).

Based on emissions ratios developed for Alternative 1 and modeling studies done by Radian (1980), it is evident that particulate emissions from the Harry Allen and Warner Valley powerplants would not cause violations of the PSD Class I increments in the Paiute Primitive Area or the Valley of Fire State Park (potential Class I areas).

Sulfur Dioxide (SO_2). Based on coal comparisons and modeling done previously (Radian, 1980; Warner Valley, ERT, 1977; NPC, 1975), SO_2 emissions from the 250-MW Warner Valley powerplant would not be expected to cause violations of any State of Utah or Federal air quality regulations or standards in the Class II area surrounding the plant site, the Zion National Park Class I area, or the Paiute Primitive Area potential Class I area. Estimated concentrations are presented in table 4-10.

Likewise, emissions of SO_2 from the 1,000-MW Harry Allen powerplant would not be expected to cause violations of the State of Nevada or Federal air quality standards or regulations in the Class II area surrounding the powerplant site when central Utah coal would be burned. Combustion of southwestern Wyoming coal would be expected to cause violations of the 24-hour PSD Class II increment for SO_2 surrounding the Harry Allen powerplant by 3 percent. These estimates are ratioed from modeling performed by EPA Region IX using the EPA screening model.

Based on emission ratios from Alternative 1 and this alternative, and modeling done by Radian (1980), combustion of central Utah or southwestern Wyoming coal would not be expected to cause violations of PSD Class I increments for SO_2 in the Paiute Primitive Area (if reclassified as Class I). However, the 3-hour Class I increments for SO_2 would be exceeded in the Valley of Fire State Park (if reclassified as Class I).

Nitrogen Oxides (NO_x). Based on emissions ratios for this alternative and Alternative 1, and modeling done previously for Alternative 1, emissions from the proposed 250-MW Warner Valley and 1,000-MW Harry Allen powerplants would not violate any applicable State or Federal air quality standards or regulations (table 4-10). The major impact from nitrogen oxide emissions would be visibility impairment. This impact is discussed in the Visibility section of this alternative.

Ozone (O_3, Photochemical Oxidants). The maximum impacts from generation electricity on the ambient O_3 concentrations would be expected to be less than about 10 percent of the background O_3 levels (SU, 1979). This impact would not be considered significant over the life of the project.

Plume Opacity. The Harry Allen and Warner Valley powerplants must comply with the NSPS of 20-percent opacity (Federal Register, Vol. 44, No. 113). The plume from the powerplants would be barely visible at the stack except during periods when the electrostatic precipitators would not be at full operating efficiency.

Trace Elements. The pathways of distribution of trace elements and the long-term accumulation effects are not well known. Based on applicable studies performed for Alternative 1, the concentrations of trace elements emitted from the Warner Valley powerplant would not be considered hazardous to plants or animals over the life of the project (NPC, 1975). The limited analyses available show that burning central Utah coal at the Harry Allen powerplant should not pose a threat to plants and animals. The impacts from combustion of southwestern Wyoming coal are unknown. Based on impacts estimated for Alton coal (Alternative 1), there would not be a significant impact over the life of the project. The magnitude and estimated impacts of emissions of trace elements are presented in tables 5 and 6 of Appendix 12 respectively.

USFWS biological opinion of 1978 (Appendix 13) specifies a concern about possible toxic buildups in the environment near the proposed Harry Allen powerplant. In this biological opinion, USFWS indicates that BLM should require the applicants to set up a monitoring program to detect trace elements near the proposed powerplant site.

Radioactive Nuclides. There would be no significant impacts anticipated from the combustion of Alton coal. Since the emission of radioactive nuclides under this alternative would be less than Alternative 1, no adverse impacts would be expected.

Condensed Water Plumes. The cooling tower and stack plumes would be visible from the proposed Harry Allen and Warner Valley powerplants. The length and height of the plumes would be dependent upon the ambient temperature and the number of generating units in operation. It could be assumed, however, that the height and length of these plumes would not be greater than those discussed in Alternative 1 since the powerplant sizes would be 50 percent less. No adverse impacts from the cooling tower plumes would be anticipated over the life of the project.

Secondary Pollutants. The impacts of secondary pollutants are discussed in Alternative 1. Because of the qualitative nature of the discussion, the same conclusion can be drawn that the major impact from secondary pollutant formation would be visibility impairment, which is discussed in the following section.

Visibility. It is the policy of NPS to protect the scenic values of Class I areas from any adverse visual impairment at human levels of perception (letter from William J. Whalen, Director NPS, to David Hawkins, EPA, Assistant Administrator, Air, Noise, Radiation, April 1979).

The visibility impacts that would be related to this alternative have not been analyzed. However, the visibility impacts have been estimated for Alternative 1. Since the emissions ratings of particulate matter, SO_2, and NO_x from the Harry Allen powerplant would be 85-percent, 81-percent, and

36-percent less respectively when burning central Utah coal, and 79-percent, 70-percent, and 47-percent less respectively when burning southwestern Wyoming coal, the visibility impairment in the Valley of Fire State Park and the Paiute Primitive Area due to the emissions of the Harry Allen powerplant in this alternative would be expected to be less than the reduction in visual range identified in Alternative 1. Therefore, the impacts to visibility from the Harry Allen powerplant would be expected to be small.

Based on emissions data for the 500-MW Warner Valley powerplant in Alternative 1 and ratios for the 250-MW powerplant in this alternative, the reduction in visual range from the Paiute Primitive area would not be expected to be significant and the visibility impacts would be expected to be small. A study is currently being conducted to determine possible visibility impacts to Zion National Park. It is anticipated that the study will be included in the final AWV EIS.

A brown haze could be visible as a result of powerplant emissions under certain atmospheric conditions, due to NO_2 discoloration of the atmosphere. The duration and significance of such an impact is unknown due to insufficient data.

Cumulative Impacts. There are no known developments proposed near the Warner Valley powerplant which would use up part of the PSD increments or otherwise cause violations of the NAAQS to occur when combined with concentrations from the Warner Valley powerplant.

The analysis of the Harry Allen powerplant in combination with any other local sources of air pollution (i.e., Reid Gardner powerplant) must demonstrate that the applicable State of Nevada and Federal air quality standards and regulations would be met. This is being studied by EPA Region IX in their PSD permit review.

Population Growth. The pollutant concentrations associated with population growth due to the AWV Energy System would not be expected to violate air quality standards and regulations.

Nonattainment Area of Las Vegas. The impacts of the Harry Allen powerplant on ambient concentrations of total suspended particulates and CO in the Las Vegas nonattainment area would be expected to be minor - less than one-half the values identified by EPA as significant (Federal Register, Vol. 43, No. 118). Significance values have not been established for O_3. However, an evaluation of meteorological conditions associated with historically high O_3 episodes, and a comparison of emissions and calculated ambient concentrations of reactive hydrocarbons and NO_x (O_3 precursors in the photochemical process) with existing emissions of these pollutants in the nonattainment area indicate that peak O_3 concentrations would not be increased (Radian, 1980).

Water Resources

Major components of this alternative which would affect water resources would be: coal mining in the central Utah or southwestern Wyoming coal fields and the Alton coal field; development of the Warner Valley water project including subsequent diversions; and allocation to and construction of the Harry Allen powerplant in Dry Lake, Nevada.

Coal Mining in Central Utah or Southwestern Wyoming

Final EISs which address the effects of coal mining on water resources in central Utah and southwestern Wyoming have been prepared (CU, 1979, and SW, 1978 respectively) and should be consulted for detailed information. Essentially, the major impacts on water resources in these areas would be those due to mine drainage, ground water aquifer interruption and replacement, and surface water contamination from wastes or sedimentation. Water pollution hazards due to mine drainage would be minimal because water in the low sulfur coal deposits would be essentially the same chemical composition as in the surrounding aquifers.

The pumping of ground water in relation to underground mining in central Utah could reduce spring and well yields in the immediate and adjacent areas (CU, 1979). Aquifers would gradually recover after the life of the project.

Ground water interruptions and replacement due to surface mining in southwestern Wyoming would not significantly affect water quality or water movement over the long term. Although there would be temporary increases in permeability and recharge of the backfill (compared to the original material), it would gradually be reduced due to natural compaction (SW, 1978). Mining operations in or below saturated zones would alter local hydrologic relationships and could reduce spring yields and streamflows and lower water levels in local wells. The number of wells, springs, and streams affected would be small.

Mining effects on surface water quality would depend on the type and concentrations of the wastes, the frequency of flow volumes, and the water quality of the stream affected. Surface runoff in the central Utah coal fields could be diverted into the ground locally due to subsidence and fracturing of the material overlaying the mines and would eventually be discharged elsewhere. However, primary impacts of mining would probably be increased suspended sediments and TDS due to surface disturbance and subsequent runoff. These impacts would be essentially local and would be ". . . relatively insignificant in terms of sediment movement because the potential source areas are very small" (CU, 1979).

Mitigating measures such as retention ponds or contour furrowing would help hold these contaminants on site. These features are described in both coal statements.

Other contaminants could be released from storage and loading areas, sewage treatment plants, and other mine facilities. Wastewater may include fecal bacteria, petroleum products, detergents, and solvents, which if allowed to discharge directly or indirectly into the stream through settling ponds or runoff, would lower the quality of downstream water. Data is not available to assess the impact that effluent would have on stream water quality in the coal fields if the effluent would be released directly to streams. However, EPA and State regulations allow no decrease in the quality of water at the point of discharge of any effluent to the stream. See regional and site specific EISs for more detail and specific impacts.

Coal Mining in the Alton Coal Fields

Impacts of coal mining in the Alton coal fields have been addressed in the SU document (1979), (USDI, 1975), and are further discussed in Alternative 1 of this chapter. Essentially the major impacts on water resources from mining in the "Alton West" lease area would be those of disturbance or removal of shallow ground water aquifers and associated springs due to surface mining and backfill replacement, surface water contamination from mine wastes, and increased sedimentation. For further discussion see Alternative 1 (Water Resources), although impacts to water resources under Alternative 3 would be less significant due to the smaller size of the coal mine and the area that would be affected.

Warner Valley Water Project

This analysis is based on flow regimes stipulated in a USFWS biological opinion designed to protect the endangered woundfin minnow (Appendix 13). A simulation of this flow regime for the years 1940 through 1975 was the basis of this analysis (Stauffer, Utah Division of Water Resources, January 24, 1980). The analysis consists of two components: (1) an analysis of the reservoir system and proposed water uses, and (2) an analysis of the effects of diversions and subsequent regime on the Virgin River below the proposed diversion site.

Based on the simulation, the average annual reservoir yield would be 24,000 acre-feet. With this average annual yield, the 49,500 acre-foot annual delivery schedule as proposed by the Washington County Water Conservancy District (December 6, 1979; fig. 2-13) would not be realized.

The proposed Warner Valley powerplant (250 MW) would use an average of about 3,000 acre-feet of water per year from the reservoir. However, up to 6,000 acre-feet of water per year could be used, depending on climatic conditions, coal burn rates, and consumer electricity demand. An additional 8,000 acre-feet per year would be used for supplemental irrigation on presently irrigated land in Washington County.

Of the 24,000 acre-foot average annual yield of the reservoir, only 10,000 acre-feet would be available to meet potential uses (table 2-10; fig. 2-13). This analysis assumes that the powerplant would consumptively use 6,000 acre-feet of water annually and that the dead storage volume of 5,000 acre-feet would be stored the first year that the available water supply would exceed the two firm commitments.

Based on 10,000 acre-feet available annually, approximately 11,165 new domestic water connections could be available to the Washington County area. This would correspond to approximately 28,000 new residents.

Table 4-4 lists the present available water supply and projected baseline water requirements for the communities with proposed uses. From this table it does not appear likely that the additional reservoir water supply available (10,000 acre-feet) would be used for domestic uses before the year 2000, especially if full treatment would be required. Interim uses such as fisheries and recreation could be developed to utilize this available capacity (table 2-10).

Based on simulated inflows to the reservoir, and outflows modified to reflect only proposed power and irrigation requirements, a recreation and fisheries usage could be maintained until other proposed uses would be developed. This flow regime would maintain the reservoir at its 55,000 acre-feet storage capacity. In addition, this proposal assumes that reservoir water quality would be adequate for fisheries use and that adequate supporting recreational facilities would be developed. Reservoir drawdown during the summer months would average 3 to 4 feet (Stauffer, January 24, 1980; Bingham Engineering, 1977) and should be adequate for fisheries stocking.

Reservoir Water Quality

Average TDS would range between 500 and 600 mg/ℓ depending on evaporation and the influence of the geologic formations underlying the reservoir, and would be the only chemical parameter exceeding State of Utah recommended drinking water standards. According to the State of Utah Department of Social Services, Division of Health (1975), the water from the reservoir would require full treatment before it could be used as a culinary source.

Turbidity levels in the reservoir would be seasonal, being low during summer months and high during winter and early spring (Alternative 1, same component).

Based on 7 years of sediment data at the Hurricane gaging station and quantitative analysis procedures used by Vaughn Hansen Associates (208 Water Quality Study, 1977), approximately 243,000 tons of sediment would be diverted annually under the proposed diversion schedule. Of this, about 155,000 tons would flow into the Warner Valley reservoir. At this rate, the reservoir's 5,000 acre-foot dead storage capacity would be filled in 50 to 70 years. Continued sedimentation beyond these dates would reduce usable storage capacity.

Failure of the proposed Warner Valley dam would result in a flood at least as damaging as a standard project flood as identified by the Army Corps of Engineers (U.S. Department of Defense, 1973). Failure would require breaching and a flood of greater magnitude than the 100-year flood could result. The probability of such a flood is not known.

New springs may occur on the west side of Warner Ridge as a result of the reservoir. Water could move through the Shinarump member of the Chinle Formation and issue from the Moenkopi Formation (Bingham Engineering, 1977). These springs would discharge on adjacent public lands and would ultimately empty into the Virgin River. The likelihood or extent of flow of these springs cannot be estimated.

Effects on the Virgin River System

Impacts to the Virgin River system below the diversion are analyzed by river segments. Table 4-5 lists pre and postproject median flows, based on a computer simulation of the Utah Division of Water Resources (Stauffer, January 24, 1980).

Hurricane Diversion to St. George-Washington Fields Diversion. Average annual flows bypassing the proposed Hurricane-Warner Valley water project diversion would be about 69,500 acre-feet, which would reduce the annual flow bypassing the diversion by about 24 percent. Median flows bypassing the diversion would be reduced by approximately one-third during the winter and spring (table 4-5).

Of the 242,600 tons of sediment diverted on the average each year, the desilting works would be expected to return about 48,500 tons of sediment to the river below the diversion, which would be carried downstream by the remaining 61,000 acre-feet of water passing the diversion each year. In addition, flows with the highest concentrations of sediment (greater than 20,000 mg/ℓ), would be allowed to pass the new diversion. Consequently, the net effect of the diversion and desilting works would be to decrease the total load carried by the river by about 5 percent and increase downstream concentrations of suspended sediment perhaps by as much as 60 percent per year below the proposed diversion.

With the CP National Utilities Company continuing the diversion of 40 ft^3/s for hydroelectric power generation and the Warner Valley water project diversion, the river would be expected to be dry from the LaVerkin diversion to LaVerkin Springs about 25 to 35 percent of the time, including some winter and spring months of dryer years. By comparison, preproject no-flow conditions below the LaVerkin diversion would probably occur about 10 to 20 percent of an average flow year.

Average water quality would be impaired below LaVerkin Springs because of the decrease in flow available to dilute the saline LaVerkin Spring flow. Annual TDS concentrations would average 2,040 mg/ℓ and would reach 9,600 mg/ℓ 25 to 35 percent of the time. At the powerplant return flow, dilution by 40 ft^3/s would reduce the annual average to about 1,500 mg/ℓ, an increase of about 350 mg/ℓ over preproject conditions.

Postproject median flows at the Hurricane gaging station would be expected to range from 75 to 130 ft^3/s yearlong, with flows over 100 ft^3/s during the winter and spring (table 4-5). Low flows during summer months would not be changed significantly since additional water would not be diverted at the proposed Warner Valley water project diversion under these conditions.

Based on simulated flows from 1940 to 1965, it appears that average salinities near the Hurricane gaging station would increase approximately 100 mg/ℓ annually. Salinity is inversely related to flows; generally the higher the flow the lower the salinity because of the effect of flow on dilution of the water from LaVerkin Springs. The increase in salinity could cause the remaining flows in the river to be less suitable for irrigation water at the St. George-Washington Fields diversion. However, impacts to these users could be negligible or slight during summer months when high quality reservoir releases would supplement water diversions from the river. The net effect may be an improvement of irrigation water for use in the St. George - Washington Fields area. The impact of the increased sediment concentrations on downstream water users would probably be minimal. While the remaining water in the river would be carrying more sediment on the average, concentrations would be well below 10,000 mg/ℓ and would not be prohibitive for diversion for agriculture. In addition, the new diversion would probably not increase the frequency of flows with extremely high concentrations of suspended sediment greater than 20,000 mg/ℓ, which generally cannot be diverted for irrigation.

St. George-Washington Fields Diversion to Bloomington. Following construction of the project, nearly all flows from May through October would be diverted at the St. George-Washington Fields diversion. Median flows would be reduced by half or more yearlong except during the summers, when nearly all flows would be diverted.

Flows bypassing the diversion would generally be less than 20 ft^3/s from May through October. Winter and spring flows would exceed 70 ft^3/s about half the time.

Flows would increase downstream from ground water influx and irrigation return flows to where postproject flows would be generally expected to be greater than 40 ft^3/s year round at Bloomington.

Salinity concentrations below the St. George-Washington Fields diversion would increase from irrigation return flows. This effect would be greatest during the summer months but specific TDS values are not known. The total flow in the Virgin River below the diversion is partially attributable to ground water accretions, and whether the supplemental irrigation would alter the existing ground water component (quality or quantity) is not known.

Average annual flow would be expected to be reduced by at least 15,000 acre-feet at Bloomington because of consumptive use (table 4-6). Consumptive use was calculated for each of the proposed uses of the reservoir water with the following assumptions:

1. Reservoir seepage and annual losses of 5,200 acre-feet would not be returned to the river (Stauffer, February 5, 1980).

2. Powerplant consumptive use would be 6,000 acre-feet per year.

3. Municipal and industrial losses would be about 40 percent of the reservoir water intended for those purposes (4,000 acre-feet). The remainder would be returned to the river.

4. Since 8,000 acre-feet of water has been identified for supplemental irrigation, no significant increase in agricultural consumptive use would occur. See Alternative 1 for additional discussion.

Bloomington, Utah to Lake Mead, Nevada. The Virgin River loses an average 51 ft^3/s to infiltration above the Virgin River Gorge. If the flow at Bloomington would be less than the infiltration capacity, then no water would enter the Gorge and the river would be dry to Littlefield Springs.

Summer flows at Littlefield, Arizona would be augmented by the new reservoir releases and return flow. Median flows could increase by 5 to 40 ft^3/s during the summer but could be reduced by 60 to 125 ft^3/s from November to May.

If the effluent reach is related to Littlefield Spring as evidence indicates, it appears that the loss of recharge to the aquifer during the winter months would be offset by the newly sustained recharge during the summer months (table 4-5). However, the water recharging the aquifer would be of poorer quality than the preproject water as described previously. It is possible that ultimately the TDS concentrations in the Littlefield Springs flow would be increased in proportion to the increase in TDS experienced at the Hurricane gaging station upstream.

The expected increase in salinity would probably range from 200 to 500 mg/ℓ from November through May following construction of the project. Average salinity could be reduced by as much as 60 mg/ℓ with the increased flow expected during the summer months. These calculations were made assuming that the quality of the water coming from the upper Virgin River would be the same under postproject conditions. However, the salinity of the upper basin water would be increased as described previously due to the reduced flows and increased salinity below LaVerkin Springs, and the increased return flows (irrigation and industrial) below the St. George-Washington Fields diversion. Quantitative effects of the increased salinity on the water quality of the Virgin River below the Virgin River Gorge is not known, but it is assumed that this factor would increase the projected TDS values for winter, spring, and annual flows.

Water users below the Virgin River Gorge should not be significantly affected by the altered flow regime and water quality. Since only good quality snowmelt peak flows are used for leaching and since these flows would continue to pass by the upstream diversions, no change from the present situation would be expected. In addition, when lower quality winter flows are diverted, they are used primarily to sluice sediment out of the canals. Additional water could be available during summer months due to increased irrigation return flow below Washington Fields. Primary crops grown in this region are alfalfa, grains, and some sileage (personal communication, Dee Hughes, former President of Mesquite Canal Company, January 23, 1980).

Dry Lake, Nevada and Las Vegas Wash

Construction of the Harry Allen powerplant along with the necessary diversion dikes and storage and settling ponds would reduce the surface area of Dry Lake playa by 1,850 acres. This would elevate flood levels of a potential 50-year flood by 8.5 feet above the present natural ponding elevation. This could result in increased maintenance problems for the existing transmission lines located along the eastern end of the playa. Flooding of the old highway frontage road and access to the town of Dry Lake should be eliminated by construction of the proposed flood control structures.

No significant impacts to Las Vegas Wash would be expected from the transfer of an average of 16 mgd of effluent from the Clark County AWT plant to the powerplant. See Alternative 1 for additional discussion.

Wetlands and Floodplains

The major areas of concern are the lack of data relating to coal development, the reduction of Virgin River flows on wetlands, and the proposal to locate the Harry Allen powerplant within the 50-year floodplain of Dry Lake. In addition, proposed rail transport and trucking of coal would require upgrading of existing local facilities which may effect an unknown but probably small amount of wetlands and/or floodplains. Approximately 2,610 floodplain acres and at least 29 miles of wetlands along the Virgin River would be affected. For further information see the wetlands and floodplain discussion in Alternative 1.

Vegetation: Species of Concern

Several vegetation species of concern could be adversely impacted with the construction and operation of the components of this alternative in the States of Utah, Arizona, Nevada, and California (Appendix 7). Although not expected to be great, the significance, duration, and character of these impacts are unknown due to the lack of on-ground information. According to the standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM is consulting with USFWS on these species in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Consultation is expected to be completed for the final EIS.

Warner Valley Powerplant and Water Project

Two officially endangered species, Pediocactus sileri and Arctomecon humilis would be impacted with the construction of the Warner Valley powerplant and water project. According to a BLM biological assessment (1980), impacts to Arctomecon humilis could lead to the extinction of the species. In accordance with the Endangered Species Act (as amended 1978) consultation between BLM and USFWS is ongoing. USFWS will issue an official biological opinion concerning these species in July 1980 which could have a bearing on the final design or feasibility of the water project and powerplant.

Central Utah Coal Field

Two locally occurring plants, Townsendia aprica and Astragulus subcinereus var. basalticas, are proposed endangered and threatened species respectively. Expansion of mining activity could impact the habitat of these species. Townsendia aprica is especially susceptible to impact because of its small numbers and limited habitat (less than 100 individuals in two populations). BLM and USFWS have not conferred on the potential impacts to these species because no mining plan has been submitted. Should this coal source be selected, an intensive on-ground survey would be initiated and BLM and USFWS would confer on the possible impacts to these plant species in accordance with Section 7 of the Endangered Species Act (as amended 1978).

Alton Coal Field

NPS has expressed concern that revegetation of coal-mined lands south of Bryce Canyon National Park could introduce plants not native to the area. Should this occur, it would be possible that these introduced plant species could eventually become established within the park, thereby altering its natural character.

Wildlife: Species of Concern

Several wildlife species of concern could be adversely impacted with the construction and operation of the components of this alternative in the

States of Utah, Arizona, Nevada, and California (Appendix 8). Although not expected to be great, the significance, duration, and character of these impacts are unknown due to the lack of on-ground information. According to standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM is consulting with USFWS on these species in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Consultation is expected to be completed for the final EIS.

Electrical Transmission System

The desert tortoise (Gopherus agassizi), currently proposed for USFWS listing as an endangered species in Utah and protected in the States of Arizona, Nevada, and California, could be adversely impacted during construction of the electrical transmission system on 6,206 acres of habitat from the Beaver Dam Slope in southwestern Utah to southern California (fig. 3-6). Collisions with construction vehicles and human capture could result in reduction of local populations. According to a BLM biological assessment, these impacts would not be significant in Utah because proposed critical habitat would essentially be avoided. BLM is consulting with USFWS on the desert tortoise, in accordance with the Endangered Species Act (as amended 1978). USFWS will issue an informal biological opinion concerning the tortoise in July 1980 which could have a bearing on the final design and routing of the transmission system.

Warner Valley Water Project

The USFWS, in a biological opinion concerning the officially endangered woundfin minnow (Plagopterus argentissimus), recommended a minimum flow criterion of 70 ft^3/s for the months of July through October and 110 ft^3/s for all other months as recorded at the Hurricane gaging station in order to protect the habitat of this fish (Appendix 13). This alternative as designed should protect the habitat of the woundfin minnow as stipulated by USFWS.

The proposed endangered Virgin River roundtail chub (Gila robusta seminuda), could be adversely affected by diversions of the Virgin River associated with the operation of the water project. In accordance with Section 7 of the Endangered Species Act (as amended 1978), BLM is consulting with USFWS on the roundtail chub (letter dated March 5, 1980). BLM prepared a biological assessment on the fish (1980), recognizing that the water project as designed under this alternative could adversely impact its habitat. However, there is insufficient data available to draw a definite conclusion.

USFWS is in the process of investigating the habitat and flow requirements of the roundtail chub and will issue an informal opinion to be included with a revised official biological opinion on the woundfin minnow in September 1980.

The possible adverse impacts to the roundtail chub would be attributed to reduced flows in the Virgin River. Reduced flows downstream from the water project diversion could adversely affect the fish by reducing its populations and habitat downriver to the Virgin River narrows (fig. 4-6). Secondary impacts to the fish associated with streamflow alterations could be changes in water quality (increased salinity), temperature (changes in critical biological temperatures), the possible introduction of exotic fish species into the reservoir, and outfalls which could lead to competition and possible reduction or extinction of the woundfin minnow and roundtail chub (BLM Biological Assessment, USDI, 1980).

Archaeology, Ethnology, and History: Cultural Resources

Since inventories are not complete, this analysis contains estimates of varying exactness relevant to the amount of resource that would be adversely impacted by various project components. Unless otherwise specified, where data is incomplete, inconclusive, or simply nonexistent, average densities of 15 sites per section (640 acres), or one site per 5 miles of linear distance (transmission lines, pipelines) is assumed and incorporated in the analysis of impacts. It is further assumed that 95 percent or more of these sites will be archaeological (rather than historical), and that 75 percent or more will be found to be of National Register caliber under the criteria that they ". . .have yielded, or may be likely to yield, information important in prehistory. . ." (36 CFR, Part 60).

Also due to the lack of a complete data base, this document does not demonstrate full compliance with procedures outlines in 36 CFR, Part 800, "Protection of Historic and Cultural Properties." It is the intention of BLM to comply with these procedures following approval of an alternative. This intent is documented by the nature and substance of the standard operating procedues developed and included in Appendix 6 and by the provision of the "Memorandums of Understanding" developed with the SHPOs of the States involved with the project (Appendix 16).

Alton Coal Fields

An estimated 43 sites would be adversely impacted during mining activities on 1,830 acres of mining permit area at Alton. Of the total sites, at least 32 would probably be of National Register caliber. Increased population pressure could lead to increased vandalism of some local sites. No significant historical properties are presently known in the Alton fields.

Warner Valley Powerplant

Construction of the powerplant would destroy eight known archaeological sites (Thompson and Thompson, 1976). These sites have not been submitted for determination of eligibility, but it is assumed that five or six would meet National Register criteria.

The Dominguez-Escalante and Honeymoon Trails would be impacted by the construction and operation of the powerplant (fig. 2-5). The proposed right-of-way boundaries of the powerplant would place the facility over portions of these historic trails. The powerplant would conflict with a NPS proposal to designate the Warner Valley portion of the Dominguez-Escalante Trail to the National Historic and Scenic Trails System. The Honeymoon Trail has been nominated for inclusion in the National Register of Historic Places. The route of the Honeymoon Trail from the Hurricane Cliffs to St. George is essentially the same as what is known as the Temple Trail.

Warner Valley Water Project

No known archaeological sites would be impacted by construction and operation of the water project.

The proposed diversion structure to be built on the Virgin River would, as designed, cause the destruction of the Hurricane Canal/Diversion. The Hurricane Diversion structure and 6.5 miles of the canal have recently been listed on the National Register of Historic Places. Construction of the proposed diversion and canal structure needed to feed water to the proposed reservoir would destroy the historic diversion structure as well as occupy portions of its canal for channeling waters to the reservoir (Washington County Water Conservancy District, 1975).

Central Utah Coal Field, Southwestern Wyoming Coal Field

Approximately 4,540 acres would be affected by mining activities in central Utah, with related impacts to an estimated 43 archaeological sites (CU, 1979). An estimated 30 or more of these sites would possibly be of National Register caliber. Principal adverse impacts would be attributed to surface construction of facilities and haul roads. No known historical properties exist in the field.

Destruction or alteration of unknown (buried) sites would occur due to mining activities in the southwestern Wyoming coal field. Although regional estimates of numbers of sites have been made for the field, it is difficult to qualify or quantify archaeological sites without a site-specific mine plan and related survey. It would be expected that 300 sites could be adversely impacted during mining activities (SW, 1978), of which a total of possibly 225 or more would be of National Register caliber. Impacts to local historic properties cannot be qualified without a site-specific mine plan.

Harry Allen Powerplant

No known cultural resources would be adversely impacted with construction or operation of the powerplant (Brooks, 1976; NPC, 1975).

Electrical Transmission System

Construction of the transmission system could adversely impact archaeological sites on 7,388 acres of right-of-way. Segments of the transmission system are considered separately because of their geographical distribution.

Spry to Alton. The nature and extent of the cultural resources along the Spry to Alton corridor are poorly known and it is difficult to qualify or quantify significant impacts. However, an estimated 17 sites would be impacted, including at least 13 probably of National Register caliber.

Warner to St. George. The proposed corridor from the Warner powerplant to St. George has not yet been surveyed. Exact surveying and alignment would determine whether or not any cultural resources would be involved. An estimated three sites would be impacted, two of which would probably be of National Register caliber.

Warner to Pecos. Portions of this corridor have been surveyed for cultural resource values but no significant archaeological sites were located (Turner et al., 1975). Certain segments paralleling the Navajo-McCullough transmission line have yet to be surveyed. An estimated 24 sites would be impacted, including an estimated 18 sites probably of National Register caliber.

Allen to Eldorado. The segment from the Allen powerplant to the Eldorado substation has not yet been inventoried, although some portions of the Navajo-McCullough transmission line (which the proposed line would parallel) have been inventoried with negative results (Turner et al., 1975). An estimated 10 sites would be impacted, seven or eight of which would be of National Register caliber.

Western Transmission System. The number of potential archaeological sites that would be adversely impacted due to construction activities along the Western Transmission System from the Eldorado substation in southern Nevada to Lugo, California are estimated by alternative corridors (Barker et al., 1979). The Memorandum of Understanding signed by BLM and the State of California for IPP (Appendix 16) is also considered to apply to the alternative routes of the Western Transmission System for the AWV Energy System until such time that a project-specific memorandum can be negotiated.

Interstate 15. An estimated 14 sites would be impacted along thie alternative route, 10 or more of which may be of National Register caliber.

Eldorado-Lugo. An estimated 17 sites would be impacted, at least 13 of which may be of National Register caliber.

Victorville-McCullough. An estimated 17 sites would be impacted, 11 of which are possibly of National Register caliber.

Highway 66. An estimated 12 sites would be impacted, at least 10 of which may be of National Register caliber.

A microwave communication site associated with the transmission system would be constructed on Spirit Mountain in southern Nevada. This mountain is an area of ethnographic importance (Cultural Resources, Chapter 3). In compliance with the American Religious Freedom Act (PL 95-341), consultation was initiated and is ongoing with regional Indian tribal authorities.

Recreation and Aesthetics

Central Utah Coal Field, Southwestern Wyoming Coal Field

Expanded coal development in the central Utah coal field would create minor impacts to visual resources in the region because those resources have already been impacted by existing coal mining. Underground mining would have only a minor impact on visual resources, depending on the severity and location of subsidence (CU, 1979).

Expansion of surface strip mining would further detract from the visual resources of the developed southwestern Wyoming mining region. Approximately

12,670 acres could be adversely affected by mining activities (SW, 1978). High walls and spoil piles would temporarily replace existing topography during actual strip mining. Even after reclamation of mined lands, the landscape would not blend entirely with surrounding unmined areas.

Alton Coal Field

As discussed in Alternative 1, actual mining activities could adversely impact Bryce Canyon National Park. The presence of mining facilities and strip mining activities would alter local visual quality in the area of the Alton West coal fields and would not meet VRM Class IV objectives, although the impacts would be less because of the smaller size of the coal mine. Mining activities would not be directly visible from Yovimpa Point or The Promontory in Bryce Canyon National Park, although dust, air pollutants, and noise could impact the aesthetic and recreational values in the park (Air Quality section of this alternative).

The proposed route to be used for trucking coal from the Alton coal field to the Warner Valley powerplant would dramatically impact traffic volume. The passing of an average of one coal-laden truck every 10 minutes would adversely affect motoring recreationists along the route, especially near Coral Pink Sand Dunes State Reserve, Hurricane, Kanab, and in Warner Valley for the life of the project.

Warner Valley Powerplant and Water Project

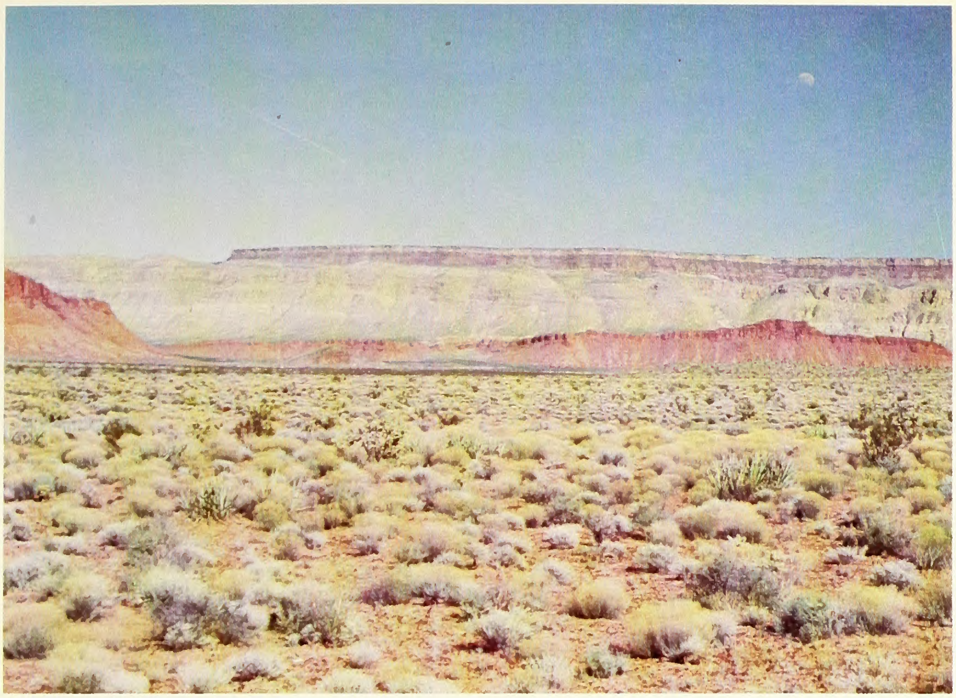
The visual resources within the St. George Basin and surrounding landscape would be adversely affected with the presence of the powerplant and related facilities and the area would not meet VRM Class IV objectives for the life of the project (fig. 4-11). Powerplant emissions would further degrade aesthetic quality because the powerplant plume would be especially visible and a yellowish-brown haze could occur during stable air conditions, which occur 30 percent of the time (Air Quality section of this alternative).

The presence of the proposed Warner Valley reservoir would have a positive impact on the recreational and scenic quality of northern Warner Valley, improving the areas of existing VRM Classes III and IV to Class II (fig. 4-8) and resulting in an influx of recreationists.

The reservoir would maintain a 55,000-acre-foot storage capacity, of which 10,000 acre-feet of water would not be utilized for domestic purposes until after the year 2000. Recreational resources such as boating, swimming, and fishing could be developed during this interim period to utilize this surplus capacity until other uses would be required. Reservoir drawdown of 3 to 4 feet during the high recreational use period (summer months) would not be expected to deter recreational use and should be adequate to develop sport fisheries (Water Resources section of this alternative).

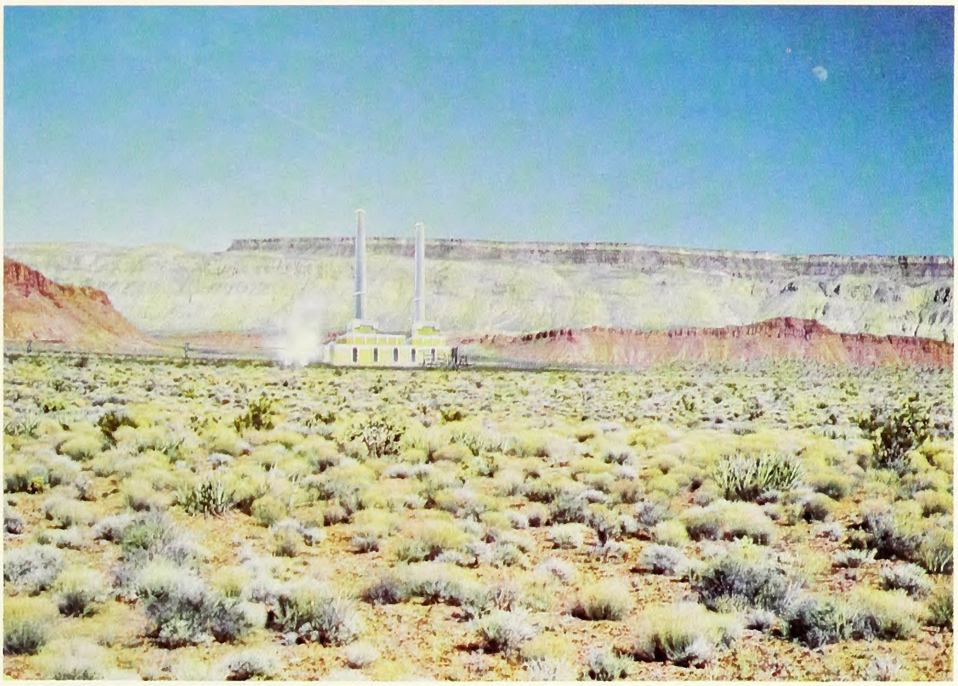
Harry Allen Powerplant

The construction of the powerplant would detract from the natural visual character of the site for the life of the project. Presence of the powerplant and facilities would prevent the area from meeting VRM Class III objectives (fig. 4-12). Powerplant emissions and the smokestack plume would



PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

EXISTING SITUATION



VISUAL SIMULATION BY BUREAU OF LAND MANAGEMENT

SIMULATED PHOTOGRAPH

FIGURE 4-11

VISUAL SIMULATION OF 250-MW WARNER VALLEY POWERPLANT

PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

EXISTING SITUATION

VISUAL SIMULATION BY BUREAU OF LAND MANAGEMENT

SIMULATED PHOTOGRAPH

FIGURE 4-12

VISUAL SIMULATION OF 1,000-MW HARRY ALLEN POWERPLANT

impact local visibility and air quality, thereby degrading visual and recreational resources (Air Quality section of this alternative).

Electrical Transmission System

The expected impacts of the Spry to Alton, Warner to St. George, Warner to Pecos, Allen to Eldorado, and the Western Transmission System corridors on recreation and aesthetics would be identical to those discussed in Alternative 1. The construction of access roads would permit increased access to previously inaccessible areas. Visual resources would be impacted with the erection of tower structures and powerlines which would detract from the surrounding scenery.

Land Use, Land Use Plans and Controls

The distribution of land ownership for lands affected under this alternative is described in table 2-9. Present land use would be changed on affected acreage during the 40-year life of the project to the project uses indicated below. After decommissioning, these areas would be available for other uses or would revert to pre-existing land uses.

Component	Acreage Affected	Present Land Use	Project Use
Alton West Coal Field	1,830	Range, Wildlife	Surface and underground mining
Central Utah Coal Field (option)	4,540	Range, Wildlife	Underground mining
Southwestern Wyoming Coal Field (option)	12,670	Range, Wildlife	Underground and surface mining
Harry Allen Powerplant	5,000	Recreation, Wildlife	Heavy industrial
Warner Valley Powerplant	3,647	Range, Recreation	Heavy industrial
Warner Valley Water Project	2,993	Range, Recreation	Reservoir, Recreation
Electrical Transmission System	7,388	Range, Recreation, Wildlife	No change on unfenced rights-of-way; (temporary impact during contruction); 359 acres of maintained access roads

Alton Coal Fields

An analysis of the impacts to land use and land use plans and controls has been previously prepared for the Alton fields (SU, 1979). These impacts are further described in Alternative 1 for the same component although less land would be affected under this alternative with the development of only the Alton West lease area for mining.

One exception to the impacts described in Alternative 1 would be the design of the coal transportation system. Trucks hauling coal to the 250-MW powerplant in Warner Valley would require upgrading of roads and highways along the proposed route. The route would create a new potential traffic hazard to private vehicles. Based on an average of 320 million vehicle (truck) miles traveled over the 40-year project life, 1,376 additional accidents and 12 fatalities could be expected to occur (personal communication, Steve Glines, Utah Division of Highway Safety, March 14, 1980).

Warner Valley Powerplant

Significant impacts to land use, land use plans and controls from the construction and operation of the Warner Valley plant would be identical to those described in Alternative 1 for the same component, except that 648 acres less would be needed to construct a smaller powerplant.

A zoning change from the present classification of open space to heavy industrial would be required for the affected area by the Washington County Planning Commission. The proposed powerplant site would also conflict with the BLM Cottonwood Canyon intensive wilderness inventory unit (fig. 3-9). The granting of a right-of-way permit is prohibited in this area as long as the interim management policy is applicable (Land Use, Chapter 3).

Warner Valley Water Project

The impacts to land use of this project would be essentially the same as discussed in Alternative 1, except that up to 18,000 acre-feet of water would be available for irrigation, municipal, and industrial water use (table 2-10). This water could provide 6,000 additional acres of alfalfa, milo, or other crops for Washington County and would amount to 12 percent of the presently irrigated cropland in Washington County (personal communication, Rich Chase, Washington County Agricultural Agent, January 14, 1980). The increased availability of water for municipal and/or industrial uses would encourage future residential and industrial growth in the communities affected. This growth would require the re-evaluation of current land use plans and controls in Washington County.

An average of 3,000 acre-feet would go to the Warner Valley powerplant for electricity production, although up to 6,000 acre-feet per year could be used, depending on consumer electricity demand, coal burn rates, and climatic conditions.

Zoning changes would be required by the Washington County Commission for acreage affected by the implementation of the water project. The multiple use category would be changed to a municipal and industrial based primary use reservoir with an agricultural secondary use.

Central Utah Coal Field, Southwestern Wyoming Coal Field

Discussion of impacts to land use and land use plans for the central Utah and southwestern Wyoming coal fields is presented in CU (1979) and SW

(1978). Present land use would change due to mine expansion on 4,540 acres if central Utah coal would be used, or 12,670 acres if southwestern Wyoming coal would be used. Mining activities would not conflict with State, local, regional, or Federal land use plans, as the areas are already zoned for mine development.

Harry Allen Powerplant

Approximately 5,000 acres of public land would change from the present multiple use status to the single use/heavy industrial category (BLM Management Framework Plan of the Virgin Valley Planning Unit - Caliente Resource Area, USDI, 1974). A zoning change from rural open to heavy industrial would have to be approved by the Clark County Comprehensive Planning and Environmental Commission.

A right-of-way would have to be obtained for the routing of the AWT pipeline across portions of Nellis Air Force Base in southern Nevada. A right-of-way would be issued by the Air Force if the action would not interfere with the mission of the base, and the action would be for the good of the public.

Electrical Transmission System

Approximately 7,388 acres of land would be required for the construction and operation of transmission lines. As explained in Alternative 1 for the same component, no conflicts with local, State, or Federal government land use plans or controls would be expected with the construction and operation of the Spry to Alton, Warner to St. George, or Allen to Eldorado transmission lines. Should either one of two bills introduced in Congress that would provide trust lands for the Moapa Band - Paiute Indians be passed, a conflict with the Warner to Pecos transmission corridor could occur. As in Alternative 1, the applicants would have to apply for a right-of-way for routing this transmission line across Nellis Air Force Base in Nevada.

The Western Transmission System could conflict with the final California Desert Conservation Area Plan, which is currently in draft form and subject to change pending public comment. All four Western Transmission System alternatives and one microwave communication site would be in conflict with BLM Wilderness Study Areas in southern California (fig. 3-8). The granting of rights-of-way is prohibited under the interim management policy as specified in the Federal Land Policy and Management Act of 1976 (Land Use, Chapter 3).

The crowding of various transmission lines into single corridors would preclude or otherwise impact other existing or protential land uses for the same area. This crowding effect would occur near Rainbow Gardens, in Eldorado Valley, and through the McCullough Pass in southern Nevada, and in the Interstate 15, Eldorado-Lugo, or Victorville-McCullough alternative corridors of the Western Transmission System in southern California. Problems may also arise in the limitation or preclusion of future transmission line routings.

Socioeconomics

Most major socioeconomic impacts would result from relatively rapid changes in local populations. The effects of such changes would show in the strains they would place on local infrastructures and the capabilities that local governments would have in dealing with and alleviating such strains.

Impacts to Central Utah

Should the central Utah area supply coal to the Harry Allen powerplant under this alternative, the associated mining activities could affect Carbon, Emery, Piute, Sanpete, Sevier and Wayne Counties, but the most pronounced impacts would be anticipated for Carbon and Emery Counties.

Population. Most socioeconomic impacts to the region would be generated by large and relatively rapid changes in population. Under the "high level production scenario" described in CU (1979), the projected level of coal production in the central Utah region would rise from an estimated 8 million tons per year (mty) in 1979-80, to around 42 mty by 1990. Only about 7 percent of this expansion would be directly attributable to the needs of the Harry Allen powerplant. Given the levels of unspecified markets described in CU (1979), the 42 mty development of coal resources could occur with or without development of the powerplants. In any case, the State of Utah is concerned about the concentration of so much development in just one area and would prefer to see it spread over other coal fields in the state. This level of expansion would be accompanied by a major expansion of regional population from around 60,000 (1977) to 112,000 (1990), an overall 87-percent increase and an average annual increase of nearly 7 percent. However, most of this growth would be expected to occur in the 1980-1985 period, which would increase the actual experienced growth rate to the 13 to 14-percent range and induce major socioeconomic problems in the region.

Employment and Income. With such pronounced increases in population, major impacts to regional employment and income would be expected. Projections (CU, 1979) indicate that total employment for the region would increase from 25,030 in 1980 to 47,150 in 1985, an 88-percent increase. The change from 1985 to 1990 would be very small, 47,150 to 47,840 (only 1 percent). Based on 1975 total personal income and total employment figures, these increases would result in an approximated $520.65 million in 1985 and $528.27 million in 1990 in total regional personal income (in constant 1975 dollars). Most of the 1980-1985 changes in total employment would result in four sectors: mining (20.8 percent), construction (14.6 percent), trade (19.3 percent), and government (16.8 percent). By 1990, mining would account for 24.2 percent of the region's employment, which represents a 50-percent increase in its share of the labor market. With such growth in a single sector, one which would represent nearly one quarter of the region's economic base, the area would become highly susceptible to fluctuations in the coal market. Major declines as affected the area in the 1950s and 1960s could be a recurring problem in the future, and one of larger proportions.

Services. As indicated in Chapter 3, the general availability of basic services in the region is currently adequate, but little excess capacity exists which could accommodate additional growth. The 13 to 14-percent growth rates projected for the mid-1980s in the region would, however, rapidly overtake any such excess capacity. It would be extremely difficult for the regional infrastructure to accommodate such growth, and major breakdowns in basic services would be likely. The likelihood of "boom-town" problems developing in the area would be very high.

Quality of Life. Population growth rates in excess of 13 percent would be very likely to generate "boom-town" conditions in the central Utah region, especially in Carbon and Emery Counties. Under such conditions, it would be likely that breakdowns would occur in some or all of the basic services of police and fire protection, water supplies, sewage disposal, education, and health care services. Chronic housing shortages already exist and would be expected to become acute as populations expand. With such problems being generated, the quality of life in the region would deteriorate significantly.

Conclusion. If the central Utah region would be chosen as the coal source for the Allen plant, the expansion of workforces attributable to the Allen project alone would blend together with the anticipated major overall regional expansions from other concurrent coal development projects in the region. Lag time between the buildup of such work forces and their demands for services and the flows of tax revenues to the region's municipalities could be expected to precipitate some service failures and consequent declines in quality of life in the region. Overall, employment in the region would be expected to increase with the expansion of mining activities in the region. This would, however, also increase the area's dependence on mining as an economic mainstay, making the region susceptible to major declines if mining activities would decrease in the future.

Impacts to Southwestern Wyoming

If the southwestern Wyoming area would be chosen to supply coal to the Harry Allen powerplant, a demand for an additional 4 mty above the high level scenario production of 35.6 mty would be imposed on the region (SW, 1978). The counties affected would be Lincoln, Sweetwater, and Uinta. The most pronounced impacts would be expected in Sweetwater County.

Population. Many major socioeconomic impacts from the expanded development of the region's coal resources would be incurred as a result of relatively rapid population increases. Projected increases between 1980 and 1985 for the three county region as a result of all activities would be some 11,601 individuals (from a 1980 base of 69,293 to 80,894 by 1985). Of these increases, some 8,609 or 74 percent would be attributable to increased mining activities. The 1990 population would be projected at 85,303.

Employment and Income. Employment in the southwestern Wyoming region would increase above the "high level production scenario" (SW, 1978) by an estimated 523 jobs to 4,195 jobs for both 1985 and 1990 (for coal mining only). This would push mining's proportion of the regional labor force to over 30 percent, generating an economy which would be extremely susceptible to fluctuations in the mining market. Total personal income for the region would be in excess of $600.7 million in 1985 and would rise to above $719 million in 1990. These increases would be 35-percent and 61-percent respectively over the 1980 projected base income level of $446.6 million.

Services. As increases in regional population would occur, so would demands for services, both public and private. Projections in the regional statement indicate that there would be shortages likely in housing, law enforcement, fire protection, and education on at least a localized basis. No major impacts would be expected in such categories as public utilities or health care because existing capacities should be able to accommodate the influx of people. The lag time between population buildups and increased tax revenues in the region would be a major factor in the above mentioned potential shortages. If such conditions would become severe and/or chronic, the quality of life would be significantly deteriorated.

Conclusion. If the southwestern Wyoming region would be chosen as the coal source for the Allen powerplant, the effects of the resulting work force expansion would be blended with the anticipated overall regional growth. The overall growth rates between 1980 and 1985 would be around 15 percent, which could be expected to generate some infrastructural problems for municipalities, especially in localized areas. Increased employment in the region would be highly beneficial but would at the same time make the region more vulnerable to major economic declines if mining activities would decrease in the future.

Impacts to Kane County and Its Communities

Project components which would directly affect Kane County and its communities would be: the Alton coal mine; and the coal transportation system via Johnson Canyon, Kanab, Fredonia, and on to Hurricane.

Population. Many Kane County communities are currently experiencing modest growth in their base populations. With the implementation of this alternative, most communities would receive additional growth, especially during the construction period in the early stages of the project (table 16 in Appendix 17).

The major inflows of people in the county would occur during the period 1980-1985. During this time, the county would experience a 26-percent overall growth rate, of which 17 percent would be attributable to the project. This would yield an average annual overall growth rate for this period in the following communities:

Community	Annual Overall Growth Rate	Attributable to Project
Alton[a]	4 percent	7 percent
Glendale[a]	12 percent	15 percent
Kanab	5 percent	3 percent
Orderville[a]	6 percent	10 percent
Countywide	5 percent	3 percent

[a]These communities are currently experiencing net out-migrations so that the growth attributable to the project would be higher than the overall annual growth rate.

Employment and Income. The implementation of this alternative would significantly expand overall countywide employment. By 1985 an additional 563 jobs would be generated by the project, either directly or indirectly. After the construction phase, this figure would stabilize at around 500 (table 17 in Appendix 17). The most conspicuously affected sectors would be mining and transportation, although additional gains would be experienced in trade, services, and government (table 18 in Appendix 17). The significance of the addition of these jobs can be seen in the projected increases in incomes and earnings in the county.

Impacts to countywide incomes would be very substantial. By 1985, project-oriented earnings would total nearly $10.75 million annually. This, by itself, would amount to nearly 75 percent of what countywide earnings would be for the same time period without the project (table 19 in Appendix 17). The implementation of this alternative would, therefore, provide a very substantial impetus to local economies.

Services. The abilities of Kane County communities to provide basic services under this alternative would be only moderately affected. Law enforcement capabilities throughout the county would have to be expanded somewhat, especially in the Glendale-Orderville area. Fire protection services would be adequate to meet population increases, but both health care services and sewage disposal facilities would become marginal and upgrading and expansions would be needed (tables 20 and 21 in Appendix 17). The major impacts to infrastructural services would occur with the Kane County educational systems which are currently at or above their enrollment capacities and would have to be substantially expanded to accommodate projected growth (table 22 in Appendix 17).

Tax Base. This project would significantly expand the assessed valuation of the county. An estimated $14.7 million increase in assessed value due to the mine complex would be anticipated, which could result in additional tax revenues in excess of $800,000 to the county (assuming a mill levy of 78.00 mills), plus around $175,000 per year in Federal royalties.

Quality of Life. Since this alternative would generally expand economic activity in the county but would not place severe strains on existing infrastructures, it would probably enhance the overall quality of life. One major exception to this would be with the truck haul route, which, as described in the Aesthetics section of this alternative, would be a major detraction to area quality of life. This would be especially true for residents of the Johnson Canyon area, where truck traffic would be concentrated.

Conclusion. While this alternative would not provide for the maximum development of the Alton coal fields, it would provide Kane County and its communities with relatively controllable growth. Additional demands would be placed on the existing infrastructure, but extreme hardships and difficulties would not be anticipated. Economic growth in the county would be moderate and the economy would remain relatively diversified, insulating it somewhat from the common "boom and bust" characteristic of mineral and energy development.

Impacts to Washington County and Its Communities

Project components which would directly affect Washington County and its communities would be: the Warner Valley powerplant; and truck traffic from the Alton coal mine to the powerplant. The powerplant would require temporary construction phase work forces of around 500 workers. Operationally, the powerplant would employ as many as 100 workers. The coal transportation system would employ as many as 100 individuals in Washington County.

Population. Implementation of this alternative would significantly affect Washington County population levels (table 23 in Appendix 17). For the period 1980-1985, the county would be expected to receive an annual growth rate increase of around 9 percent. During this same period, the affected communities would be anticipated to receive the following population impacts:

Community	Annual Overall Growth Rate	Attributable to Project
Hurricane	6 percent	4 percent
Ivins	8 percent	5 percent
LaVerkin	7 percent	4 percent
Leeds	6 percent	4 percent
St. George	12 percent	8 percent
Santa Clara	8 percent	3 percent
Toquerville	7 percent	3 percent
Washington	8 percent	5 percent
Countywide	9 percent	6 percent

Employment and Income. Overall countywide employment would be significantly expanded under this alternative. Increases in employment by 1985 due to this alternative would be around 1,550 new jobs. This estimate includes both construction and operational work forces. Long-term employment would adjust back to around 700 to 800 new jobs. The sectors of the economy most dramatically affected would be construction (temporarily), transportation, trade, and government (tables 24 and 25 in Appendix 17).

The major impacts of the above increases in employment would be seen in changes to countywide earnings. Increases in employment up through 1985 could generate as much as $21.4 million per year. During the operation phase, added annual incomes could range from $8.5 to $11 million as shown below.

Type of Employment	In Thousands of 1977 Dollars 1985	1990	1995	2000	2020
Temporary Construction	$ 7,553.4	0	0	0	0
Operating	2,326.5	2,638.7	2,913.4	3,216.5	3,216.5
Indirect	11,520.1	5,814.6	6,711.8	7,794.1	7,859.5
TOTAL	$21,400.0	$8,453.3	$9,625.2	$11,010.6	$11,076.0

Source: Calculated from Socioeconomics, Centaur Associates Inc., 1980

Predictably, the sectors of the economy which would receive the largest portions of these earnings increases would be construction (temporarily) and the TCU grouping.

Services. Impacts to basic services in Washington County would be essentially the same as described in Alternative 1. Some expansion of such services as law enforcement and fire protecton would be needed, especially in the St. George area. Already over-burdened sewage disposal facilities in the Hurricane area would probably be pushed beyond the breakdown point, and the countywide school system would have to be substantially expanded to accommodate increased populations (tables 12 through 15 in Appendix 17).

Tax Base. The implementation of this alternative would expand Washington County's base assessed valuation by nearly $32 million, which could amount to an additional $2.53 million in tax revenues (assuming a mill levy of 78.00 mills). The 1977 assessed valuation in the county was around $46.5 million (Utah Foundation, 1978), so such an increase in the tax base would be extremely beneficial for the county. In contrast with Kane County, Washington County would not receive any Federal coal royalties.

Quality of Life. Since this alternative would expand the economic activity in the county without generating major stresses on the existing infrastructures, it would probably result in an enhanced quality of life.

Conclusion. As with Kane County, this alternative would provide Washington County with a moderate and relatively manageable rate of growth. Some additional demands would be placed on local infrastructures. Most problems which might occur from such increased loads would be in the form of an aggravation of existing deficiencies rather than an infusion of new ones. The expansion of the county's tax base provided by this alternative would be extremely beneficial and more than sufficient to offset any added infrastructural costs.

Impacts to Clark County and Its Communities

Project components which would directly affect Clark County and its communities would be: the 1,000-MW Harry Allen powerplant; and an electrical transmission system.

The socioeconomic impacts generated in Clark County would be essentially the same or less than those described in Alternative 1. Therefore, no major distinguishable socioeconomic impacts would be anticipated in the Las Vegas Valley metropolitan area.

Tax Base. The assessed valuation of Clark County would be expanded by nearly $250 million, which could yield an approximate $15.63 million in increased tax revenues (assuming a levy of 2.2527 per $100 assessed valuation). Some of this amount would be required to provide services for the added population, but such an expansion of the tax revenues would be expected to add significantly to the tax base above and beyond the amount needed for expanded services.

Impacts to the Western Transmission System Region

Impacts to the Western Transmission System region would be the same as described in Alternative 1.

Conventional Energy Sources Mix

Coal-fired generating capacity (1,250 MW) equal to approximately 12.5 million barrels of oil per year would be available for use in the service areas of NPC, SCE, PG&E, and the city of St. George, Utah. If this capacity would be utilized to reduce oil-fired generation, the electric consumer would benefit from a more stable fuel price structure and the nation would benefit from a reduction in foreign oil imports.

Energy Efficiency

This alternative would provide for an average output of 875 MW of electrical power (70 percent of capacity). Its energy efficiency is expressed in terms of output as a percent of input and is a factor in determining this alternative's effectiveness in converting one form of energy (resources) into another form (electricity). The energy efficiency of this alternative was computed by deriving energy equivalents for all resource inputs and comparing the total of these equivalents on an annual basis to the projected energy output of the Harry Allen and Warner Valley powerplants (Appendix 19).

The energy efficiency of this alternative is calculated at 23.4 percent if central Utah coal would be used, or 23.3 percent if southwestern Wyoming coal would be used.

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The adverse environmental impacts of major concern which would be sustained unavoidably in the event of its implementation are presented in table 4-11. Also included are the resources which would be irreversibly or irretrievably committed with the implementation of the alternative, and an examination of the relationship between the short-term uses of resources and the maintenance of long-term productivity.

TABLE 4-11

ALTERNATIVE 3

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship of Short-term Use of the Environment and the Maintenance and Enhancement of Long-term Productivity

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources: Irreversible	Commitment of Resources: Irretrievable	Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
Air Quality	Air quality degraded by emission of the following pollutants: Warner Valley Powerplant Using Alton Coal - 5.19 tons per day of SO_2, 1.02 tons per day of particulate matter, and 17.15 tons per day of NO_x. Harry Allen Powerplant Using Central Utah Coal - 7.95 tons per day of SO_2, 1.22 tons per day of particulate matter, and 87.20 tons per day of NO_x. Harry Allen Powerplant Using Southwestern Wyoming Coal - 12.06 tons per day of SO_2, 1.75 tons per day of particulate matter, and 72.66 tons per day of NO_x.	Yes	No	No	Yes	Emissions would ultimately be removed naturally from the atmosphere or would precipitate and be deposited on the earth.
	24-hour PSD Class II increments for SO_2 occasionally exceeded should the Harry Allen powerplant burn southwestern Wyoming coal. Class I increments exceeded at the Valley of Fire State Park.	Yes	No	No	Yes	See above.
	Trace elements from powerplant emissions accumulated in soil in surrounding areas.	Yes	No	No	Yes	Trace element depletion would not be complete for an unknown period of time after project life.
	Brown haze visible from both powerplants under certain meteorological conditions. Cooling plumes visible at certain times.	Yes	No	No	Yes	Emissions would ultimately be removed naturally from the atmosphere.
Water Resources	Contamination and sedimentation of surface streams and reductions in the yields of local shallow ground water wells and springs due to strip mining at Alton coal fields.	Yes	No	Project life	Yes	Reductions in contamination and sedimentation of surface stream and recharge of shallow ground water aquifers would take an unknown period of time after project life.
	Reduction in flows of Virgin River of 29,200 acre-feet per year at the Warner Valley water project diversion.	Yes	No	Project life and beyond	Project life and beyond	Water project diversions would continue for an unknown number of years after the short-term (more than 100 years), as projected community growth would utilize continually larger quantities of water.

TABLE 4-11 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources: Irreversible	Commitment of Resources: Irretrievable	Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
	Warner Valley diversion preclusion of up to 29,200 acre-feet of water per year from downstream use.	Yes	No	Project life and beyond	Project life and beyond	See above.
	Consumptive use of up to 18,000 acre-feet of water per year for municipal, industrial, and irrigation uses (Warner Valley water project).	Yes	No	Project life and beyond	Project life and beyond	See above.
	Increased salinity by approximately 100 mg/ℓ in the Virgin River as a result of Warner Valley water project diversion.	Yes	No	Project life and beyond	Project life and beyond	See above.
	Consumptive use of up to 6,000 acre-feet of water per year at Warner Valley powerplant.	Yes	No	Project life	Yes	Water lost to evaporation in power generation process would be eventually returned via hydrologic cycle.
	Consumptive use of an average 17,922 acre-feet of water (effluent) per year from the Clark County AWT plant at the Harry Allen powerplant.	Yes	No	Project life	Yes	See above; effluent transferred from treatment plant would be made up with increasing community growth and related effluent increase.
	Reduction of water quality in surface streams with increases of total dissolved solids, sediments, and contaminants related to mining in central Utah and southwestern Wyoming.	Yes	No	Project life and beyond	Yes	Contamination and sedimentation of surface streams would continue for an unknown period of time after the project life.
	Reduction in local spring and well yields due to underground mining in central Utah and related ground water pumping.	Yes	No	Project life and beyond	Yes	Recharge of affected aquifer would require an unknown period of time after the project life.
Vegetation Species of Concern	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 7) with the construction and operation of project components.	Yes	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.
	Loss of population of the endangered bear-claw poppy (Arctomecon humilis) related to the construction and operation of the Warner Valley powerplant and water project.	Yes	Yes	Yes	Yes	Loss of this population could lead to the extinction of the species.
Wildlife Species of Concern	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 8) with the construction and operation of project components.	Yes	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.

TABLE 4-11 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources: Irreversible	Commitment of Resources: Irretrievable	Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
	Construction and operation of the coal slurry pipeline and electric transmission system disturbing up to 6,206 acres of habitat of the desert tortoise (Gopherus agassizi), a species proposed for endangered classification in Utah and protected in Arizona, Nevada, and California.	Yes	Unknown	Unknown	Yes	See above.
Cultural Resources	Adverse impact to an estimated 162 archaeological sites including central Utah coal field, or 419 sites including southwestern Wyoming coal field with the construction of the various project components.	Yes	Yes	Yes	Yes	Although some information would become instantly available, construction activities would result in the alteration of sites to a point at which the information would not be available for future investigation.
	Adverse impact to the ethnologic importance of Spirit Mountain with the placement of a microwave communication station.	Yes	Unknown	Unknown	Yes	Placement of the microwave station could permanently disgrace the sacredness of the mountain.
	Destruction of the Hurricane Canal Diversion, (listed on the National Register) with the construction of the Warner Valley water project diversion structure and canal system.	Yes	Yes	Yes	Project life and beyond	Loss of this antiquity would be permanent.
	Impact of construction of Warner Valley powerplant over portions of the Dominguez-Escalante Trail (being studied by NPS for inclusion in the National Historic and Scenic Trail System), and the Honeymoon Trail (nominated for inclusion on the National Register).	Yes	No	Project life	Yes	Character and use of trails would be lost in affected portions for the life of the project.. After decommissioning, some construction scars would permanently alter natural character of the trails.
Recreation and Aesthetics	Adverse impact to the scenic character of the St. George Basin, Zion National Park, and Dry Lake, Nevada when visibility would be reduced by concentrations of stack emissions from the Warner Valley powerplant; also adverse impact to local aesthetic and recreational resources.	Yes	No	Project life	Yes	Emissions would ultimately be removed naturally in the atmosphere.
	Further degradation of the visual and recreational resources in central Utah and southwestern Wyoming on affected lands with activities of coal mining.	Yes	Yes	Yes	Yes	Portions of the visual resource would be permanently altered even after reclamation.
	Blasting associated with mining activities in the Alton coal fields could alter or destroy the delicate erosional features in Bryce Canyon National Park.	Unknown	Yes	Yes	Yes	Destruction of erosional features would permanently degrade the recreational resource in Bryce Canyon.

TABLE 4-11 (concluded)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
			Irreversible	Irretrievable		
	Visual resources degraded throughout the affected environment with the actual presence of powerplants and transmission lines.	Yes	No	No	Yes	Decommissioning would remove alien structures from natural environment; some residual construction scars would remain in certain areas.
Land Use	Change from present land uses to project uses on 18,369 acres including the central Utah coal field, or 26,499 acres including the southwestern Wyoming coal field.	Yes	No	No	Yes	Land could revert to previous uses in most affected areas after project life.
	Change in zoning in Kane, Washington, and Clark Counties for those areas to be occupied by the Alton coal mine, Warner Valley powerplant, and Harry Allen powerplant respectively.	Yes	No	No	Yes	Land could be rezoned for other projected uses after project life.
	Change in zoning in Washington County for area to be occupied by Warner Valley water project.	Yes	Yes	Yes	Project life and beyond	Water project would be considered a permanent fixutre in the landscape.
	Violation of BLM Wilderness Study Areas in southern California with placement of Western Transmission System, and loss of wilderness character.	Yes	Unknown	Unknown	Project life and beyond	Wilderness characteristics would be lost in affected areas until restored naturally over time (if possible).
	Violation of trust lands of Moapa Band-Paiute Indians (if awarded by Congress) with construction and operation of the coal slurry pipeline and transmission system.	Yes	No	No	Yes	Granting of rights-of-way would be subject to tribal authority.
Socio-economics	Rapid population growth exceeding the abilities of local infrastructures to provide basic services in the central Utah or the southwestern Wyoming regions, and in Kane County in southern Utah. Quality of life adversely affected.	Yes	No	No	Yes	Growth trends would stabilize over the course of the project and would probably be reversed at the end of the project. Without appropriate planning, the "bust" portion of the "boom and bust" cycle could be experienced in some areas.
Coal Resources	A total of 160 million tons of coal mined and consumed if central Utah coal used, or 200 million tons if southwestern Wyoming coal used.	Yes	Yes	Yes	Yes	Coal would be unavailable for future use.

ALTERNATIVE 4: IMPACTS OF MAJOR CONCERN

Implementation of this alternative would involve the following major components which are analyzed according to their significant impacts to the environment: coal mining in central Utah or southwestern Wyoming; construction and operation of the 2000-MW Harry Allen powerplant in Dry Lake, Nevada; and a transmission system to send electrical power from the Harry Allen powerplant to the NPC, SCE, and PG&E service areas.

Air Quality

This alternative must comply with the applicable State and Federal air quality standards and regulations shown in table 4-1.

Coal Mining and Coal Transportation in Central Utah or Southwestern Wyoming

There would be no significant particulate matter impacts to air quality from the transportation of coal proposed under this alternative.

Visibility impacts from the strip mining of coal in southwestern Wyoming would be due to the increase of airborne particles. Maximum estimated visibility reductions in the mandatory Class I Bridger Wilderness Area would be less than 0.7 percent from an assumed background visibility of 40 miles. At the potential Class I area of Fossil Butte National Monument, visibility would be reduced an estimated 8.9 percent (SW, 1978). The relative significance of these visibility impacts must be determined by the Federal land manager (BLM) responsible for these areas. In the case of Fossil Butte National Monument, this determination must be made only if the area is designated Class I. These estimates are for the operation of the whole southwestern Wyoming coal field. Since coal mined for the Harry Allen plant would be only a portion of the total coal mined, the impact from mining coal for the Harry Allen powerplant would be expected to be equal to or less than the above estimates, depending upon the location of mining activity.

The increase in particulate matter concentrations at Capitol Reef National Park from mining activities in central Utah would be less than the PSD Class I increments. The relative significance of the impairment must be determined by NPS. It is the policy of NPS to protect the scenic values of Class I areas from any adverse visual impairment at human levels of perception (letter from William J. Whalen, Director NPS, to David Hawkins, EPA, Assistant Administrator Air, Noise, Radiation, April 1979).

Population Growth. The air quality impacts from population growth due to increased strip mining in southwestern Wyoming and underground mining in central Utah have been analyzed in SW (1978) and CU (1979) respectively, and were found to be insignificant. A study completed by EPA (1977) shows that increases in particulate matter, SO_2, NO_2, hydrocarbons, CO, and photochemical oxidents (O_3) from mining related population growth could be expected. As discussed in Alternative 1, these increases would not be expected to have significant impacts on air quality over the life of the mining operations.

Construction and Operation of the 2,000-MW Harry Allen Powerplant

The air quality impacts from implementation of this alternative have not been specifically analyzed in a separate dispersion modeling study. Instead, differences in coal quality between Alton coal and the central Utah and southwestern Wyoming coals were compared and the emission rates calculated for this alternative were ratioed with emission calculations from the applicants' proposal (Alternative 1), for which dispersion modeling exists. The concentration estimates for the Harry Allen powerplant for Alternative 1 (table 4-3) were multiplied by the ratio of Alternative 4/ Alternative 1 emissions for the Harry Allen powerplant to arrive at estimated air quality impacts from this alternative (table 4-12). References cited in this alternative refer to the study or publication from which the original modeling results in Alternative 1 were taken.

The following air quality impacts would be expected from the construction and operation of the proposed 2,000-MW Harry Allen powerplant burning central Utah coal (12,000 Btu per pound, 0.45 percent sulfur, 6.5 percent ash) or southwestern Wyoming coal (9,827 Btu per pound, 0.54 percent sulfur, 7.38 percent ash):

	Central Utah Coal (tons per day)	Southwestern Wyoming Coal (tons per day)
SO_2	15.90	24.12
Particulate matter	2.44	3.50
NO_x	174.40	145.30

These emissions would comply with NSPS. Since no BACT analysis has yet been made by EPA for the Harry Allen powerplant, the analysis for the Warner Valley powerplant was used.

Particulate Matter. The construction of the Harry Allen powerplant would create particulate matter emissions. These emissions would be minimized through use of BACT as required by the State of Nevada (personal communication, Nevada DEP, March 20, 1980). Similarly, coal storage piles and transfer systems would be sprayed with dust suppressants or enclosed in buildings to minimize particulate matter emissions as agreed to by the project proponents. Therefore, the impacts would not be considered significant over the life of the project.

Combustion of central Utah or southwestern Wyoming coal would comply with emission limitations described under the revised NSPS (Federal Register, Vol. 144, No. 113.). When compared to modeling done previously by NPC (1975), BLM (Harry Allen, ERT, 1977), and EPA, the combustion of coal with the qualities stated above at the Harry Allen powerplant would not violate the NAAQS or PSD Class II increments for particulate matter. These comparisons are presented in table 4-12.

Based upon the ratio of emissions from Alternatives 1 and 4 and modeling done by Radian (1980) for Alternative 1, air quality increments for particulate matter in the potential Class I Paiute Primitive Area and Valley of Fire State Park would be met. These results are presented in table 4-12.

TABLE 4-12

Estimated Air Quality Impacts Due to Emissions from the Proposed 2000-MW Harry Allen Powerplant, Burning Central Utah or Southwestern Wyoming Coal

	Estimated Concentration ($\mu g/m^3$)					Nitrogen Oxide(NO_x)
	Sulfur Dioxide(SO_2)			Particulate Matter		
	Annual	24-Hour	3-Hour	Annual	24-Hour	Annual
Central Utah Coal Based On:						
Class II						
EPA Region IX	a	123.9	a	a	a	a
ERT	1.3	8.4	98.2	0.2	1.1	15.2
Bechtel	1.0	36.0	121.0	1.0	5.5	12.0
Class I						
Paiute Primitive Area (Radian)	<1.0	<1.0	<1.0	<2.5	<5.0	a
Valley of Fire (Radian)	0.9	6.5	50.9	0.3	2.0	a
Southwestern Wyoming Coal Based On:						
Class II						
EPA Region IX	a	187.1	a	a	a	a
ERT	2.0	12.7	148.3	0.3	1.6	12.6
Bechtel	1.0	54.4	181.5	1.0	8.0	10.0
Class I						
Paiute Primitive Area (Radian)	<1.0	<1.0	<1.0	<4.0	<8.0	a
Valley of Fire (Radian)	1.4	9.8	76.9	0.43	2.8	a

Sources: Warner Valley, ERT, 1977
Harry Allen, ERT, 1977
NPC, 1975
Modeling Summaries Completed by EPA Region IX, February 27, 1978
Radian, 1980

[a]Not calculated.

Note: These concentration estimates have been normalized to reflect application of BACT and compliance with NSPS.

$\mu g/m^3$ = micrograms per cubic meter

Sulfur Dioxide (SO_2). Based on coal comparisons and modeling done previously by EPA Region IX (EPA, 1978), SO_2 emissions from the Harry Allen powerplant would violate the 24-hour PSD Class II increments in the area surrounding the plant. The EPA modeling results were based on the EPA Valley screening model. On May 19, 1980, NPC submitted the results of plume tracer studies done by North American Weather Consultants to EPA Region IX. EPA is currently reviewing this information.

Based on results from a study conducted by Radian (1980) for Alternative 1 and the ratio of emissions from Alternatives 1 and 4, the PSD Class I increments for SO_2 would not be exceeded in the Paiute Primitive Area potential Class I area. There would however be estimated violations of the Class I SO_2 increments in the Valley of Fire State Park potential Class I area (Radian, 1980). The SO_2 concentration estimates are presented in table 4-12.

Nitrogen Oxides (NO_x). Based on the ratio of emissions from Alternatives 1 and 4 and modeling done previously for Alternative 1, emissions of NO_x from the Harry Allen powerplant would not violate the NAAQS. The visibility impacts from plume discoloration are discussed in the Visibility section of this alternative. The NO_x concentration estimates are presented in table 4-12.

Ozone (O_3, Photochemical Oxidants). There has been concern in recent years about O_3 production from powerplants. O_3 concentrations in powerplant plumes have been found to be lower than ambient levels near the point of emission. O_3 concentrations in the plume increase to approximately ambient levels far downwind. In urban plumes with higher hydrocarbon concentrations, the O_3 concentration can increase downwind. Even in such situations, the net increase in O_3 is less than about 10 percent above ambient levels (SU, 1979). O_3 levels from the Harry Allen powerplant would not be expected to cause violations of the O_3 standard over the life of the project.

Plume Opacity. Under normal operating conditions the plume from the proposed Harry Allen powerplant would be barely visible at the stack. However, during startup operations before the electrostatic precipitators would be able to reach operating efficiency, or during upset conditions, the plume could be highly visible. These conditions would be expected to occur infrequently.

Trace Elements. The coal burned at the generating complex would contain small amounts of trace elements which would be released into the atmosphere during powerplant operation. However, trace element deposition has been difficult to assess. Pathways by which trace elements are distributed through the environment are complex and poorly defined. The long-term accumulation of trace elements from powerplants is not well known.

The trace element content of Wasatch Plateau coal (central Utah coal field) is shown in table 7 of Appendix 12. While no studies have been performed to estimate impacts from trace elements of this coal, modeling done for the Harry Allen powerplant burning Alton coal shows that trace element concentrations would not be expected to be hazardous to plants or animals (NPC, 1975). Since the Wasatch Plateau coal trace element content and the Alton coal trace element content are within an order of magnitude of each other, and since the trace element concentration levels that were estimated are well below the standards or threshold limits, the coal from central Utah would not be expected to be hazardous to plants or animals. No trace element data was found on the southeastern Wyoming coal, so no impacts could be estimated. However, based on the impacts from the Alton coal, there would be no significant impacts expected over the life of the powerplant.

Radioactive Nuclides. Radioactive materials are present in any coal and certain amounts of radioactive nuclides would be emitted from the stack. Based on combustion of Alton coal, maximum ground level exposure from the proposed Harry Allen powerplant emissions would fall well below the standards for general public exposure set by the Atomic Energy Commission (now U.S. Department of Energy) (NPC, 1975) and, therefore, no significant impact would be anticipated in the short-term. Since central Utah coal is lower than Alton coal in radioactive element content, no significant impact would be anticipated. Based on the Alton and central Utah coal qualities, no significant short-term impacts would be expected from Wyoming coal and the impact over the long-term life of the project is not known.

Condensed Water Plumes. Condensation of water vapor emitted from the powerplant stacks and cooling towers would produce a visible plume for a distance downwind from the plant. The stack plume from the Harry Allen powerplant would be visible for more than 400 feet approximately 30 percent of the time. Depending on the number of units in operation, plumes longer than 1 mile would be visible between 1 and 5 percent of the time. Cooling tower plumes longer than 100 feet downwind would occur about 22 percent of the time. Plumes longer than 1,000 feet would occur only about 1 percent of the time. The height of the visible cooling tower plume would exceed 500 feet less than 20 percent of the time and would exceed 1,000 feet less than 1 percent of the time (NPC, 1975).

Because of the distance from major roads, the direction of prevailing winds, and the arid climate, impacts to motorists from icing and fogging of highways by cooling tower plumes from the Harry Allen powerplant should be minimal.

Secondary Pollutants. Gaseous emissions from coal-fired powerplants are carried by atmospheric transport. They can undergo chemical transformation and new pollutants may be formed (Wilson, 1976). SO_2 may be converted to sulfate aerosols (particulates) and NO_x may undergo reactions to form nitrate aerosols (particulates). Sulfate and nitrate aerosols may travel hundreds of miles and cause air quality degradation. Both nitrate and sulfate particulates tend to be fine particles between 0.2 and 2 microns in size. In the arid southwest, aerosols in this size range may be suspended in the air for days before they are removed by natural processes such as wet and dry deposition in soil or on vegetation.

The major impacts from these secondary pollutants would be on atmospheric visibility. This topic is discussed in the following section.

Visibility. Visibility impacts from powerplant plumes are caused by particulates (fly ash), secondary pollutants (sulfates, nitrates), water, and NO_2. These impacts are generally in the form of (1) reduction in visual range, and (2) visibility of the plume itself (plume blight).

The visibility impacts that would result from this alternative have not been analyzed, however, the visibilty impacts due to the Harry Allen powerplant have been estimated for Alternative 1. The emission rates of particulate matter and SO_2 from the Harry Allen powerplant would be 70 percent and 61 percent less respectively, and No_x emissions would be 28 percent more from burning central Utah coal compared to Alton coal. The emission rates of particulate matter and SO_2 from burning southwestern Wyoming coal would be 57 percent and 41 percent less, respectively and NO_x emissions would be 7 percent greater than emissions from burning Alton coal.

The decrease in particulate matter and SO_2 emissions from this alternative would cause a decrease in visibility impairment while the increase in NO_x emissions would cause increased visibility impacts.

The net result of the visibility impacts from the decrease in particulate and SO_2 emissions compared with Alternative 1, and the increase in NO_x emissions cannot be determined without more detailed study. It could be expected that impacts to visual range would be less, while the frequency of occurrence and intensity of discoloration from the NO_x emissions would be greater.

Cumulative Impacts. Emissions from the operation of the Harry Allen powerplant could combine with emissions from the Reid Gardner powerplant located at Moapa, Nevada to cause increased ambient pollutant concentrations. The EPA has notified NPC of its intent to approve the addition of a fourth unit to the Reid Gardner powerplant. Addition of this unit has been estimated to bring the Reid Gardner powerplant within 97 percent of the 24-hour NAAQS for SO_2 and 84 percent of the 24-hour NAAQS for particulate matter. Unit four would also use up 75 percent of the 24-hour Class II PSD increment for SO_2 and 19 percent of the particulate matter increment (letter from EPA to NPC, November 5, 1979). In order to construct the Harry Allen powerplant, NPC must show compliance with the NAAQS and PSD increments alone and in combination with other sources in the area. EPA Region IX is currently assessing these cases in their PSD permit review process.

Population Growth. The increased level of pollution from the population growth associated with construction and operation of the Harry Allen powerplant would not be expected to be significant over the life of the project.

Las Vegas Nonattainment Area. The impacts of the Harry Allen powerplant on ambient concentrations of total suspended particulates and CO in the Las Vegas nonattainment area would be expected to be minor (less than one-half the values identified by EPA as significant). Significance values have not been established for O_3; however, an evaluation of meteorological conditions associated with historically high O_3 episodes, and comparison of emissions and calculated ambient concentrations of reactive hydrocarbons and NO_2 (O_3 percursors in the photochemical process) with existing emissions of these pollutants in the nonattainment area, indicate that peak O_3 concentrations would not be increased (Radian, 1980).

Water Resources

Components of this alternative which would have significant impacts on water resources would be: coal mining in central Utah or southwestern Wyoming; and the Harry Allen powerplant at Dry Lake, Nevada.

Final EISs that address the effects of coal mining on water resources in central Utah (CU, 1979) and southwestern Wyoming (SW, 1978) should be consulted for detailed information. As discussed in Alternative 3, the major impacts on water resources in these areas would be those due to mine drainage, ground water pumping, ground water aquifer interruption and replacement, and surface water contamination from wastes or sedimentation. Water pollution hazards due to mine drainage would be minimal because water in the low sulfur coal deposits is essentially the same chemical composition as in the surrounding aquifers.

Dry Lake, Nevada and Las Vegas Wash

Construction of the Harry Allen powerplant (along with the necessary diversion dikes, storage ponds, and settling ponds) would reduce the surface area of the Dry Lake playa by 1,850 acres. This would elevate flood levels of a potential 50-year flood by 8.5 feet above the present natural ponding elevation, resulting in increased maintenance problems for the existing transmission lines located along the eastern end of the playa. Flooding of the old highway frontage road (and access to the town of Dry Lake) should be eliminated by construction of the proposed flood control structures.

No significant impacts would be expected in Las Vegas Wash from the transfer of an average 31 mgd of effluent from the Clark County AWT plant to the powerplant. See Alternative 1 for additional discussion.

Wetlands and Floodplains

The major areas of concern as noted earlier under Alternatives 1, 2, and 3 are the lack of data regarding coal development and the proposal to locate the Harry Allen powerplant within an existing floodplain. In addition, the proposed rail transport of coal would require some upgrading of existing facilities in the vicinity of Dry Lake which may affect some wetlands or floodplains. Although the amount of land involved is unknown, it is believed to be quite small. Approximately 1,850 floodplain acres would be affected.

Vegetation: Species of Concern

Several vegetation species of concern could be adversely impacted with the construction and operation of the components of this alternative in the States of Utah, Arizona, Nevada, and California (Appendix 7). Although not expected to be great, the significance, duration, and character of these impacts are unknown due to the lack of on-ground information. According to standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM is conferring with USFWS on these species in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Consultation is expected to be completed for the final EIS.

Central Utah Coal Field

As described in Alternative 3, two local species of plants located in the central Utah fields, Townsendia aprica and Astragalus subcinereus var. basalticas, are candidates for endangered and threatened status respectively. Expansion of mining activities could impact the habitat of these species, depending on the location of actual surface disturbance. Townsendia aprica is especially susceptible to impact because of small numbers and limited habitat. BLM would confer with USFWS concerning possible impacts on these plant species should this alternative be selected and a mining plan submitted in accordance with Section 7 of the Endangered Species Act (as amended 1978).

Wildlife: Species of Concern

Several wildlife species of concern could be adversely impacted with the construction and operation of the components of this alternative in the States of Utah, Arizona, Nevada, and California (Appendix 8). Although not expected to be great, the significance, duration, and character of these impacts are unknown due to the lack of on-ground information. According to standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM is consulting with USFWS on these species in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Consultation is expected to be completed for the final EIS.

Electrical Transmission System

The desert tortoise (Gopherus agassizi), currently proposed for USFWS listing as an endangered species in Utah and protected in the States of Arizona, Nevada, and California, could be adversely impacted during construction of the electrical transmission system on 8,850 acres of habitat from the Beaver Dam Slope in southwestern Utah to southern California (fig. 3-6). Collisions with construction vehicles and human capture could result in reductions of local populations. According to a BLM biological assessment, these impacts would not be significant in Utah, where proposed critical habitat would essentially be avoided. In coordination with the Endangered Species Act (as amended 1978), BLM is consulting with USFWS on the desert tortoise. USFWS will issue an informal biological opinion concerning the tortoise in July 1980 which could have a bearing on the final design and routing of the transmission system.

Archaeology, Ethnology, and History: Cultural Resources

Since inventories are not complete, this analysis contains estimates of varying exactness relevant to the amount of resource that would be adversely impacted by various project components. Unless otherwise specified, where data is incomplete, inconclusive, or simply nonexistent, average densities of 15 sites per section (640 acres), or one site per 5 miles of linear distance (transmission lines, pipelines) is assumed and incorporated into the analysis of impacts. It is further assumed that 95 percent or more of these sites will be archaeological (rather than historical), and that 75 percent or more will be found to be of National Register caliber under the criteria that they ". . . have yielded, or may be likely to yield, information important in prehistory . . ." (36 CFR, Part 60).

Also due to the lack of a complete data base, this document does not demonstrate full compliance with procedures outlined in 36 CFR, Part 800, "Protection of Historic and Cultural Properties." It is the intention of BLM to comply with these procedures following approval of an alternative. This intent is documented by the nature and substance of the standard operating procedures developed and included in Appendix 6 and by the provisions of the "Memorandums of Understanding" developed with the SHPOs of the States involved with the project (Appendix 16).

Central Utah Coal Field, Southwestern Wyoming Coal Field

According to CU (1979), six archaeological sites would be impacted on each square mile (640 acres) of ground disturbed. Adverse impacts to 85 archaeological sites would result from mining activite on 9,080 acres where sites are unidentified or buried. Probably 65 or more of these sites would be of National Register caliber. Increased coal development would lead to increased population growth locally and would open previously inaccessible areas. This could result in increased vandalism of archaeological and historical sites. Principal adverse impacts would be attributed to activities of construction of ancillary facilities and haul roads.

Surface strip mining and underground mining in southwestern Wyoming would adversely impact unknown buried archaeological sites. Such sites would not be discovered until they would be unearthed, altered, or destroyed by mining activities. Approximately 600 sites would be adversely impacted during the life of the project (SW, 1978). It is possible that 450 or more of these sites would be found to be of National Register caliber.

Harry Allen Powerplant

No known cultural resources would be adversely impacted with construction or operation of the powerplant (Brooks, 1976; NPC, 1975).

Electrical Transmission System

Transmission system construction would adversely impact cultural resource sites on as much as 8,850 acres of right-of-way. Transmission line segments are considered separately because of their geographical distribution.

Allen to Eldorado. The segment from the Allen powerplant to the Eldorado substation has not yet been inventoried, although some portions of the Navajo-McCullough transmission line (which the proposed line would parallel) have been inventoried with negative results (Turner et al., 1975). An estimated 10 sites would be impacted, seven or eight of which would probably be of National Register caliber.

Western Transmission System. The number of potential archaeological sites that would be impacted due to construction activities along the Western Transmission System from the Eldorado substation in southern Nevada to Lugo, California are estimated by alternative corridors (Barker et al., 1979). The Memorandum of Understanding signed by BLM and the State of California for IPP (Appendix 16) is also considered to apply to the alternative corridors of the Western Transmission System of the AWV Energy System until such time that a project-specific memorandum can be negotiated.

Interstate 15. An estimated 14 sites would be impacted along this alternative route, 10 or more of which may be of National Register caliber.

Eldorado to Lugo. An estimated 17 sites would be impacted, at least 13 of which may be of National Register caliber.

Victorville to McCullough. An estimated 17 sites would be impacted, 11 of which are possibly of National Register caliber.

Highway 66. An estimated 12 sites would be impacted, at least 10 of which are possibly of National Register caliber.

A microwave communication site associated with the transmission system would be constructed on Spirit Mountain in southern Nevada. This mountain is an area of ethnographic importance (Cultural Resources, Chapter 3). In compliance with the American Religious Freedom Act (PL 95-341), consultation was initiated and is ongoing with regional Indian tribal authorities.

Recreation and Aesthetics

Central Utah Coal Field, Southwestern Wyoming Coal Field

As discussed in Alternative 3 for the same component, expanded development of coal resources in the central Utah coal field would have little impact on the visual resources of the region because the area has already been impacted by existing mines. Underground mining would cause only minimal impacts to the visual and recreational resources, depending on the location and extent of subsidence.

Expanded strip mining in the southwestern Wyoming coal fields onto approximately 25,340 acres of presently undeveloped land would further degrade scenic resources in the area.

Harry Allen Powerplant

Impacts to recreation and aesthetics are discussed in Alternative 1 for the same component. Stack emissions from the powerplant would adversely impact local recreational and aesthetic values (Air Quality section of this alternative). Construction of the proposed plant would introduce alien structures to the landscape and the area would not meet VRM Class III objectives (fig. 4-10).

Electrical Transmission System

This alternative would require three separate transmission routes: Allen to Pecos, Allen to Eldorado, and the Western Transmission System. Impacts to visual resources associated with the transmission system would involve the introduction of tower structures and related components as intrusions on the natural landscape. For specific information concerning the Allen to Pecos route see Alternative 2 for the same component. The Allen to Eldorado and the Western Transmission System alternative routes are analyzed in Alternative 1.

Erection of the transmission system would involve the construction of roads to permit access along the proposed corridor on 8,850 acres of right-of-way. These roads would facilitate increased access of ORV recreationists to many previously isolated areas (Alternative 1, same component).

Land Use, Land Use Plans and Controls

The distribution of land ownership for lands affected under this alternative is described in table 2-13. Present land use would be changed to the project uses indicated below on affected acreage during the 40-year life of the project. After decommissioning, these areas would be available for other uses or would revert to the pre-existing land uses.

Component	Acreage Affected	Present Land Use	Project Use
Central Utah Coal Field (option)	9,080	Range, Wildlife	Underground mining
Southwestern Wyoming Coal Field (option)	25,340	Range, Wildlife	Underground and surface mining
Harry Allen Powerplant	5,887	Recreation, Wildlife	Heavy industrial
Electrical Transmission System	8,850	Range, Recreation, Wildlife	No change on unfenced rights-of-way (temporary impact during construction); 229 acres of maintained access roads

Central Utah Coal Field, Southwestern Wyoming Coal Field

Mining development would change land use on 9,080 acres of currently unmined land in the central Utah coal fields. Zoning in the area already permits mining development. A detailed description of impacts to land use, plans, and controls is provided in CU (1979). Mining activities would not conflict with State, local, or Federal land use plans.

There would be no identifiable adverse impacts to local or State land use plans nor to plans of the Forest Service or BLM concerning mine expansion in southwestern Wyoming onto 25,340 acres of land already zoned for mine development. A more complete description of impacts to land use, and land use plans and controls is available in SW (1978).

Harry Allen Powerplant

A change from mutliple use to single use/heavy industrial status would occur on 5,887 acres of land at Dry Lake, Nevada. A zoning change from rural open to heavy industrial would be required by the Clark County Comprehensive Planning and Environmental Commission.

A right-of-way would have to be obtained for the routing of the AWT pipeline across portions of Nellis Air Force Base in southern Nevada. The base would grant a right-of-way as long as the action would not interfere with the mission of the base, and the action would be for the good of the public.

Electrical Transmission System

Approximately 8,850 acres would be needed for the construction of the transmission system. No conflicts would be expected with local, State, or Federal land use plans or controls from the construction of the Allen to Eldorado transmission lines. The applicants would have to secure a right-of-way to route the Allen to Pecos line across Nellis Air Force Base in Nevada. The alternative routes of the Western Transmission System in southern California could be in conflict with the final California Desert Conservation Area Plan, which was published by BLM in draft form February 1980, and is subject to change pending public comment.

The routing of all four alternative corridors of the proposed Western Transmission System and a proposed microwave station (atop Clipper Mountain near Essex, California) would be in conflict with BLM Wilderness Study Areas (fig. 3-8). The granting of rights-of-way in these areas is prohibited under an interim management policy (Federal Land Policy and Management Act of 1976).

The crowding of various transmission lines into single corridors would preclude or otherwise impact other existing or potential land uses for the same area. This crowding effect would occur near Rainbow Gardens, in Eldorado Valley, and through the McCullough Pass in southern Nevada, and in the Interstate 15, Eldorado-Lugo, or Victorville-McCullough alternative corridors of the Western Transmission System in southern California. Problems may also arise in the limitation or preclusion of future transmission line routings.

Socioeconomics

Most socioeconomic impacts would occur in central Utah or southwestern Wyoming and in the Clark County, Nevada area. They would result from the construction and operation of the powerplant and transmission systems.

Impacts to Central Utah and Southwestern Wyoming

Impacts to these areas would be essentially the same as described in Alternative 3.

Impacts to Washington County and Its Communities

There would be no impacts to Washington County resulting from this alternative.

Impacts to Clark County and Its Communities

The socioeconomic impacts attributable to this alternative would be identical to those discussed in Alternative 1.

Impacts to the Western Transmission System Region

Impacts to the Western Transmission System region would be the same as described in Alternative 1.

Conventional Energy Sources Mix

Coal-fired generating capacity (2,000 MW) equal to approximately 20 million barrels of oil per year would be available for use in the service areas of NPC, SCE, and PG&E. If this capacity would be utilized to reduce oil-fired generation, the electric consumer would benefit from a more stable fuel price structure and the nation would benefit from a reduction in foreign oil imports.

Energy Efficiency

This alternative would provide for an average output of 1,400 MW of electrical power (70 percent of capacity). Its energy efficiency is expressed in terms of output as a percent of input and is a factor in determining this alternative's effectiveness in converting one form of energy (resources) to another (electricity). As in Alternative 1, the energy efficiency of this alternative was computed by deriving energy equivalents for all resource inputs and comparing the total of these equivalents on an annual basis to the energy output of the proposed Harry Allen powerplant (Appendix 19).

The energy efficiency of this alternative is calculated at 24.0 percent should central Utah coal be used, or 23.8 percent should southwestern Wyoming coal be used.

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The adverse environmental impacts of major concern which would be sustained unavoidably in the event of implementation are presented in table 4-13. Also included are the resources which would be irreversibly or irretrievably committed with the implementation of the alternative, and an examination of the relationship between the short-term uses of resources and the maintenance and enhancement of long-term productivity.

TABLE 4-13

ALTERNATIVE 4

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship of Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
			Irreversible	Irretrievable		
Air Quality	Air quality degraded by emission of the following pollutants: Harry Allen Powerplant - 15.9 tons per day of SO_2, 2.44 tons per day of particulate matter, and 174.4 tons per day of NO_x if burning central Utah coal; and 24.12 tons per day of SO_2, 3.5 tons per day of particulate matter, and 145.3 tons per day of NO_x if burning southwestern Wyoming coal.	Yes	No	No	Yes	Emissions would ultimately be removed naturally from the atmosphere or would precipitate and be deposited on the earth.
	24-hour PSD Class II increment for SO_2 exceeded when burning central Utah coal or southwestern Wyoming coal at the Harry Allen plant site. Class I increments exceeded in Valley of Fire State Park.	Yes	No	No	Yes	See above.
	Trace elements from powerplant emissions accumulated in soil in surrounding areas.	Yes	No	No	Yes	Trace element depletion would not be complete for an unknown period of time after project life.
	Brown haze visible in the Dry Lake, Nevada area under certain meteorological conditions. Cooling tower plumes visible on occasion.	Yes	No	No	Yes	Emissions would ultimately be removed naturally from the atmosphere.
Water Resources	Contamination and sedimentation of surface streams and reductions in yields of local shallow wells and springs due to strip mining in southwestern Wyoming.	Yes	No	Project life and beyond	Yes	Reductions in the contamination and sedimentation of surface streams and the recharge of shallow ground water acquifers would require an unknown period of time after project life.
	Loss of natural flow in as many as 22 local springs and reduction in yields of an unknown number of wells and springs in adjacent areas due to ground water pumping in the central Utah coal fields.	Yes	No	Project life	Yes	Recharge of aquifers would require an unknown period of time after project life.
	Consumptive use of up to 34,724 acre-feet of water (effluent) from the Clark County AWT plant at the Harry Allen powerplant.	Yes	No	Project life	Yes	Water lost to evaporation would be eventually returned via hydrologic cycle; effluent transferred from treatment plant would be made up with increased community growth and related effluent increase.

(continued)

TABLE 4-13 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
			Irreversible	Irretrievable		
Vegetation Species of Concern	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 7) with the construction and operation of project components.	Yes	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.
Wildlife Species of Concern	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 8) with the construction and operation of project components.	Yes	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.
	Construction and operation of coal slurry pipeline and electrical transmission system disturbing up to 8,850 acres of habitat of the desert tortoise (Gopherus agassizi), a species proposed for endangered classification in Utah and protected in Arizona, Nevada, and California.	Yes	Unknown	Unknown	Yes	See above.
Cultural Resources	Adverse impact to an estimated 112 archaeological sites including central Utah coal field, or 627 sites including the southwestern Wyoming coal field with the construction of the various project components.	Yes	Yes	Yes	Yes	Although some information would become instantly available, construction activities would result in the alteration of sites to a point at which the information would not be available for future investigation.
	Adverse impact to the ethnologic importance of Spirit Mountain with the placement of a microwave communication station.	Yes	Unknown	Unknown	Yes	Placement of the microwave station could permanently disgrace the sacredness of the mountain.
Recreation and Aesthetics	The scenic character of Dry Lake, Nevada would be impacted when visibility would be reduced by concentrations of stack emissions from the Harry Allen powerplant; also adverse impact to local aesthetic and recreational resources.	Yes	No	Project life	Yes	Emissions would ultimately be removed naturally in the atmosphere.
	Visual resources degraded throughout the affected environment with the actual presence of powerplants and transmission lines.	Yes	No	No	Yes	Decommissioning would remove alien structures from natural environment; some residual construction scars would remain in certain areas.

(continued)

TABLE 4-13 (concluded)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
			Irreversible	Irretrievable		
Land Use	Change from present land uses to project uses on 15,196 acres including the central Utah coal field, or 31,456 acres including the southwestern Wyoming coal field.	Yes	No	No	Yes	Land could revert to previous uses in most affected areas after project life.
	Change in zoning in Clark County, Nevada for the area to be occupied by the Harry Allen powerplant.	Yes	No	No	Yes	Land could be rezoned for other projected uses after project life.
	Violation of BLM Wilderness Study Areas in southern California with placement of Western Transmission System, and loss of wilderness character.	Yes	Unknown	Unknown	Project life and beyond	Wilderness characteristics would be lost in affected areas until restored naturally over time (if possible).
Socio-economics	Rapid population growth exceeding the abilities of local infrastructures to provide basic services in the central Utah or southwestern Wyoming regions. Quality of life adversely affected.	Yes	No	No	Yes	Growth trends would stabilize over the course of the project and would probably be reversed at the end of the project. Without appropriate planning, the "bust" portion of the "boom and bust" cycle could be experienced in some areas.
Coal Resources	A total of 240 million tons of coal mined and consumed if central Utah coal used, or 326 million tons if southwestern Wyoming coal used.	Yes	Yes	Yes	Yes	Coal would be unavailable for future use.

ALTERNATIVE 5: IMPACTS OF MAJOR CONCERN

The description of this alternative is presented in Chapter 2 for the service areas of each of the participating utilities: the city of St. George, NPC, PG&E, and SCE. The impacts of this alternative in each of these service areas are described below. Major impact areas discussed are: energy demand, socioeconomics, and the physical environment.

The year 1990 was chosen as a target date for partial implementation of this alternative and its comparison with energy demand projections in the city of St. George and NPC service areas (Chapters 2 and 3, Alternative 5). Full implementation could occur by the year 2000. The year 1991 was chosen for the PG&E and SCE service areas because the California Energy Commission (CEC) used this year as a target date in their energy demand forecasts and in the analyses of the impacts of implementing conservation and alternative energy source programs on these forecasts (Biennial Report, 1979).

Energy Demand

St. George Service Area in 1990 and 2000

Impacts to Consumption. The projected total electrical energy consumption, without conservation, for St. George in the year 1990 would be 156.9 million kilowatt hours (kWh x 10^6). The total consumption, with the implementation of conservation programs for the same year, would be 134.3 kWh x 10^6, or a savings of 22.6 kWh x 10^6 (a 14.4-percent reduction). The following table presents the reduction in energy demand that would be achieved by this alternative in the years 1990 and 2000.

	Consumption (kWh x 10^6)		Peak Demand (MW)		
Year	Without Alt. 5	With Alt. 5	Without Alt. 5	With Alt. 5	Percent Reduction
1990	156.9	134.3	39.8	34.1	14.4
2000	192.7	144.7	49.0	36.8	25.0

Impact to Peak Demand. Given the above consumption reductions, there would be an expected proportional reduction in peak demand of about 5.7 MW in the St. George service area in 1990 with a corresponding reduction in needed capacity. In the year 2000, as much as 25-percent reduction in consumption and peak demand could occur with a resulting reduction in needed capacity of 12.2 MW.

Nevada Power Company Service Area in 1990 and 2000

Impacts to Consumption. The total projected electrical energy consumption without conservation in the NPC service area for the year 1990 would be 8,961 kWh x 10^6 (Chapter 3, Existing and Projected Energy Demand). The total consumption with conservation/ alternative energy sources for the same year would be 8,195 kWh x 10^6. This represents a consumption reduction of 766 kWh x 10^6 (or 8.6 percent) (Chapter 2, Alternative 5). The following table describes energy demand reductions for the years 1990 and 2000.

Year	Consumption (kWh x 10^6) Without Alt. 5	With Alt. 5	Peak Demand (MW) Without Alt. 5	With Alt. 5	Percent Reduction
1990	8,961	8,195	2,045.9	1,870.0	8.6
2000	11,316	9,488	2,583.0	2,169.7	16.0

Impacts to Peak Demand. Given the above reductions in consumption, there would be an expected proportional reduction in peak demand.

With an 8.6-percent reduction in consumption, a reduction of about 176 MW in peak demand could be achieved in the NPC service area with a corresponding reduction in the need for capacity. By the year 2000, (with full utilization of this alternative), a 16-percent reduction (413 MW) in peak demand could be achieved.

Pacific Gas and Electric Service Area in 1991

According to CEC forecasts (1979) (Chapter 3, Need for Additional Energy Sources), PG&E (including the Sacramento Municipal Utility District [SMUD]) will need approximately 7,011 MW of additional capacity over its current generating capacity to meet energy demands in 1991. This amount considers new load growth, a 50-percent oil and gas displacement, retiring of old or inefficient units, and losses of out-of-State power purchases.

From the initial 7,011 MW of needed capacity, 6,513 MW would be met with those sources currently under construction and those sources considered preferrable by CEC included in PG&E's resource plan for 1990 (Chapter 3, Existing and Projected Electrical Energy Sources Mix). When those sources are applied to the needed capacity, a deficit remains of 498 MW (CEC staff Memorandum to the Executive Commission, April 25, 1980; Chapter 1, Purpose and Need).

Should this alternative be implemented, the remaining energy demand could be met in the following manner:

1. 1,195 MW would be met with the use of the "Feasible Alternative Energy Sources Mix" (Chapter 2, Alternative Electrical Energy Sources).

2. 775 MW of electrical energy demand would be displaced with the use of direct solar technologies (50 percent of maximum as described in Chapter 2, Substitution of Direct Renewable Energy for Electricity).

3. 1,587 MW of electrical energy demand would be displaced with the use of conservation and load management practices (Chapter 2, Conservation and Load Management in California).

The sources presented in this alternative total 3,557 MW. This represents a surplus energy supply of 3,059 MW over and above the capacity needed after application of PG&E's energy sources presently under construction or planned in the PG&E resource plan. Energy sources under construction or planned by the utilities are only represented up to the year 1990, yet these sources are compared to the need for additional capacity in 1991. This analysis is considered conservative because utility planned additions for 1991 are not included. The displacement of capacity by solar technology in the year 1990 is also applied to the 1991 figure for needed capacity, yielding a conservative figure of savings.

Southern California Edison Service Area in 1991

According to CEC forecasts (1979) (Chapter 3, Need for Additional Energy Sources), SCE (including Anaheim) will need approximately 6,604 MW of additional capacity over its current generating capacity to meet energy demand in 1991. This amount considers new load growth, a 50-percent displacement of oil and gas capacity, retiring of old units, and losses of out-of-State power purchases.

From the initial 6,604 MW of needed capacity, 4,033 MW would be met with those energy sources currently under construction and those sources considered preferrable by CEC included in PG&E's resource plan for 1990 (Chapter 3, Existing and Projected Electrical Energy Sources Mix) and 512 MW would be met in the city of Anaheim by the IPP in Utah (CEC staff Memorandum, April 25, 1980). When these sources are applied to the needed capacity, a deficit remains of 2,059 MW.

Should this alternative be implemented, the remaining energy demand could be met in the following manner:

1. 1,103 MW would be met with the use of the "Feasible Alternative Energy Sources Mix" (Chapter 2, Alternative Electrical Energy Sources).

2. 625 MW of electrical energy demand would be displaced with the use of direct solar technologies (50 percent of maximum as described in Chapter 2, Substitution of Direct Renewable Energy for Electricity).

3. 1,439 MW of electrical energy demand would be displaced with the use of conservation and load-management practices (Chapter 2, Conservation and Load Management in California).

The sources included in this alternative total 3,167 MW. This represents a surplus energy supply of 1,108 MW over and above the capacity needed after application of SCE's energy sources presently under construction or planned in the SCE resource plan. As explained in the preceeding section for PG&E, this is considered a conservative figure.

Socioeconomics

The elements of this alternative which would generate socioeconomic impacts would be: possible increases in building capital costs with the installation of alternative energy systems and some conservation/load management components; some shifts and/or expansions in employment as alternative energy support industries come into existence; and changing energy use patterns to shift demand peaks downward. Impacts would be anticipated to occur only in those areas where conservation and alternative energy source options are actively pursued.

City of St. George and Nevada Power Company Service Areas

Although no figures are available on the estimated effects of the development of conservation/alternative energy source programs on total employment numbers in the St. George and NPC service areas, it is reasonable to assume that two types of change in employment could occur. Those persons currently working in energy source related fields (i.e., plumbing, air conditioning, insulation, etc.) could shift to the development of alternative energy sources, integrating it into their existing work loads. New industry could be created by the development of alternative energy sources, generating new employment opportunities in the area. The employment sectors most likely to be affected would be the service and the construction sectors.

Probably the most noticeable impacts of conservation/alternative energy source uses would occur through enforcing conservation/load management programs. These would involve such activities as thermostat setbacks, improving appliance efficiency ratings, changing daily energy use habits to decrease levels of peak demand (e.g., doing laundry, taking showers and baths, cooking, etc. during nonpeak periods of the day), and/or changing to lower wattage lighting (switching from incandescent to flourescent). Such activities, especially those of rearranging daily habits, would be disruptive when initially put into effect, and depending upon public attitudes, could be viewed as a deterioration of the quality of life enjoyed by residents in the city of St. George and NPC service areas. In most cases, these activities would involve little or no monetary expenditures (buying more energy efficient appliances would be an exception). Rearrangement of personal schedules and conveniences, possibly conflicting with existing work schedules, would be necessary, however, and could be interpreted as changing desired lifestyles.

Pacific Gas and Electric and Southern California Edison Service Areas

Without a project-specific analysis, the socioeconomic impacts of this alternative could not be quantified. A generic discussion follows, however, concerning socioeconomic impacts which could occur.

Development of Alternative Energy Sources. A shift to alternative energy sources could result in a related flux in the job mix. An expansion of employment could be generated, probably in the service and construction sectors. Rates of growth in employment could decrease in the conventional energy source sector (i.e., gas and oil-fired powerplants) as some of these workers would shift over to jobs in the alternative energy source sector.

Development of alternative energy sources could also result in new patterns of population concentration. Facilities and workers would have to be located at the energy source (i.e., geothermal and wind source areas). This factor could lead to new communities or added growth in established communities that otherwise may not experience such growth.

Displacement of Energy Demand With Solar Technology. Solar technology uses could change the number and mix of jobs in the California economy by 1991. Solar technologies could create more employment for the same amount of energy production than conventional energy technologies (Decade of the Sun, CEC, 1980). Ninety percent of those jobs created would be indirect and induced employment brought about with the need for production of solar hardwares, water heaters, etc. Employment of solar installers and other related occupations jobs would probably result in an expansion of the service and construction sectors of the economy.

Solar technology, by reducing reliance on conventional energy sources especially in the residential sector, should have a stabilizing or reducing effect on the per capita cost of energy. Although requiring additional initial capital outlays, the reduction in energy consumption would result in a reduction of the actual cost of energy over the long term. High capital outlays required by solar technologies should be offset by savings on monthly energy bills in the long term.

Conservation and Load Management. In the short term, a shift to more conservation and less electricity production would require adjustments. Some workers, equipment, industries, and services would be needed for different purposes such as the production and installation of insulation and retrofitting components, utility programs, and streetlight upgrading.

Consumer attitudes could be a barrier to conservation. Many conservation activities should be initiated by individuals, not governments or utility companies. Consumers tend to lack a sense of urgency on energy issues with few people expressing concern over energy availability and shortages (Comptroller General, 1979). As a result, the active participation of individuals in conservation programs has been slow to develop. In addition, initial conservation costs (i.e., retrofitting insulation, and energy-efficient appliances) could discourage consumers.

Individuals would be reluctant to change their lifestyles to accommodate the conservation and load management of energy. Mandatory or voluntary conservation measures such as retiming household jobs (e.g., washing clothes), and space conditioning and water heating thermostat setbacks could be viewed by most consumers as an infringement on their personal freedom. Many consumers also believe that energy research and development would bring about ways to perpetuate their current lifestyles while requiring little or no sacrifice in current living patterns.

Conservation and load management, by reducing reliance on conventional energy sources especially in the residential sector, should have a stabilizing or a reducing effect on the per capita cost of energy. Although these measures may require additional capital outlays, the reduction in energy consumption should result in the reduction of the actual energy costs to the consumer over the long term.

Physical Environment

The development of alternative energy sources in the participating utilities' service areas (especially in California) could lead to some adverse impacts to the physical environment. Because specific projects and locales are not described in this EIS, environmental impacts cannot be quantified. Site and project specific environmental assessments would have to be prepared should such projects be planned for development. Impacts to the physical environment could include:

1. Impacts to air quality and visibility associated with the development of geothermal, cogeneration, and biomass (solid wastes) energy sources.

2. Impacts to water resources associated with the development of geothermal and hydroelectric energy sources (disturbances to existing water resources and related ecology).

3. Impacts to existing vegetation and wildlife with the development of hydroelectric and geothermal sources (disturbances to existing water resources).

4. Impacts to existing land use and land use plans due to the land requirements for the development of hydroelectric, geothermal, solar, and wind sources.

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The implementation of this alternative would utilize essentially renewable resources as its energy source and would involve only minor impacts that could be considered adverse. Few irreversible or irretrievable commitments of resources would occur. This alternative would involve minimal and diversified use of the environment in the short-term. Therefore, the long-term productivity of the environment could be enhanced as more resources in their natural state would be maintained for future availability.

ALTERNATIVE 6: IMPACTS OF MAJOR CONCERN

The alternative of "No Action" is described in Chapter 2. If the proposed project would not be implemented, the environmental impacts associated with activities of construction and operation would not occur. A continuation of current environmental and socioeconomic trends would be expected in the proposed project area.

No project related adverse impacts, whether short-term or residual, would occur to: climate, air quality and visibility, topography, geology, paleontology, mineral development, soils, water resources (including wetlands and floodplains), vegetation, wildlife, cultural resources, recreation, aesthetics, land use and land use plans and controls, and socioeconomic conditions. Current land uses would continue or the land would be available for unspecified future uses. Coal resources which would have been developed for the proposed project would be available for other uses or projects in the future (i.e., other power projects, chemicals, gasification, etc.). Water resources which would have been utilized or impacted by activities of the proposed and alternative actions would remain available in their present condition for other uses and downstream users (i.e., agriculture, fish habitat, or municipal water supply). Socioeconomic trends would continue as projected (Affected Environment, Chapter 3) without the implementation of the applicants' project.

The alternative of "No Action" to the proposed action would, however, necessitate the development by participating utilities of alternate methodologies to meet the short-term demand for energy in their respective service areas. The utilities would have to investigate the possibility of developing other powerplants or alternative energy sources which they have concluded, through their analysis, are needed to meet that demand.

Washington County Water Conservancy District

It should be pointed out that the objectives of the Warner Valley water project as specified by the applicant, to provide water for a municipal water supply, industrial development, and/or agricultural development would have to be realized through other methodologies or projects.

California Utilities

According to the Proponents' Environmental Assessment (SEC and PG&E, 1979), the utilities could develop several alternatives should the proposed project not be implemented. Such alternatives include: other coal-fired generating stations; nuclear generating stations; conventional and combined-cycle natural gas and oil-fired generating stations; gas turbines; hydroelectric stations; geothermal, wind, solar, "synfuels", and biomass technologies; cogeneration; and conservation and load-management programs (see Proponents' Environmental Assessment for a more detailed description of each of these alternatives).

According to SCE and PG&E (1979), if the applicants' proposed project were not implemented, the companies would give emphasis to the development of coal-fired plants which are currently being considered for other sites, including the "California Coal Project" (a coal-fired steam generating plant consisting of three 500-MW units), the "Montezuma 1 and 2 Facility" (comprising two 800-MW units), and "Fossil 3 and 4" (an additional two 800-MW units).

In this case, the impacts involving the construction and operation of a coal-fired steam-electric generating project would be shifted to different geographical locations outside of the proposed project area, and entirely new analyses of environmental impacts would have to be made.

Skyrocketing prices, the scarcity of oil and natural gas, and the unstable political situation in the oil-producing region of the Middle-East have led to a new attitude about the continued use of petroleum fuels. U.S. Goverment policy is deemphasizing the use of oil and natural gas by requiring drastic reductions in powerplant use while promoting the development of other alternatives (Chapter 3, Existing Legislation and Incentives Favoring Conservation and the Development of Alternative Energy Sources). Gas and oil are no longer considered a practical electricity generating alternative for the future.

Hydroelectric generating stations may be developed in the near future for use as intermediate and peaking resources only, due to their limited reliability (weather-dependent).

The development of geothermal, wind, solar, synfuels, and biomass technologies in combination with conservation and end-use efficiency may be a very practical alternative to the proposed action. CPUC is currently conducting research into a variety of these methods (Alternative 5 of this chapter).

Nevada Power Company

NPC is studying the feasibility, as a participant, of two coal-fired steam-electric generating facilities in addition to the proposed AWV project. The "White Pines" facility near Ely, Nevada would produce 1,500 MW of power with some 200 MW to be allocated to NPC (personal communication, John Arlidge, Special Projects Manager, NPC, January 16, 1980). The company is also a participant (260 MW) in the proposed "California Coal Project" currently under study (see preceeding section, California Participants).

According to NPC (1975), should the proposed project not be implemented, the company would have to run existing systems at full capacity while reducing the reserve capacity that the utility deems necessary to insure system reliability. Extended power shortages could occur and it would be necessary to exercise customer load - management controls, optimize all existing energy limited resources, buy power from other companies, start all standby units, utilize all spinning reserves, optimize hydroelectric operations, and optimize primary and secondary fuel storage. These procedures would only satisfy local energy demand temporarily until other power sources could be developed.

Engineering and legal constraints limit the expansion of most existing systems. Such expansion would not replace the need for base load operations as they would be used essentially as peaking units (NPC, 1975).

A program of conservation and alternative energy sources development could possibly meet or at least reduce the demand for electrical power in the NPC service area. Such an alternative to the proposed project and its environmental consequences are discussed in Alternative 5 of this EIS.

City of St. George, Utah

The city of St. George is participating in the proposed AWV Energy System to meet its projected future energy demand. Should the proposed project not be implemented, the city would have to consider other alternatives to meet that demand. According to Burns and McDonnell (1977), the city could develop two other alternatives to meet its energy demand: (1) the installation of solely-owned generation facilities; or (2) purchase electrical energy requirements from Utah Power and Light Company (UP&L). The first method would involve the construction of four solely-owned steam-electric generating plants of 40-MW (net) capacity each for service in 1982, 1987, 1991, and 1994, and purchase its supply electricity deficiencies from UP&L. The second option would involve the purchase of all its electricity supply needs from UP&L (assuming continued purchase of present allocation from the U.S. Water and Power Resources Service, Colorado River Storage Project).

With the exception of these options, no other method of power generation for meeting future municipal needs is being studied or considered (personal communication, Rudger McArthur, Director of Public Utilities, city of St. George, January 21, 1980).

The city of St. George could develop other methods in order to meet estimated future energy demands should the AWV Energy System not be implemented. The Intermountain Power Agency (IPA) is the executor of IPP involving the construction and operation of a 3,000-MW coal-fired steam-generating facility near Lynndyl, Utah. Several Utah municipalities and corporate utilities are participating and will be interconnected within IPA's electricity supply network. Although all power has tentatively been allocated, there exists the possibility that lay-off power will be available for purchase from several of the IPA members (personal communication, Clark Layton, Federal Consultant, IPA, May 12, 1980). The city of St. George could negotiate for the amount and price of that electricity supply.

It may be feasible for the city of St. George to initiate a program of conservation and alternative energy sources development. The feasibility of such a program is discussed in Alternative 5.

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

All unavoidable adverse impacts and irreversible or irretrievable commitments of resources associated with the applicants' proposed project activities would not occur should the project not be implemented.

LIST OF PREPARERS

Name and Assignment	Education	Professional Experience
EIS Team Members		
Dave Everett, Team Leader	BS Biology	10 years
Paul Dulin, Assistant Team Leader	MA Environmental Geography	3 years
Terry Lewis, Writer/Editor	MA English	6 years
Jay Carlson, Socioeconomics	MS Resource Economics	4 years
Al Larson, Air Quality	BS Chemical Engineering	5 years
Bill Wiley, Hydrology	BS Geography, Hydrology	2 years
Glen Yankus, Recreation, Graphics	MA Parks, Recreation	2 years
Don Hook, Energy Efficiency	BS Civil Engineering	4 years
Steve Winslow, Hydrology	MS Hydrology	3 years
Steve Hedges, Wildlife	BS Biology	5 years
Gardiner Dalley, Cultural Values	MA Anthropology/ Paleoecology	2 years
Lou Bechtold, Aesthetics	BA Landscape Architecture	32 years
John Anderson, Botanist	BA Biology BS Range Management	3 years
Mike Noel, Land Use/Wilderness	MA Biology Plant Ecology	2 years
Kent Utley, Engineering	BS Civil Engineering	12 years
Thomas Judkins, Geology, Minerals	MS Geology	4 years
Connie Murdock, Clerk/typist	Technical Instruction	9 years
Diana Willson, Clerk/typist	Technical Instruction	4 years

(continued)

LIST OF PREPARERS (concluded)

Name and Assignment	Education	Professional Experience
	Special Assistance	
Donald Cain, Quality Control	BS Botany	17 years
Thomas Thompson, National Interests	BS Range	14 years
Bill Wagner, Air Quality	PhD Radiation, Biology	14 years
Don Hook, Energy Efficiency	BS Civil Engineering	4 years
Max Hodson, Soils Reviewer	BS Soils	18 years
Thomas Slater, Quality Control	MS Landscape Architecture	18 years
Dennis Curtis, Quality Control	MS Geography	12 years
Graphic Productions, Richfield, Utah	Simulations and Graphics	

LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT

SPECIAL INTEREST GROUPS

Atomic Industry Forum
Bunkerville Citizens' Advisory Council
California Historical Landmarks Advisory
Chemehuevi Indian Tribe
Citizens for Survival
Colorado River Indian Tribes
Desert Bighorn Council
Desert Fishes Council
Desert Protective Council
Desert Sportsman Rifle and Pistol
Desert Tortoise Council
Environmental Defense Fund
Fort Mojave Indian Reservation
Friends of Nevada Wilderness
Friends of the Earth
Gamblers Motorcycle Club
Goodsprings Citizens' Advisory Council
DES Environmental Defense Fund
High Uintas Wilderness Coalition
Houston Audubon Society
Huntington Botanical Garden
Isaac Walton League
ISSUE
Kaibab Indian Tribe
Las Vegas Bronco Club
Las Vegas Jeep Club
Las Vegas Tribal Council
Logandale Citizens' Advisory Council
Los Angeles Audubon Society
Mesquite Citizens' Society
Mine Operators Association
Mint 400 Racing Headquarters
Moapa Citizens' Advisory Council
Moapa Indian Tribe
Motorcycle Racing Association of Nevada
National Audubon Society
National Outdoor Coalition
National Public Lands Task Force
National Resources Defense Council
National Wildlife Federation
Nature Conservancy
Nellis Rod and Gun Club
Nevada Cattlemen's Association
Nevada Frontloaders
Nevada Land Action Association
Nevada Public Land Users Association

Nevada Wildlife Federation
Nevada Woolgrowers Association
Oasis Motorcycle Club
Overton Citizens' Advisory Council
Public Lands Council
Quechan Indian Tribe
Red Rocks Audubon Society
Rimbenders Motorcycle Club
SCAG
Shamrocks Motorcycle Club
Sierra Club
Sierra Club Conservation Department
Sierra Club Legal Defense Fund
Sierra Club L.V. Group, Toiyabe Chapter
Sierra Club Utah Chapter
Silver City Scramblers
SNORE
SOURCE
Southern Council of Conservation Clubs
Southern Nevada Conservation Council
Southern Nevada Land Cruisers
Sportsman Racing Association
Spring Mountain Free Trappers
The Wilderness Society
United Mining Councils
Utah Audubon Society
Utah Environmental Center
Virgin Valley's Sportsmen's Association
Walt's Racing Association
Western Regional Council

LOCAL GOVERNMENTS, COMMISSIONS, AND ASSOCIATIONS

Boulder City, Mayor
Cedar City, Mayor
Clark County Commissioner
Coconino County Commissioner
Escalante, Mayor
Five-County Association of Governments
Garfield County Commissioner
Glendale Town Office
Henderson, Mayor
Hurricane, Mayor
Kanab, Mayor
Las Vegas, Mayor
Mojave County Commissioner
San Bernardino County Commissioner
Santa Clara, Mayor
St. George, Mayor
Toquerville, Mayor
Tropic, Mayor
Washington County Commissioner
Washington, Mayor

STATE GOVERNMENTS

Agriculture and Horticulture Commission
Antelope Valley Resource Conservation District
Arizona Division of Environmental Health
Arizona Economic Planning and Development
Arizona State Clearing House A-95
Arizona State Planning
Barstow Branch Library
California Department of Fish and Game
California Division of Highways
California Energy Commission
California Highway Commission
California Outdoor Recreation
California State Clearing House
California State Division of Mines and Geology
California State Lands Commission
California Wildlife Federation Board
Clark Conty Game Management Board
Energy Resources Conservation and Development
Governors of Arizona, California, Nevada, and Utah
Los Angeles Department of Water and Power
Mojave County Board of Supervisors
Mojave Water Department
Morango Basin Conservation Area
National Area and Trail Coordinator
Natural Resources Clinic
Nevada Department of Fish and Game
Nevada Division of Colorado River Resources
Nevada Division of Environmental Protection
Nevada Division of State Lands
Nevada Division of State Parks
Nevada Division of Water Resources
Nevada Highway Department
Nevada Public Services Commission
Nevada State Clearing House
Nevada State Engineer
Nevada State Planning
Riverside County Planning Commission
San Bernardino Association of Governments
San Bernardino County Board of Supervisors
San Bernardino County Building and Safety
San Bernardino County Museum
San Bernardino County Regional Parks Department
San Bernardino County Road Department
San Bernardino Planning Department
Southern California Air Pollution Control
State Legislatures of Arizona, California, Nevada, and Utah
Utah Association of Counties
Utah Department of Development Services
Utah Department of Natural Resources
Utah Department of Transportation
Utah Division of Health

Utah Division of Oil, Gas, and Mining
Utah Division of Parks and Recreation
Utah Division of State Lands
Utah Division of Water Resources
Utah Division of Wildlife Resources
Utah Energy Office
Utah Geological and Mineralogical Survey
Utah Planning Office
Utah State Clearing House
Utah Water Rights Division
Victorville Branch Library
Victorville Planning Commission
Washington County Water Conservancy District

FEDERAL GOVERNMENT AGENCIES

Army Corps of Engineers
BLM District Managers of Arizona Strip, Las Vegas, and Riverside
BLM State Directors of Arizona, California, Nevada, and Utah
Bonneville Power Administration
Bureau of Indian Affairs
Bureau of Outdoor Recreation
Department of Energy
Environmental Protection Agency
Federal Aviation Administration
Federal Energy Administration
Federal Highway Administration
Federal Information Center
George Air Force Base
National Heritage and Conservation Association
National Park Service
    Bryce Canyon National Park
    Zion National Park
Office of the Solicitor
Rocky Mountain Regional Director, Federal Aviation Administration
U.S. Fish and Wildlife Service
U.S. Forest Service
    Angeles National Forest
    Dixie National Forest
    San Bernardino National Forest
U.S. Geological Survey
U.S. Soil Conservation Service
Western Area Power Administration
Western Office of Reviews and Compliance

CONGRESSIONAL DELEGATIONS

States of Arizona, California, Nevada, and Utah

UTILITIES AND COMMERCIAL VENTURES

Bechtel Power Company
Bingham Engineering
Bountiful Light and Power Company
City of St. George
Garkane Power Association, Inc.
General Telephone Company
Intermountain Consumer Power
Intermountain Power Project
Nevada Power Company
Pacific Gas and Electric
South Central Utah Telephone
Southern California Edison
Southern California Gas Company
St. George Utility Director
Union Pacific Railroad
Utah International, Inc.
Vaughn Hansen Associates
Washington County Water Conservancy District
Western States Water Council

APPENDIX 1

Scoping Meeting Rating Form

Name Representing Date

____

Direction 1. List at least five topics you believe should be discussed in the Allen-Warner Valley Environmental Impact Statement. These topics should be the ones you feel must be evaluated before a decision on the proposed energy project can be made. Please list the topics in their order of importance to you, i.e., the most important first, the second most important next, etc.

1. ____
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2. ____
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3. ____
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4. ____
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5. ____
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Others ____
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Direction 2. List below at least two alternatives (exclusive of the company's proposal) you believe should be evaluated in sufficient depth to permit their possible selection as the preferred environmental alternative. Please list the alternatives in their relative order of importance, i.e., the most important first, followed by the second most important, etc.

1. ____________________

____

____

2. ____________________

____

____

Others ____________________

APPENDIX 2

Screening Matrix for Alternative Selection

Alternatives Suggested During Scoping Procedures	Legally Acceptable	Technology Commercially Available by 1985	Economically Reasonable (No More Than 120% of Item Replaced)	Avoids or Minimizes Impacts or Enhances Other Environmental Factors	Meets a Major Portion of Applicant's Need for Power	Reasonably Energy Efficient (No More Than 120% of Item Replaced)	Specific Enough to Permit an In-Depth Analysis	Obviously No Worse Environmentally Than Item Replaced	Meets Reasonable Criteria for EIS
1. Tax credits for power companies promoting conservation	Unknown	Yes	Yes	Yes	Unknown	Yes	No	Yes	No
2. Ilok coal processing technique	Yes	Unknown	Unknown	Unknown	N/A	Unknown	No	Unknown	No
3. Upgrade Colorado River hydroelectric systems	Yes	Unknown	Yes	Yes	No	Yes	Yes	Yes	No
4. Solar energy from satellites	Unknown	Unknown	Unknown	Yes	Yes	Yes	No	Yes	No
5. Harness wave motion of the sea	Yes	Unknown	Unknown	Yes	Yes	Unknown	No	Unknown	No
6. Low fall dams on the Virgin River	Unknown	Yes	No	Yes	Unknown	Unknown	No	Unknown	No
7. Improve Parker Dam	Yes	No	Unknown	Yes	No	Unknown	Yes	Unknown	No
8. Construct the Kaiparowits project	Unknown	Yes	No	Yes	Yes	Unknown	Yes	Unknown	No
9. Move well field west of Sevier Fault	Unknown	Yes	Yes	Yes	N/A	Yes	No	Unknown	No
10. Amend environmental laws to permit development	Yes	N/A	N/A	No	Yes	Yes	Yes	No	No
11. Improve existing powerplants and mines	Yes	Unknown	Unknown	Yes	Unknown	Yes	No	Unknown	No

(continued)

Alternatives Suggested During Scoping Procedures	Legally Acceptable	Technology Commercially Available by 1985	Economically Reasonable (No More Than 120% of Item Replaced)	Avoids or Minimizes Impacts or Enhances Other Environmental Factors	Meets a Major Portion of Applicant's Need for Power	Reasonably Energy Efficient (No More Than 120% of Item Replaced)	Specific Enough to Permit an In-Depth Analysis	Obviously No Worse Environmentally Than Item Replaced	Meets Reasonable Criteria for EIS
12. Use central Utah coal railed to Harry Allen powerplant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13. Use Wyoming coal railed to Harry Allen powerplant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14. Use Lake Powell water for coal slurry-line	Unknown	Yes	Unknown	Yes	N/A	No	Yes	Yes	No
15. Construct smaller powerplants	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
16. Construct power-plants at mines in central Utah	Yes	Yes	Unknown	Yes	Yes	Yes	No	Unknown	No
17. Build a 1,500-MW plant at Warner Valley and a 1,000-MW plant at Harry Allen	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
18. Construct Harry Allen plant in Los Angeles and use Colorado River water	Unknown	Yes	Unknown	Yes	Yes	Yes	No	Unknown	No
19. Move all power-plants to Utah	Yes	Yes	Yes	Yes	Yes	Yes	No	Unknown	No
20. Construct power-plants in areas of electrical use	Yes	Yes	Unknown	Yes	Yes	Yes	No	Unknown	No
21. Company's proposal without Warner Valley powerplant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

(continued)

Appendix 2 (continued)

Alternatives Suggested During Scoping Procedures	Legally Acceptable	Technology Commercially Available by 1985	Economically Reasonable (No More Than 120% of Item Replaced)	Avoids or Minimizes Impacts or Enhances Other Environmental Factors	Meets a Major Portion of Applicant's Need for Power	Reasonably Energy Efficient (No More Than 120% of Item Replaced)	Specific Enough to Permit an In-Depth Analysis	Obviously No Worse Environmentally Than Item Replaced	Meets Reasonable Criteria for EIS
22. Build a 125-MW plant in Warner Valley and truck coal from Alton	Yes	Yes	Unknown	Yes	No	Unknown	Yes	Yes	No
23. Mine coal from Alton only by underground methods	Yes	Yes	No	Yes	N/A	Unknown	Unknown	Yes	No
24. Obtain coal elsewhere and ship by rail	Yes	Yes	Unknown	Yes	N/A	Unknown	No	Unknown	No
25. Construct powerplant at Alton	Unknown	Yes	Yes	Yes	Yes	Yes	No	No	No
26. Rail coal instead of using coal slurry	Yes	Yes	No	Yes	N/A	No	Yes	Unknown	No
27. Use energy conservation and alternate energy sources	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
28. Use coal gasification to produce electrical power	Yes	Unknown	Unknown	Yes	N/A	Unknown	No	Unknown	No
29. Use gasahol to produce electrical power	Yes	Unknown	No	Yes	N/A	No	No	Unknown	No
30. Use Lake Powell water to slurry Kaiparowits coal	Unknown	Yes	No	Yes	N/A	No	Yes	Unknown	No
31. Return AWT water to Colorado River	No	Yes	Yes	No	N/A	Yes	Yes	No	No

(continued)

Appendix 2 (continued)

Alternatives Suggested During Scoping Procedures	Legally Acceptable	Technology Commercially Available by 1985	Economically Reasonable (No More Than 120% of Item Replaced)	Avoids or Minimizes Impacts or Enhances Other Environmental Factors	Meets a Major Portion of Applicant's Need for Power	Reasonably Energy Efficient (No More Than 120% of Item Replaced)	Specific Enough to Permit an In-Depth Analysis	Obviously No Worse Environmentally Than Item Replaced	Meets Reasonable Criteria for EIS
32. Reuse slurry water via return flow system	Yes	Yes	No	Yes	N/A	No	Yes	Unknown	No
33. Use California's share of Lake Powell water to slurry coal	No	Yes	Yes	Yes	N/A	No	Yes	Unknown	No
34. Use California's share of Lake Powell water to replace water taken from Alton area	No	Yes	Unknown	Yes	N/A	No	Yes	Unknown	No
35. Build Warner Valley reservoir for nonpower purposes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes
36. Enlarge Warner Valley reservoir	Yes	Yes	Unknown	Unknown	N/A	Unknown	Unknown	Unknown	No
37. Construct powerplants in California with railed coal	Unknown	Yes	Unknown	Yes	Yes	Yes	No	Unknown	No
38. Construct powerplants in California with slurried coal	Unknown	Yes	Unknown	Yes	Yes	Yes	No	Unknown	No
39. Expand Reid Gardner powerplant	Yes	Yes	Yes	Yes	Unknown	Yes	No	Yes	No
40. Construct a 2,000 MW powerplant at Alton	Unknown	Yes	Yes	Yes	Yes	Unknown	No	No	No
41. Construct powerplants elsewhere	Yes	Yes	Unknown	Yes	Yes	Unknown	No	Unknown	No
42. Construct a nuclear plant	Unknown	Yes	Unknown	Yes	Yes	Unknown	No	Unknown	No

(continued)

Appendix 2 (concluded)

Alternatives Suggested During Scoping Procedures	Legally Acceptable	Technology Commercially Available by 1985	Economically Reasonable (No More Than 120% of Item Replaced)	Avoids or Minimizes Impacts or Enhances Other Environmental Factors	Meets a Major Portion of Applicant's Need for Power	Reasonably Energy Efficient (No More Than 120% of Item Replaced)	Specific Enough to Permit an In-Depth Analysis	Obviously No Worse Environmentally Than Item Replaced	Meets Reasonable Criteria for EIS
43. Construct an oil-fired powerplant	Unknown	Yes	Unknown	Yes	Yes	Unknown	No	Unknown	No
44. Increase size of Harry Allen plant to 2,500 MW	No	Yes	Yes	Yes	Yes	Yes	Yes	Unknown	No
45. Expand existing energy systems	Unknown	Yes	Unknown	Yes	Unknown	Unknown	No	Unknown	No
46. Expand Colorado River hydroelectric system	Unknown	Yes	Unknown	Yes	Yes	Unknown	Unknown	Unknown	No

APPENDIX 3

Government Depository Libraries that have Public Review Copies of U.S. Department of the Interior Environmental Impact Statements

A limited number of the environmental impact statements referenced in this document may be available upon request to the respective departmental offices and bureaus of the U.S. Department of the Interior that prepared the documents. Public reading copies are available for review at the following Government Depository Libraries:

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Auburn, Alabama 36830

Birmingham Public Library
2020 7th Avenue North
Birmingham, Alabama 35203

University of Alabama Library
P.O. Box 2600
Huntsville, Alabama 35807

University of Southern Alabama Library
Documents Division
Mobile, Alabama 36608

Hollis Burke Frissell Library
Tuskegee Institute
Tuskegee Institute, Alabama 36088

University of Alabama Library
Reference Department
Drawer S
University, Alabama 35486

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Anchorage, Alaska 99501

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Department of Library & Archives
Attention: Director
3rd Floor State Capitol
Phoenix, Arizona 85007

Phoenix Public Library
12 East McDowell Road
Phoenix, Arizona 85004

Arizona State University
College of Law Library
Tempe, Arizona 85281

Arizona State University Library
Documents Service
Tempe, Arizona 85281

University of Arizona Library
Documents
Tucson, Arizona 85721

University of Arkansas Library
Reference Department
Fayetteville, Arkansas 72701

Arkansas State University
Dean B. Ellis Library
State University, Arkansas 72467

Humboldt State College Library
Arcata, California 95521

University of California
General Library
Documents Department
Berkeley, California 94720

Pomona College Documents Collection
Honnold Library
222 East 9th Street
Claremont, California 91711

West Hills Community College Library
300 Cherry Lane
Coalinga, California 93210

University of California Library
Government Documents Department
Davis, California 95616

University of California-Davis
School of Law Library
Davis, California 95616

California State College
Library at Hayward
25800 Hillary Street
Hayward, California 94542

University of California Library
Government Publications Department
P.O. Box 19557
Irvine, California 92713

University of California at San Diego
Library Documents Department
LaJolla, California 92093

J.F.K. Memorial Library
5151 State College Drive
Los Angeles, California 90032

Los Angeles Public Library
Acquisitions
361 South Anderson
Los Angeles, California 90033

University of California at Los Angeles
Library
403 Hilgard Avenue
Los Angeles, California 90024

University of Southern California
Library
P.O. Box 77983
Los Angeles, California 90007

U.S. Geological Survey Library
345 Middlefield Road
Menlo Park, California 94025

California State University at Northridge
1811 Nordhoff Street
Northridge, California 91324

Riverside Public Library
P.O. Box 468
Riverside, California 92502

University of California Library
P.O. Box 5900
Riverside, California 92507

California State Library
Documents Section
P.O. Box 2037
Sacramento, California 95809

California State University
2000 Jed Smith Drive
Sacramento, California 95819

San Diego Public Library
820 East Street
San Diego, California 92101

San Diego State University
Malcolm A. Love Library
San Diego, California 92182

San Francisco Public Library
Government Documents Department
San Francisco, California 94102

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Government Publications
1630 Holloway Avenue
San Francisco, California 94132

U.S. Court of Appeals Library
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San Francisco, California 94101

California State Polytechnical University
Library
San Luis Obispo, California 93401

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Government Publications Section
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University of California
Library Documents Section
Santa Cruz, California 95060

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Public Library
3rd & East Streets
Santa Rosa, California 95404

Stanford University Libraries
Government Documents Department
Stanford, California 94305

Adams State College
Learning Resources Center
Alamosa, Colorado 81101

University of Colorado Library
Government Documents Division
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Colorado College
Charles Leaming Tutt Library
Colorado Springs, Colorado 80903

Auraria Libraries
Documents Department
Lawrence and 11th Streets
Denver, Colorado 80204

Denver Public Library
Documents Division
1357 Broadway
Denver, Colorado 80203

Jefferson County Public Library
10200 West 20th
Denver, Colorado 80215

University of Denver Park Campus
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Denver, Colorado 80210

Colorado State University Library
Fort Collins, Colorado 80523

Colorado School of Mines
Arthur Lakes Library
14th & Illinois
Golden, Colorado 80401

University of Northern Colorado
Library Documents Room
Greeley, Colorado 80631

Western State College
Leslie J. Savage Library
Gunnison, Colorado 81230

University of Southern Colorado
Library
2200 Bonforte Blvd.
Pueblo, Colorado 81001

Western Connecticut State College
Library
181 White Street
Danbury, Connecticut 06810

Connecticut State Library
231 Capitol Avenue
Hartford, Connecticut 06115

Yale University Library
Public Documents Room
New Haven, Connecticut 06520

University of Connecticut
Wilbur Cross Library
Storrs, Connecticut 06268

Library of Congress
Depository Unit
Washington, D.C. 20240

U.S. Department of the Interior
Office of Library Services
Serials Branch
Washington, D.C. 20240

Delaware State College
William C. Jason Library
Dover, Delaware 19901

University of Delaware
Morris Library
Newark, Delaware 19711

Wilmington Institute & Newcastle County Library
10th & Market Streets
Wilmington, Delaware 19801

Florida Atlantic University Library
Division of Public Documents
Boca Raton, Florida 33432

Nova University Law Library
3301 College Avenue
Fort Lauderdale, Florida 33314

University of Florida Library
Documents Department
Gainesville, Florida 36201

University of Miami Library
Government Publications
P.O. Box 248214
Miami, Florida 33124

Selby Public Library
1001 Boulevard of the Arts
Sarasota, Florida 33577

Florida A&M University
Coleman Memorial Library
Tallahassee, Florida 32307

Florida State University
R.M. Strozier Library
Tallahassee, Florida 32306

University of South Florida Library
4202 Fowler Avenue
Tampa, Florida 33620

University of Georgia
Libraries
Athens, Georgia 30601

Georgia Institute of Technology
Price Gilbert Memorial Library
223 North Avenue NW
Atlanta, Georgia 30332

Augusta College
Reese Library
2500 Walton Way
Augusta, Georgia 30904

Brunswick Glyn City
Resource Library
208 Gloucester Street
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West Georgia College
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Mercer University
Stetson Memorial Library
1330 Edgemont Avenue
Macon, Georgia 31207

Georgia Southern College
Rosenwald Library
Statesboro, Georgia 30458

University of Guam
R.F.K. Memorial Library
P.O. Box EK
Agana, Guam 96910

University of Hawaii Library
2550 The Mall
Honolulu, Hawaii 96822

University of Idaho Library
Documents Section
Moscow, Idaho 83843

Idaho State University Library
Documents Department
Pocatello, Idaho 83201

Southern Illinois University
Morris Library
Documents Center
Carbondale, Illinois 62901

Eastern Illinois University
Booth Library
Charleston, Illinois 61920

Chicago Public Library
Technical Services Center
425 North Michigan Avenue
Chicago, Illinois 60611

Field Museum of Natural History
Library
Roosevelt Rd. & Lake Shore Dr.
Chicago, Illinois 60605

John Crenar Library
Acquisitions Department
35 West 33rd Street
Chicago, Illinois 60616

Northeastern Illinois University Library
Bryn Mawr at St. Louis Avenue
Chicago, Illinois 60625

University of Chicago Library
1100 East 5th Street
Chicago, Illinois 60637

Northern Illinois University
Swen Franklin Parson Library
DeKalb, Illinois 60115

Southern Illinois University
Lovejoy Memorial Library
Edwardsville, Illinois 62025

Northwestern University Library
Government Publications Dept.
Evanston, Illinois 60201

Macmurray College
Henry Pfeiffer Library
Jacksonville, Illinois 62650

Western Illinois University Library
Macomb, Illinois 61455

Monmouth College Library
Monmouth, Illinois 61462

Illinois State Library
Government Documents
Centennial Building
Springfield, Illinois 62706

University of Illinois Library
Documents Division
Room 2200
Urbana, Illinois 61801

Indiana University Library
Documents Department
Bloomington, Indiana 47401

Fort Wayne Public Library
900 Webster Street
Fort Wayne, Indiana 46802

Indiana Purdue University
Regular Campus Library
2101 East US 30 Bypass
Fort Wayne, Indiana 46805

De Pauw University
Roy O. West Library
Greencastle, Indiana 46135

Indiana State Library
Serials Section
140 North Senate Avenue
Indianapolis, Indiana 46204

Purdue University Library
LaFayette, Indiana 47907

Ball State University Library
Government Publications
Muncie, Indiana 47306

St. Josephs College Library
Rensselaer, Indiana 47978

Earlham College
Lilly Library
Richmond, Indiana 47374

Indiana University at South Bend
Library
1825 Northside Boulevard
South Bend, Indiana 46615

Indiana State University
Documents Library
Cunningham Memorial Library
Terre Haute, Indiana 47809

Iowa State University Library
Government Documents Dept.
Ames, Iowa 50010

University of Northern Iowa Library
Documents Collection
Cedar Falls, Iowa 50613

University of Northern Iowa
Library Documents Collection
Cedar Falls, Iowa 50613

Grinnell College Library
Grinnell, Iowa 50112

University of Iowa Library
Government Documents Department
Iowa City, Iowa 52242

University of Kansas Library
Documents Collection
Lawrence, Kansas 66044

Kansas State University Library
Documents Department
Manhattan, Kansas 66506

University of Kentucky
Government Publications Department
Lexington, Kentucky 40506

Louisville Free Public Library
4th and York Streets
Louisville, Kentucky 40203

University of Louisville Library
Belknap Campus
Louisville, Kentucky 40208

Louisiana State University Library
Government Documents Department
Baton Rouge, Louisiana 70803

Southern University Library
So. Baton Rouge Post Office
Baton Rouge, Louisiana 70813

Louisiana State University at Eunice
Ledoux Library
Eunice, Louisiana 70535

University of Southwestern Louisiana
Library
USL Box 4 0199
LaFayette, Louisiana 70504

Northwestern State University
Watson Memorial Library
Natchitoches, Louisiana 71457

Tulane University
Howard Tilton Memorial Library
New Orleans, Louisiana 70118

University of New Orleans Library
Lake Front
New Orleans, Louisiana 70122

Louisiana Technical University
Prescott Memorial Library
Ruston, Louisiana 71270

Nicholls State University
Library Documents Division
Thibodaux, Louisiana 70301

Maine Maritime Academy
Nutting Memorial Library
Castine, Maine 04421

University of Maine
Raymond H. Fogler Library
Orono, Maine 04473

U.S. Naval Academy
Nimitz Library
Annapolis, Maryland 21402

Enoch Pratt Free Library
400 Cathedral Street
Baltimore, Maryland 21201

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Milton S. Eisenhower Library
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University of Maryland
McKeldin Library
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Station Library
NAS NATC Building
Patuxent River, Maryland 20670

University of Lowell
Alumini Lydon Library
1 University Avenue
Lowell, Massachusetts 01854

Library of Massachussetts
Goodell Library
Amherst, Massachussetts 01002

Boston College
Bapst Library
Boston, Massachussetts 02167

Boston Public Library
Documents Receipts
Boston, Massachussetts 02117

Harvard College Library
Serials and Records Division
Boston, Massachussetts 02138

Massachussetts Institute of Technology
Library
14 East 210
Boston, Massachussetts 02139

State Library of Massachussetts
State House
Boston, Massachussetts 02133

Stonehill College
Cushing Martin Library
North Easton, Massachussetts 02356

Albion College
Stockwell Memorial Library
Albion, Michigan 49224

University of Michigan
Harlan Hatcher Library
Ann Arbor, Michigan 48104

Detroit Public Library
5201 Woodward Avenue
Detroit, Michigan 48202

University of Detroit Library
4001 West McNichols Road
Detroit, Michigan 48221

Wayne State University
G. Flint Purdy Library
Detroit, Michigan 48202

Wayne State University
Law Library
468 West Ferry Street
Detroit, Michigan 48202

Michigan State University
Library Documents Department
East Lansing, Michigan 48824

Oakland Community College
Martin L. King Learning Center
27055 Orchard Lake Road
Farmington, Michigan 48024

Calvin College Library
3207 Burton Street SE
Grand Rapids, Michigan 49506

Grand Rapids Public Library
Library Plaza
Grand Rapids, Michigan 49502

Michigan Tech University
Library Documents Department
Houghton, Michigan 49931

Western Michigan University
Dwight B. Waldo Library
Kalamazoo, Michigan 49001

Michigan State Library
Government Library, Law Building
525 West Ottawa Street
Lansing, Michigan 48913

Monroe County Library
Documents Division
3700 South Custer Road
Monroe, Michigan 48161

Eastern Michigan University Library
Ypsilanti, Michigan 48197

Mankato State College
Government Publications
Mankato, Minnesota 56001

Minneapolis Public Library
300 Nicollet Mall
Minneapolis, Minnesota 55401

University of Minnesota
Wilson Library
Documents Division
Minneapolis, Minnesota 55455

Carleton College Library
Northfield, Minnesota 55057

Saint Cloud State College
Library Documents
Saint Cloud, Minnesota 56301

Mississippi College School of Law
Library
P.O. Box 4008
Clinton, Mississippi 39058

Mississippi State College for Women
J.C. Fant Memorial Library
College Station Box E
Columbus, Mississippi 39701

University of Southern Mississippi
Library
Southern Station, P.O. Box 53
Hattiesburg, Mississippi 39401

Mississippi State University
Mitchell Memorial Library
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University of Mississippi Library
Documents Department
University, Mississippi 38677

University of Missouri
Library Documents
Columbia, Missouri 65201

Southeast Missouri State University
Kent Library
CPE Giradeau, Missouri 63701

University of Missouri at Kansas City
General Library, Gov't. Documents
5100 Rockhill Road
Kansas City, Missouri 64110

University of Missouri at Rolla
Library Documents
Rolla, Missouri 65401

Southwest Missouri State College
Library
901 South National
Springfield, Missouri 65802

University of Missouri at St. Louis
Thomas Jefferson Library
8001 Natural Bridge Road
St. Louis, Missouri 63121

Eastern Montana College
Library Documents
Billings, Montana 59101

Montana State University Library
Bozeman, Montana 59717

University of Montana Library
Documents Department
Missoula, Montana 59801

Nebraska Library Commission
Nebraska Public Clearinghouse
1420 P Street
Lincoln, Nebraska 89557

University of Nebraska
D.L. Love Memorial Library
Lincoln, Nebraska 68508

University of Nebraska Library
60th & Dodge Street
Omaha, Nebraska 68182

University of Nevada in Las Vegas
James Dickinson Library
4505 Maryland Parkway
Las Vegas, Nevada 89154

University of Nevada Library
Government Publications
Reno, Nevada 89557

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2 White Street
Concord, New Hampshire 03301

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Dartmouth College
Baker Library
Hanover, New Hampshire 03755

Bayonne Free Public Library
697 Avenue C
Bayonne, New Jersey 07002

Ramapo College Library
P.O. Box 542
Mahwah, New Jersey 07430

Rutgers University Library
Government Documents Department
New Brunswick, New Jersey 08901

Newark Public Library
5 Washington Street
Newark, New Jersey 07101

Rutgers State University
John Cotton Dana Library
185 University Avenue
Newark, New Jersey 07102

Princeton University
Library Documents Division
Princeton, New Jersey 08540

University of New Mexico
Zimmerman Library
Albuquerque, New Mexico 87131

New Mexico State University
Library Documents
P.O. Box 3475
Las Cruces, New Mexico 88001

New Mexico Highlands University
Donnely Library
Las Vegas, New Mexico 87701

Eastern New Mexico University Library
Portales, New Mexico 88130

New Mexico State Library
P.O. Box 1629
Santa Fe, New Mexico 87501

New York State Library
Cultural Education Center
Empire State Plaza
Albany, New York 12230

State University of New York Library
Vestal Parkway East
Binghamton, New York 13901

State University of New York
Drake Memorial Library
Brockport, New York 14420

Fordham University Library
Public Documents Section
Bronx, New York 10458

Brooklyn Public Library
Social Science Department
Grand Army Plaza
Brooklyn, New York 11238

Polytechnical Institute of Brooklyn
Spicer Library
33 Jay Street
Brooklyn, New York 11201

Buffalo & Erie County
Public Library
Lafayette Square
Buffalo, New York 14203

State University of New York
Lockwood Memorial Library
Buffalo, New York 14214

Saint Lawrence University
Owen D. Young Library
Canton, New York 13617

Corning Community College
Arthur A. Houghton Jr. Library
Corning, New York 14830

Long Island University
B. Davis Schwartz Memorial Library
C.W. Post Center
Greenvale, New York 11548

Colgate University Library
Reference Librarian
Hamilton, New York 13346

Queens Borough Public Library
Documents Librarian
89 11 Merrick Boulevard
Jamaica, New York 11432

Columbia University Libraries
420 West 118th Street, Room 327
New York, New York 10027

New York Public Library
Astor Branch
476 5th Avenue
New York, New York 10018

New York Public Library
Lenox Branch
476 5th Avenue
New York, New York 10018

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Law Library
40 Washington Square South
New York, New York 10012

New York University Library
Documents Department 7th Floor
70 Washington South
New York, New York 10012

York Law Institute Library
120 Broadway
New York, New York 10005

State University of New York
Penfield Library
Oswego, New York 13126

Vassar College Library
Poughkeepsie, New York 12601

State University of New York Library
College at Purchase
Purchase, New York 10577

University of Rochester Library
River Campus Station
Rochester, New York 14627

Southampton College Library
Montauk Highway
Southampton, New York 11968

State University of New York in Stony Brook
Main Library Documents
Stony Brook, New York 11790

Syracuse University Library
Documents Division
Syracuse, New York 13210

Nassau Library System
900 Jerusalem Avenue
Uniondale, New York 11553

Syracuse University Utica Rome
811 Court Street
Utica, New York 13502

Apalachian State University Library
Government Documents
Boone, North Carolina 28607

University of North Carolina Library
BA SS Division Documents
Chapel Hill, North Carolina 27514

University of North Carolina
Atkins Library Documents Department
UNCC Station
Charlotte, North Carolina 28223

Duke University
William R. Perkins Library
Durham, North Carolina 27706

East Carolina University
Library Documents Department
Greenville, North Carolina 27834

North Carolina State University
D.H. Hill Library
P.O. Box 5007
Raleigh, North Carolina 27607

University of North Carolina
William M. Randall Library
P.O. Box 3725
Wilmington, North Carolina 28401

North Dakota State University Library
Federal Documents Office
Fargo, North Dakota 58102

Ashland College Library
Ashland, Ohio 44805

Ashland College Library
Ashland, Ohio 44805

Ohio University Library
Documents Department
Athens, Ohio 45701

Public Library of Cincinnati
and Hamilton County
800 Vine Street
Cincinnati, Ohio 45202

University of Cincinnati Library
Serials Division
Cincinnati, Ohio 45221

Case Western Reserve University
Freiberger Library
11161 East Blvd.
Cleveland, Ohio 44106

Cleveland Public Library
325 Superior Avenue
Cleveland, Ohio 44114

Cleveland State University Library
1860 Chester Avenue
Cleveland, Ohio 44115

Ohio State Library
State Office Building
65 South Front Street
Columbus, Ohio 43215

Hiram College
Teachout Price Memorial Library
P.O. Box 98
Hiram, Ohio 44234

Kent State University Library
Documents Division
Kent, Ohio 44242

College of Steubenville
Starvaggi Memorial Library
Steubenville, Ohio 43952

Toledo Public Library
325 Michigan Street
Toledo, Ohio 43624

University of Toledo Library
2801 West Bancroft Street
Toledo, Ohio 43606

College of Wooster
Andrews Library
Technical Services
Wooster, Ohio 44691

Central State University
Library Documents Department
Edmond, Oklahoma 73034

University of Oklahoma Libraries
Documents Division
401 West Brooks
Norman, Oklahoma 73069

Oklahoma Department of Libraries
Government Documents
200 NE 18th Street
Oklahoma City, Oklahoma 73105

Oklahoma State University Library
Stillwater, Oklahoma 74074

Tulsa City County Library
400 Civic Center
Tulsa, Oklahoma 74103

University of Tulsa
McFarlin Library
600 South College
Tulsa, Oklahoma 74104

Southern Oregon College Library
1250 Sisiydu Blvd.
Ashland, Oregon 97520

University of Oregon Library
Documents Section
Eugene, Oregon 97403

Eastern Oregon College Library
LaGrande, Oregon 97850

Bonneville Power Administration Library
P.O. Box 3621
Portland, Oregon 97208

Portland State University Library
P.O. Box 1151
Portland, Oregon 97207

Oregon State Library
State Library Building
Salem, Oregon 97310

Oregon State University
Library Documents Division
State University, Oregon 97331

Lehigh University
Library 30
Bethlehem, Pennsylvania 18015

Dickinson College Library
Carlisle, Pennsylvania 17013

State Library of Pennsylvania
Government Publications Section
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Harrisburg, Pennsylvania 17126

Franklin and Marshall College
Fackenthal Library
Lancaster, Pennsylvania 17604

Allegheny College
Reis Library
North Main Street
Meadville, Pennsylvania 16335

Drexel University Library
32nd & Chestnut Streets
Philadelphia, Pennsylvania 19104

Free Library of Philadelphia
Government Publications
Logan Square
Philadelphia, Pennsylvania 19103

University of Pittsburgh
Hilman Library
Documents Office
Pittsburgh, Pennsylvania 15260

Slippery Rock State College
Maltby Library
Slippery Rock, Pennsylvania 16057

Pennsylvania State University
Library Documents Section
University Park, Pennsylvania 16802

Westmoreland City Community College
Learning Research Center
Armbrust Road
Youngwood, Pennsylvania 15697

University of Puerto Rico
Library Documents Room
Mayaguez Campus
Mayaguez, Puerto Rico 00708

University of Puerto Rico
General Library
Documents & Maps Room
San Juan, Puerto Rico 00931

University of Rhode Island Library
Government Publications Office
Wakefield, Rhode Island 02881

Richland County Public Library
1400 Sumter Street
Columbia, South Carolina 29201

South Carolina State Library
Documents Librarian
P.O. Box 11469 Cap Station
Columbia, South Carolina 29211

University of South Carolina
Undergraduate Library
Columbia, South Carolina 29208

South Dakota School of Mines & Technology
Library
Rapid City, South Dakota 57701

Chattanooga Hamilton County
Bicentennial Library
1001 Broad Street
Chattanooga, Tennessee 37402

Tennessee Technological University
Jere Whitson Memorial Library
Cookeville, Tennessee 38501

East Tennessee State University
Sherrod Library Documents Department
University Station
Johnson City, Tennessee 37601

Memphis & Shelby County
Public Library
1850 Peabody Avenue
Memphis, Tennessee 38104

Memphis State University
John W. Brister Library
Memphis, Tennessee 38111

Joint University Libraries
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Nashville, Tennessee 37203

Tennessee State Library and Archives
State Library Division
Nashville, Tennessee 37219

University of the South
Jessie Ball Dupont Library
Sewanee, Tennessee 37375

Texas A & M University Library
A & M College, Texas 77843

University of Texas at Arlington
Library Documents
Arlington, Texas 76019

Texas State Library
U.S. Documents Section
P.O. Box 12927
Austin, Texas 78711

University of Texas at Austin Library
Main Building 316
Austin, Texas 78712

University of Texas Law Library
2500 Red River Street
Austin, Texas 78705

Lamar University Library
P.O. Box 10021
Beaumont, Texas 77710

East Texas State University Library
East Texas Station
Commerce, Texas 75428

Dallas Public Library
1954 Commerce Street
Dallas, Texas 75201

El Paso Public Library
Documents & Geneaology
501 North Oregon
El Paso, Texas 79901

University of Texas at El Paso
Library Documents Division
El Paso, Texas 79968

Houston Public Library
Julia Ideson Bldg.
500 McKinney
Houston, Texas 77002

University of Houston Libraries
Documents Division
3801 Cullen Blvd.
Houston, Texas 77004

Texas Tech University Library
P.O. Box 4079
Lubbock, Texas 79409

Stephen F. Austin State University
Steen Library
Documents Department
Naccodoches, Texas 75962

North Texas State University Library
North Texas, Texas 76203

University of Texas at Dallas
Library
P.O. Box 643
Richardson, Texas 75080

San Antonio College Library
1001 Howard Street
San Antonio, Texas 78288

Trinity University Library
Documents Collection
715 Stadium Drive
San Antonio, Texas 78284

University of Texas at San Antonio
Library
San Antonio, Texas 78285

Baylor University Library
P.O. Box 6307 BU Station
Waco, Texas 76706

Utah State University
Library Documents Division
Logan, Utah 84321

Weber State College Library
3750 Harrison Blvd.
Ogden, Utah 84408

Brigham Young University
Lee Library
Documents & Map Section
Provo, Utah 84602

University of Utah
Law Library
Salt Lake City, Utah 84112

University of Utah
Marriott Library
Salt Lake City, Utah 84112

University of Vermont
Bailey Library
Burlington, Vermont 05401

Florence Williams Public Library
4950 King Street
Christiansted, Virgin Islands 00820

University of Virginia
Alderman Library
Public Documents
Charlottesville, Virginia 22903

University of Virginia
Law Library
Documents Department
Charlottesville, Virginia 22901

Old Dominion University
Documents Dept. University Library
5215 North Hamton Blvd.
Norfolk, Virginia 23508

U.S. Geological Survey Library
National Center Mail Stop
12201 Sunrise Valley Drive
Reston, Virginia 22092

Virginia Commonwealth University
James Brothers Cabell Library
901 Park Avenue
Richmond, Virginia 23220

Hollins College
Fishburn Library
Roanoke, Virginia 24020

College of William and Mary
Swen Library
Documents Department
Williamsburg, Virginia 23185

Western Washington State College
Wilson Library
516 High Street
Bellingham, Washington 98225

Eastern Washington State College
Library
Cheney, Washington 99004

Central Washington University
Library Documents Section
Ellensburg, Washington 98926

Washington State Library
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Olympia, Washington 98501

Washington State University Library
Serial Record Section
Pullman, Washington 99163

Seattle Public Library
6th and Madison
Seattle, Washington 98104

University of Washington Library
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Seattle, Washington 98195

University of Washington
Law Library
1100 NE Campus Parkway JB 20
Seattle, Washington 98195

Spokane Public Library
Reference Department
West 906 Main Avenue
Spokane, Washington 99201

Tacoma Public Library
Documents Division
1102 South Tacoma Avenue
Tacoma, Washington 98402

University of Pugent Sound
Collins Memorial Library
1500 North Wagner
Tacoma, Washington 98416

Whitman College Library
Penrose Memorial Library
Walla Walla, Washington 99362

Davis & Elkins College Library
Elkins, West Virginia 26241

Glenville State College
Robert F. Kidd Library
Glenville, West Virginia 26351

Marshall University Library
Documents Librarian
1655 3rd Avenue
Huntington, West Virginia 25701

West Virginia University Library
Morgantown, West Virginia 26505

Lawrence University
Seeley G. Mudd Library
Documents Department
Appleton, Wisconsin 54912

Beloit College Libraries
Serials Documents Department
Beloit, Wisconsin 53511

State Historical Society Library
816 State Street
Madison, Wisconsin 53706

Milwaukee Public Library
814 West Wisconsin Avenue
Milwaukee, Wisconsin 53233

University of Wisconsin in Milwaukee
Library Documents
Milwaukee, Wisconsin 53201

Wisconsin State University
Forrest R. Polk Library
800 Algona Blvd.
Oshkosh, Wisconsin 54901

University of Wisconsin at Platteville
725 West Main Street
Platteville, Wisconsin 53818

University of Wisconsin at Stevens Point
Documents Section
Learning Resources Center
Stevens Point, Wisconsin 54481

Wisconsin State University
Jim Dan Hill Library
18th & Grand Avenue
Superior, Wisconsin 54880

Wyoming State Library
Supreme Court & Library Bldg.
Cheyenne, Wyoming 82201

University of Wyoming
Coe Library
Laramie, Wyoming 82070

APPENDIX 4

Applicants' Proposed Design and Operating Procedures

Air Quality

1. During the construction and operational phases of the AWV Energy System project, fugitive dust from unpaved roads and other disturbed soil surfaces will be controlled by periodically sprinkling with water or by application of other suitable chemical dust suppression agents as required.

Effectiveness. The measure could be up to 100-percent effective in preventing fugitive dust, depending upon frequency of application of water. Use of chemical dust suppression agents would provide less than 100-percent control but would last much longer between applications.

2. Powerplant stack emissions will be controlled by utilizing a wet lime scrubber for sulfur dioxide (SO_2) and an electrostatic precipitator for particulates. Control of nitrogen oxides sufficient to meet EPA emission standards will be accomplished by boiler design. The SO_2 particulate removal systems must meet a Best Available Control Technology (BACT), which at a minimum will be as stringent as the New Source Performance Standards.

Effectiveness. SO_2 removal would be over 80-percent effective; particulate removal over 90-percent effective. NO_2 removal would be expected to be at the lower limit allowable because of operating efficiency requirements.

3. Within the powerplants, lime required for the SO_2 abatement system will be stored in silos equipped with bag filters. Lime handling and transfer will be in closed systems.

Effectiveness. This method of controlling lime storage and transfer would be completely effective in preventing introduction of lime into the atmosphere.

4. Fly ash from the powerplants will be confined to closed hoppers and silos and transported dry by pneumatic or mechanical methods in closed transfer systems until mixed with station wastewater and transferred to the waste disposal ponds.

Effectiveness. Handling fly ash in this manner would be 100-percent effective in preventing its introduction into the atmosphere except for a small amount that could possibly blow off disposal ponds after evaporation.

5. Wherever active and inactive coal inventories are stored dry, as in piles, a dust suppression system based on sprayed wetting and stabilization agents will be employed. Inactive coal storage piles will be compacted to eliminate windblown dust. Coal conveyors' enclosures and wet suppression for transfer points will provide BACT for the coal handling system.

Effectiveness. Dust suppression would be 80 percent or greater.

6. The coal slurry preparation plant will employ BACT for pollutant control, including dust and noise inhibitors.

Effectiveness. This commitment would insure meeting applicable pollution control standards.

7. A monitoring program will be used throughout the construction and operational phases of the project at both powerplants. This program will monitor air quality (SO_2, particulate matter, and nitrogen oxides), stack emissions, fugitive dust, noise, and the ecological effects resulting from the project in order to insure proper control of potential pollutants.

Effectiveness. The commitment to monitor air quality would allow identification of needs and insure meeting standards set for emission control.

Soils

1. In areas of excavation for the slurry pipeline, topsoil will be removed from disturbed areas during construction and stockpiled onsite for future reclamation efforts. The stockpiled topsoil will be revegetated to prevent loss of the material.

Effectiveness. Stockpiling topsoil would insure a higher probability of success in reclamation efforts. Degree of success would vary according to quality and quantity of topsoil available in conjunction with localized climatic conditions. Revegetation of stockpiles would effectively reduce loss of soil through erosion after vegetation would become established (2 to 3 years).

2. Interceptor dikes for erosion control will be constructed on disturbed slopes 50 feet or longer. Where construction activities impair existing drainage systems, waterways will be restored or rerouted.

Effectiveness. The amount of erosion which would occur would be reduced, although degree of effectiveness cannot be determined at this time.

3. In areas characterized by unconsolidated earth where sidehill cutting will be required, new permanent slopes will not exceed a 33-percent grade (3:1 slope).

Effectiveness. Success would vary according to specific onsite conditions. Erosion would be reduced, however, amount cannot be determined at this time.

4. In critical areas such as the highly erodable dune lands, washes, and stream embankments, contours will be restored to conform with adjacent areas at the end of construction where possible.

Effectiveness. Such contouring would be nearly 100-percent effective in making the area blend into the surrounding land form. Success in erosion control could vary from near present conditions to substantially worse conditions, depending upon land form.

5. Where the slurry pipeline crosses highly erodible dune land and sand areas, straw or native grass hay at the rate of 2 tons per acre will be applied. The mulching material will be anchored to the soil by punching, disking, or by the application of a suitable tucking compound. This mulch will be applied immediately following construction.

Effectiveness. Mulching would greatly enhance the probability of revegetation success, as well as preventing soil erosion.

6. In construction of the Warner Valley dam, unusable material from foundation, dam, and outlet works excavation will be distributed within the reservoir area and eventually inundated by the reservoir waters.

Effectiveness. Once inundated, this material would be eliminated as a visual detraction.

7. The Warner Valley dam abutments and foundation will be grouted and sealed to control seepage under the embankment materials.
Effectiveness. Proper grouting and sealing would prevent failure of the dam due to seepage.

8. Unsuitable gypsiferous soils will not be used in the Warner Valley dam embankment.
Effectiveness. The possibility of dam failure due to subsidance or piping would be effectively reduced to near zero probability.

Vegetation

1. Prior to disturbance of surface areas, an inventory of threatened and endangered plant species will be accomplished, and necessary measures to mitigate possible impacts on such threatened or endangered species shall be agreed upon between the authorized representative of the company and the land manager.
Effectiveness. Mitigating measures to avoid impacts to threatened and endangered plant species could be 100-percent effective.

2. Clearing of vegetation will be limited to the minimum necessary for construction. As determined by the authorized representative of the land manager, seeding or other approved means of revegetation shall be performed to the extent practicable on disturbed areas during the first fall following completion of construction.
Effectiveness. Reducing the amount of actual disturbance would reduce impacts. Reseeding or other revegetation would reduce impact from disturbance; however, an estimate of its effectiveness cannot be made at this time.

Wildlife

1. Plant facilities and waste disposal areas will be fenced to prohibit entry by larger terrestrial animals.
Effectiveness. Fencing would be 100-percent effective in preventing loss of these animals due to such hazards.

2. Electrical transmission lines under 230 kV will be constructed to meet Rural Electric Association standards for prevention of raptor electrocution.
Effectiveness. Construction to these standards would eliminate danger to raptors from electrocution.

3. Except for conductor stringing, powerline construction in desert bighorn sheep habitat areas will take place during the fall or early winter.
Effectiveness. Avoiding construction during these seasons will nearly eliminate disruption of the desert bighorn sheep breeding period. Some disruption from conductor stringing could result.

4. Wildlife guzzlers disturbed by construction of the project will be moved to specified locations outside the areas of construction activity.

Effectiveness. The availability of water for animals using these guzzlers would be preserved.

5. Prior to disturbance of surface areas, an inventory of threatened and endangered animal species will be accomplished, and necessary measures to mitigate possible impacts on such species shall be agreed upon between the authorized representative of the company and the land manager.

Effectiveness. Mitigating measures to protect threatened and endangered wildlife species would be expected to be nearly 100-percent effective.

Water Resources

1. Sanitation facilities capable of handling the maximum construction force will be provided. Equipment will include portable chemical toilets in remote areas, toilet trailers in some areas, and permanent toilet facilities in some major construction areas. Sanitary wastes will be disposed of by transporting to offsite disposal areas or from onsite packaged sewage treatment plants with effluent going to onsite evaporation ponds.

Effectiveness. Commitment to this stipulation would result in 100-percent mitigation of potential impacts to water resources.

2. All ponds for evaporation of wastewater, as well as sewage treatment, will be constructed of impervious materials to prevent leakage into the groundwater.

Effectiveness. Prevention of leakage into the ground water from this source could be up to 100-percent effective, depending on type of impervious material used.

3. Petroleum products from equipment and vehicles will be collected and disposed of.

Effectiveness. Waste petroleum products could be completely contained. The only potential for introduction into the environment would be at the disposal site.

4. Wastewater from concrete batch plants and from vehicles transporting concrete will be directed to evaporation ponds for impoundment and evaporation.

Effectiveness. Wastewater could be completely prevented from entering into ground or surface waters through proper construction of evaporation ponds.

5. The grade of all plant sites will be designed to channel runoff into an evaporation pond(s) so as to keep any contaminated waters onsite.

Effectiveness. This measure would be 100-percent effective in keeping contaminated waters onsite, provided evaporation ponds would be impermeable and of sufficient capacity.

6. The Virgin River crossing by the coal slurryline will be made during low or no-flow periods (July through October). At the crossing point, the pipeline will be coated with layers of reinforced gunite for added weight.

Effectiveness. Sediment concentration in the Virgin River due to construction activities would be negligible. The possibility of washout would be greatly reduced by application of gunite.

7. The coal slurry pipeline crossing of the Muddy River will be accomplished by boring under the existing channel without disturbing the river.

Effectiveness. This measure would be 100-percent effective in preventing sediment introduction into the Muddy River due to construction activities. The potential for pipeline washout would be nearly eliminated.

8. The amount of powerplant cooling tower drift will be limited in quantity by the use of cooling tower drift eliminators.

Effectiveness. Application of this measure would keep cooling tower drift within accepted limits.

Cultural Resources

1. Prior to disturbance of surface areas, the company will survey and inventory archaeological, historical, and cultural sites within the proposed area of distrubance. The inventory will be presented to the Bureau of Land Management. Data on archaeological and historical sites of significance will also be presented to the State Historic Preservation Officers of the various states for a determination of possible impacts on such sites.

Effectiveness. Evaluation and assessment of archaeological sites would insure that potential National Register Properties would not be disturbed or destroyed without the due consideration required by Executive Order 11593.

2. A qualified archaeologist will be onsite during initial ground distrubance. If an archaeological site is discovered, disturbance will be stopped until an evaluation of the site can be made. Subsequent actions will depend on the significance of the site encountered. The site will be either avoided or salvaged, as determined by a representative of the land manager.

Effectiveness. A professional archaeologist knowledgeable of the site locations would work with construction crews and point out the locations of sites to be avoided. This would achieve 100-percent effectiveness for site avoidance, and would preclude the necessity of marking sites in a conspicuous manner, thus reducing the potential of impacts from vandalism. Having an experienced archaeologist working with construction crews would markedly reduce impacts associated with the possibility of encountering buried sites. Such an individual could be expected to recognize a buried site almost immediately, whereas an equipment operator or supervisor might not recognize certain site types at all. However, even this measure would not be 100-percent effective, as a buried site would have to be cut into and exposed to some extent before it could be recognized.

Land Use

1. A field representative of the company will represent the entire construction operation. All government or land owner interaction with the company will be through the field representative.

Effectiveness. Having one recognized individual with which to interact would eliminate most of the communication difficulties and misunderstandings that would be inherant when several individuals would become involved.

2. All construction and operational workers would be given a briefing on the environmental stipulations contained in the rights-of-way grant.

Effectiveness. Noncompliance with the stipulations through ignorance would be eliminated.

3. After construction and land rehabilitation have been completed, a joint compliance check of rights-of-way will be made by the construction manager and the land owner and/or administrator to determine compliance with the terms and conditions of the rights-of-way permits.

Effectiveness. Compliance with terms and conditions of the right-of-way permits would be assured.

4. The company will notify the Bureau of Land Management, U.S. Fish and Wildlife Service, and the State Fish and Game Agency of the construction schedules in each of the States through which the rights-of-way for the project are received.

Effectiveness. Agencies would be able to schedule any necessary action on their part.

5. Disturbances to existing structures and facilities (fences, cattleguards, roads, watering and irrigation facilities, etc.) caused by construction activities will be kept to a minimum. Functional use of these facilities will be maintained at all times and will be permanently restored after construction.

Effectiveness. This measure would facilitate livestock handling and would prevent trespass by livestock across existing fence boundaries. Interruption of traffic, irrigation, etc., would be prevented. Immediate installation of such facilities would result in 100-percent effectiveness of this measure.

6. New or upgraded roads needed for construction will be developed according to the following criteria:

1. The minimum centerline radius of curvature shall be based on the turning radius required for the largest construction equipment.

2. Grades in excess of 15 percent shall be submitted to the land manager for review.

Effectiveness. Proper road design for the specific needs and terrain would be assured.

7. The existing access roads used to construct the Navajo-McCullough 500 kV and the Reid Gardner-Pecos 230 kV lines will be utilized to construct the parallel segments of the proposed power transmission lines.

Effectiveness. Using existing roads where possible would eliminate unnecessary new disturbance of the land surface, reducing impacts to soils, vegetation, aesthetics, etc., on approximately 168 miles of right-of-way.

8. After construction, temporary construction roads will be blocked off from public use unless the land owner and surface management agency specify otherwise.

Effectiveness. Blocking roads would prevent further surface disturbance from vehicle use and would allow faster rehabilitation of the disturbed area.

9. All primary and secondary access roads to plant sites and the coal mine shall be paved.

Effectiveness. Paving the principle roads would greatly reduce erosion and would prevent vehicle-created dust.

Recreation and Aesthetics

1. The station color scheme (except aluminum products) will be selected for compatibility with the surrounding environment.

Effectiveness. This measure would decrease visibility of the structures and lessen visual impact.

2. Where 500-kV transmission lines run in the same corridor as existing 500 kV lines, an effort will be made to place the towers of the new line as nearly opposite the towers of the existing line as possible in order to minimize the visual effect of the two transmission lines.

Effectiveness. Proper alignment of new towers would lessen visual impact by 50 to 75 percent.

3. During slurry pipeline construction when backfilling operations have been completed in rocky areas, surplus rock will be distributed over the entire right-of-way. Only large rocks that disrupt the continuity of the landscape will be removed and disposed of in borrow pits or other inconspicuous locations. In no case will a windrow be formed.

Effectiveness. The adverse impact to visual resources due to construction operations would be lessened, however, extent has not been determined.

4. Screen plantings of native trees thinned from adjacent areas will be made 200 to 300 feet on either side of where the slurry pipeline crosses a highway and where the area is presently wooded.

Effectiveness. Screen planting of native trees would be nearly 100-percent effective in eliminating visual intrusion of right-of-way, depending on terrain.

5. An interpretive signing program will be undertaken to place a sign at the previous location of the Skutumpah sawmill and a sign or several signs along the route of the old Alton-Kanab road where the route is visible from any new or improved project roads used by the public.

Effectiveness. Interpretive signing would be desirable, however, actual benefit has not been determined.

6. Where the adjacent land has soil cover, the slurry pipeline ditch will be covered with enough soil to allow for subsidence during the compaction process. Berms, other than those used for erosion control, will be eliminated.

Effectiveness. The pipeline would be less visible; however, remaining scars would be dependent on surrounding vegetation and success of revegetation efforts.

Appendix 5

Actions Required to Authorize the Applicants' Proposed Project and Reasonable Alternatives

Agency	Activity/Action	Alternatives 1	2	3	4	5	6
Department of Defense							
Army Corps of Engineers	Construction of diversion structure in the Virgin River (Permit).	X		X	X		
	Discharge of dredged material into the Virgin River (Permit).	X		X	X		
	Construction of coal slurry pipeline crossing the Virgin and Muddy Rivers (Permit).	X	X				
Air Force	Grant right-of-way for AWT Pipeline.	X	X	X	X		
Department of the Interior							
Fish and Wildlife Service	Issue biological opinion on threatened and endangered species in project area.	X	X	X	X		
Office of Surface Mining Reclamation and Enforcement	Approval of mining plan for coal lease areas in the Alton coal field.	X	X	X			
Bureau of Land Management							
Arizona	Grant coal slurry pipeline right-of-way.	X	X				
	Grant electrical transmission line right-of-way.	X		X			
California	Grant communications site right-of-way.	X	X	X	X		
	Grant electrical transmission line right-of-way and microwave right-of-way.	X	X	X	X		

(continued)

Agency	Activity/Action	Alternatives 1	2	3	4	5	6
Nevada	Grant coal slurry pipeline right-of-way.	X	X				
	Grant Harry Allen powerplant right-of-way or conduct land sale.	X	X	X	X		
	Grant electrical transmission line right-of-way.	X	X	X	X		
Utah	Grant coal slurry pipeline right-of-way.	X	X				
	Grant Warner Valley water project right-of-way.	X		X	X		
	Grant Warner Valley powerplant right-of-way or conduct land sale.	X		X			
	Grant electrical transmission line right-of-way.	X	X	X			
National Park Service	Determine visibility impacts to Bryce Canyon and Zion National Parks.	X	X	X			
Department of Transportation							
Federal Aviation Administration	Airports - construction, alteration, activation, and deactivation.	X	X	X	X		
	Navigable airspace (special use airspace).	X	X	X	X		

(continued)

Appendix 5 (continued)

Agency	Activity/Action	Alternatives 1	2	3	4	5	6
Environmental Protection Agency							
	Issue PSD permit for the Warner Valley powerplant.	X		X			
	Issue PSD permit for the Harry Allen powerplant.	X	X	X	X		
Interstate Commerce Commission							
	Approve rail freight rates for transport of coal.			X	X		
Federal Power Commission							
	Approve wholesale power rates.	X	X	X	X		
Federal Communications Commission							
	Grant operation permits.	X	X	X	X		
Federal Energy Administration							
	Approve the use of coal as the primary energy source in new steam-electric generating units.	X	X	X	X		
State of Arizona							
Various State Agencies	Grant right-of-way for coal slurry pipeline.	X	X				
	Grant right-of-way for electrical transmission system.	X		X			
	Issue Encroachment Permit for crossing of State highways.	X	X	X			

(continued)

Agency	Activity/Action	Alternatives 1	2	3	4	5	6
State of California							
Various State Agencies	Issue Certificate of Convenience and Necessity.	X	X	X	X	X	
	Issue Encroachment Permit for crossing of State highways.	X	X	X	X		
State of Nevada							
Various State Agencies	Issue Certificate of Convenience and Necessity.	X	X	X	X	X	
	Issue Encroachment Permit for crossing State highways.	X	X	X	X		
	Grant water rights.	X	X	X	X		
	Grant coal slurry pipeline right-of-way.	X	X				
	Grant right-of-way for electrical transmission lines.	X	X	X	X		
State of Utah							
Various State Agencies	Issue pollution discharge permits.	X	X	X			
	Grant right-of-way for transmission lines.	X	X	X			
	Grant right-of-way for powerplant.	X		X			
	Grant right-of-way for coal slurry pipeline.	X	X				

(continued)

Agency	Activity/Action	Alternatives 1	2	3	4	5	6
State of Utah (continued)							
	Grant right-of-way for reservoir site.	X		X	X		
	Grant water rights for reservoir and coal field.	X	X	X	X		
	Issue Encroachment Permit for crossing State highways.	X	X	X			
Local Agencies							
County Planning Commissions of:	Grant construction permits.						
Kane County, Utah		X	X	X			
Washington County, Utah		X		X	X	X	
Clark County, Nevada		X	X	X	X	X	
Lincoln County, Nevada		X	X	X		X	
Mojave County, Arizona		X	X	X			
San Bernardino County, California		X	X	X	X	X	
Los Angeles County, California						X	
Washington County, Utah	Hold bond elections to authorize water project funding.	X		X	X		
St. George, Utah	Hold bond election to authorize Warner Valley powerplant funding.	X		X			

APPENDIX 6

Standard Operating Procedures

The following procedures apply to proposed Alternatives 1 through 5, inclusive where they are appropriate, feasible, possible, and practical.

General

1. Uses of public lands required to implement the preferred alternative not yet specifically addressed in this environmental impact statement (EIS) will be subject to further environmental assessment and possible modification by the authorized officer (AO).
Effectiveness. All elements of the environment would receive proper consideration.

2. Mining claims located on public lands needed for development of the preferred alternative will be adjudicated in accordance with proper procedures. Should the claim(s) be determined to be valid, a use arrangement satisfactory to the mining claimant must be developed between the grantee and the mining claimant.
Effectiveness. The mining claimants' interests would be protected.

3. An attempt will be made to accommodate the affected State governments to the extent possible with the arrangements made for the reduction of adverse socioeconomic and environmental impacts.
Effectiveness. Conflicts with the affected State governments would be minimized.

4. The grantee will do everything reasonable, both independently and/or upon request of the AO, to prevent and suppress fires caused by the grantee, his contractors or sub-contractors on or near the lands occupied. Federal, private, and State interests will be compensated by the grantee for suppression and rehabilitation expenses as per existing statutes.
Effectiveness. The possibility of fires would not be eliminated. Identifying liability for such fires may tend to make the grantee more cautious. Various interests would be protected against loss due to fire.

5. The grantee shall comply with applicable Federal, State, and local laws and all regulations issued thereunder affecting in any manner of construction, operations, maintenance, or termination of the system.
Effectiveness. Commitment to this stipulation would insure protection afforded by such laws and regulations.

6. The grantee shall take all measures to protect the health and safety of all persons affected by its activities performed in connection with the construction, operation, maintenance, and termination of the system, and shall immediately abate any heatlh or safety hazards.
Effectiveness. Adherance to this stipulation would insure a safe work environment for employees and the general public.

7. Equipment repair areas and construction yards will be located at least 0.5 mile (0.8 km) from the nearest residence or business.

Effectiveness. This measure would be 100-percent effective in reducing annoyance from noise to businesses and residents of the area.

8. An adequate reclamation plan based on reclamation studies conducted at the expense of the grantee in accordance with 30 CFR, Part 211 and 30 CFR, Part 700 et. seq. regulations will be prepared and followed by the applicant.
Effectiveness. Proper reclamation procedures would be assured. Chances for reclamation success would be enhanced, though degree cannot be determined.

9. The grantee will provide botanists, archaeologists, paleontologists, wildlife biologists, and other specialists as appropriate (subject to approval of the AO), for all necessary surveys in areas to be disturbed by the project. These individuals must have the necessary valid permits or licenses. Separate permits shall be required for survey and mitigation excavation.
Effectiveness. This measure would insure the proper consideration for sensitive values in the fields of profession identified. This would be nearly 100-percent effective for surface resources; somewhat less for subsurface resources.

10. All construction areas will be maintained in a neat and orderly condition at all times.
Effectiveness. Visual quality and safety would be enhanced.

11. Transmission lines will be maintained and repaired using the same or more environmentally acceptable techniques as used in the original construction.
Effectiveness. Using such techniques would be 100-percent effective in preventing resource damage of greater severity than that caused during original construction.

12. Final road and tower construction engineering specifications (including a centerline survey, tower-site surveys, substations and communications systems designs and locations, locations of borrow sites, stockpiling, and storage areas, specific drainage devices proposed, work schedule, needed equipment, rehabilitation measures, waste disposal methods, and sites specifically requested for deviations from those specifications) will be supplied in writing to BLM for study and approval at least 1 year prior to proposed construction.
Effectiveness. Such submission would be 100-percent effective in providing sufficient time for necessary planning.

13. The company will notify BLM, U.S. Fish and Wildlife Service, and the State Wildlife Agency of the construction schedules at least 90 days in advance of any construction within that State. The company will also notify these agencies of any changes in schedule at least 30 days in advance of construction.
Effectiveness. Notification as specified would be 100-percent effective in providing adequate time for necessary action.

Air Quality

1. If trace element problems develop, based on fallout monitoring and concurrent bioassay work as performed by the grantee or identified by the responsible agency, the operations of the powerplants will be modified to eliminate these affects.

Effectiveness. Modification of the powerplants based on monitoring would be 100-percent effective in preventing trace element problems beyond those occurring up to the time of modification.

Soils

1. Water bars will be constructed on permanent dirt or gravel access roads to adequately divert runoff to natural drainages. The location of water bars will be determined by the AO. Roadside drainage ditches will be constructed on access roads to reduce water flow and velocity. Drainage ditches will be dug at intervals determined by the AO. Roads will be "out-sloped" as much as possible. Berms will be removed.

Effectiveness. This measure would be helpful in preventing or controlling erosion. The degree of effectiveness cannot be determined at this time.

2. Terracing, contour furrowing, mulching, sediment basins, sediment fences, and check-dams will be used to control local erosion and prevent offsite sedimentation as determined necessary by the AO.

Effectiveness. Such structures could be very effective in preventing erosion and sedimentation. The degree of effectiveness would depend on site specific conditions.

3. Scalping of topsoil will not be allowed except as approved by the AO. When scalping is allowed, suitable topsoil and subsoil will be scraped and stockpiled for reclamation use.

Effectiveness. The stockpiling and respreading of topsoil would make it possible to establish a suitable seedbed on about 140 miles of right-of-way.

4. Wherever possible, major drainages should be spanned, and access roads will be properly built in flood prone and flash flood areas to avoid erosion and gullying. Caution will be exercised in the location of batch plants and pulling yards to avoid drainages during rainy periods.

Effectiveness. The degree of effectiveness cannot be determined at this time.

Vegetation

1. Along transmission lines, removal of trees will be limited to those closer than 20 feet to an electrical power conductor. Whenever possible, clearing of trees creating a hazard should be done after conductor installations to minimize tree removal.

Effectiveness. Reducing the amount of right-of-way clearing by an estimated 85 percent on Federal land would substantially decrease the overall rate of soil erosion. Reducing the amount of actual soil disturbance would mitigate against destruction of rare and endangered plants and animals (both proposed and designated). There would also be a reduction in the disturbance of archaeological resources.

2. The applicants will be required to establish a vegetation cover within 5 years from the completion of construction on all disturbed areas designated by the AO. Species seeded, rate, and method of application will be approved by the AO.

Effectiveness. The commitment to artificially reestablish a vegetation cover would have a marginal degree of success. In areas where successful, artificial revegetation could be expected to provide a suitable ground cover within 5 years of construction, thereby reducing the time these areas would be subject to increased rates of soil erosion. Where artificial revegetation would not be successful, revegetation could require from 10 to 100 years.

Wildlife

1. No new main access roads will be permitted within the Clark Mountain Sensitive Area.

Effectiveness. This measure would minimize further impacts to values present in this area.

2. A field inventory of raptor nesting sites will be performed by a qualified raptor specialist provided by the applicant and approved by BLM if construction activities would be occurring during the sensitive nesting and brood period. If an active nesting site is in use, necessary measures to be taken shall be agreed upon between the AO and the grantee.

Effectiveness. This measure would minimize impacts on raptors in areas of construction.

3. The applicants or their contractors will construct one additional big game watering facility for each existing one within 300 yards (274 m) of construction activities in bighorn sheep habitat. These facilities are to be similar to the existing ones and located on the opposite side of the right-of-way. The type and location of each new watering facility will be determined conjunction with the BLM and the State Wildlife Agency.

Effectiveness. Construction of these watering facilities would lessen impacts to the bighorn sheep. The degree of effectiveness cannot be determined at this time.

4. The grantee shall construct, maintain, operate, and/or modify structures and facilities as directed by the AO to protect and minimize adverse effects upon raptors and other wildlife.

Effectiveness. Proper design in construction, operation, and maintenance of structures and facilities would be nearly 100-percent effective in protection of raptors. Other wildlife would be less affected by structures and facilities, however, measures taken to protect other wildlife would be less effective.

5. The grantee shall report any and all wildlife kills, including raptor electrocutions, discovered or reported on or near project facilities to the AO.

Effectiveness. Reporting of wildlife kills would aid in determining problem areas. Once the problem would be determined, corrective action could be taken; however, effectiveness would be highly variable.

Water Resources

1. The applicant will be required to install culverts or bridges at points where new permanent access roads will cross live streams. Where streams are crossed by temporary roads or culverts, they will be removed upon completion of the project. Any construction activity in a perennial stream will be prohibited unless specifically allowed by the appropriate Federal official. All stream channels and washes will be returned to as near their natural state as possible.

Effectiveness. This measure would be 100-percent effective in preventing sedimentation in the stream except during installation of such culverts. Rehabilitation would meet with varying degrees of success, depending upon the site.

2. The applicant will be required to bury the slurryline in bedrock or at least 15 feet below the existing bed at Kanab Creek, Fort Pierce Wash, Virgin River, Beaver Dam Wash, Toquop Wash, Meadow Valley Wash, and the Muddy River. Shallower burial may be allowed where applicant can demonstrate in writing to BLM (through the use of adequate field studies and design) that the pipeline would not be exposed in the event of a 50-year flood.

Effectiveness. Burying the slurryline in bedrock or to a depth of 15 feet on river and wash crossings would eliminate the possibility of a pipeline rupture due to flooding. Burying the pipeline at river and wash crossings would reduce the risks of adverse impacts to endemic fishes caused by slurry discharge.

3. The applicant will be required to install and maintain automatic pressure sensitive valves on both sides of river crossings, specifically at Kanab Creek, Fort Pierce Wash, and the Virgin River. The applicant will also be required to install and maintain valves on major wash crossings, specifically Fort Pierce Wash, Toquop Wash, Beaver Dam Wash, and Sand Wash. With BLM approval, this system could be modified, provided that the protection remained the same or improved.

Effectiveness. In the event of a break, check valves and sectionalized valving would reduce spill volumes to less than 0.02 acre-feet at the Virgin River crossing. This represents a 98-percent reduction in the maximum amount of slurry that could be discharged at this point. Similar reductions could be expected at other crossings where check valves would be installed. The intensity of ground water impacts would also be reduced by at least 50 percent due to sectionalized valving. Sectionalized valving would substantially reduce risks of adverse impacts to endemic fishes caused by the slurry discharge.

4. Blasting will be prohibited within 500 feet of all live springs, reservoirs, or water wells.

Effectiveness. The possibility of damage or loss of the water source would be eliminated.

5. The grantee shall not use water from springs, wells, seeps, creeks, or streams which have been appropriated to Federal agencies or other users without the written authorization from the AO or water right owner.

Effectiveness. Conflicts arising over unauthorized use of water would be avoided.

6. Any water used with the approval of the AO or water right owner shall be only for the specific purpose and duration described in the written authorization of the AO or water right owner.

Effectiveness. Conflicts arising over unauthorized use of water would be avoided.

7. The applicant will not construct holding ponds, liquid or solid waste disposal areas within 100 feet of tributary washes and their immediate flood plains.

Effectiveness. This measure would be 100-percent effective in preventing a spill of wastes into the environment.

Cultural Resources

1. If cultural sites are determined to exist as determined by cultural inventories performed by the grantee, measures to be taken to mitigate possible impacts will be agreed upon between the AO, the appropriate State Historic Preservation Officer (SHPO), and the grantee.

Effectiveness. The BLM would apply consistent management practices along the entire route for all archaeological and historical resources, conveying information to the SHPO or other agencies as appropriate. Regulatory conformance would be assured.

2. The applicant will provide a qualified paleontologist who will be approved by the AO. The paleontologist will conduct an intensive survey of all areas to be disturbed which are identified by the AO as having high potential for paleontological resources. Construction activities may be halted by the AO until appropriate action is determined.

Effectiveness. This measure would be 100-percent effective in preventing damage to surface paleontological resources and in preventing damage to subsurface resources beyond that caused during discovery.

3. Prior to project approval, contemporary ethnic groups which may have special concerns for cultural resources in either proposed or alternative power transmission corridors will be consulted by the grantee in order to identify sites or areas of special religious significance. During construction through areas identified as having special religious significance to Native Americans, the applicant will provide for a Native American adviser (approved by the appropriate BLM District official) to help in avoiding the sensitive sites. The applicant will further insure that these groups will be kept informed of the progress of construction work and that any discoveries of archaeological, ethnographic, or historical value will be brought to the attention of such groups.

Effectiveness. This measure would be 100-percent effective in insuring that interests of such groups would be given consideration.

4. Prior to site specific mitigation of impacts to cultural resources, a memorandum of agreement shall be entered into between the applicant, the SHPO, and BLM.

Effectiveness. Such an agreement would insure that each agency would have input into determining the type of mitigation necessary.

5. For all sites located, the archaeological contractor shall provide the data necessary for determination of eligibility for inclusion to the National Register of Historic Places.

Effectiveness. This measure would insure that all sites would be given proper consideration for inclusion on the National Register of Historic Places.

6. Should any one or parts of an alternative conflict with areas under consideration for programs of the Land and Water Conservation Fund, the applicant will negotiate with the Heritage Conservation and Recreation Service of the U.S. Department of the Interior for the development of mitigating measures and/or a resolution of the conflict.

Effectiveness. The integrity of Land and Water Conservation Fund programs would be assured.

Land Use

1. Upon revocation or termination of this grant, or termination of use of any part of the energy system located on public lands, the grantee shall remove all improvements and equipment, except as otherwise approved in writing by the AO, and shall restore the land to a satisfactory condition as determined by the AO.

Effectiveness. Abandoned improvements and equipment would be prevented from becoming an eyesore and/or safety hazard.

2. The grantee shall avoid areas subject to mudflows, landslides, mudslides, avalanches, rock falls, and other types of mass movements where practicable in locating the powerline and slurryline. Where such avoidance is not practicable, the powerline and slurryline design, based upon detailed field investigations and analysis, shall provide measures to prevent the occurrence of, or protect the powerline and slurryline against the effects of mass movements.

Effectiveness. Avoidance of or designing for such conditions would be effective in lessening associated dangers. Avoidance would be 100-percent effective. Where avoidance would not be practical, effectiveness of design would be variable, subject to severity of any such mass movements.

3. No dumping of oil waste, toxic materials, solid or liquid wastes will be allowed except in authorized waste disposal sites. No burning of debris or waste materials will be allowed except as specifically authorized by the AO.

Effectiveness. This would eliminate contamination of ground water and surface water and would prevent air pollution.

4. Specific sites (e.g., archaeological sites, areas with threatened and endangered species, fragile watershed, etc.), where construction equipment and vehicles will not be allowed will be clearly marked on the site by the AO before any equipment is brought in. The grantee will be responsible to assure that construction personnel are well versed in recognizing these markers and that they understand the restrictions of equipment movement that are involved.

Effectiveness. This measure would be 100-percent effective in protecting identified sites.

5. Travel will be restricted to right-of-way and existing public roads. Cross-country motor vehicle travel will be prohibited.

Effectiveness. This measure would reduce impacts on soil and vegetation outside access roads and immediate construction areas.

6. The grantee or permittee shall confine all activities within the area specifically defined in the right-of-way or permit.

Effectiveness. This measure would reduce impacts on soil and vegetation outside access roads and immediate construction areas.

7. Access roads needed to transport personnel and material will be of temporary nature only, and must be approved in writing by the AO prior to construction.

Effectiveness. This measure would prevent unnecessary soil and vegetation disturbance and would help hold allowed disturbance to a minimum.

8. The grantee or permittee shall make application in accordance with applicable regulations for all proposed access roads not granted in the primary right-of-way or permit and located on public lands outside the permit or grant area.

Effectiveness. This measure would prevent unnecessary soil and vegetation disturbance and would help hold allowed disturbance to a minimum.

9. Grantee will compensate livestock operators for privately owned permanent improvements lost due to project construction.

Effectiveness. The monetary investment of private parties would be protected.

10. The applicant will develop a plan acceptable to the Federal Aviation Administration for marking transmission lines in agricultural areas and aircraft traffic areas, such as airports, or will reroute facilities to such locations as acceptable to the Federal Aviation Administration.

Effectiveness. This measure would insure the safety of those engaged in air traffic.

11. In areas designated by the AO where access across the terrain or management constraints preclude standard construction methods, helicopters will be used to erect towers and string conductors.

Effectiveness. Use of helicopters would keep surface disturbance to an absolute minimum in areas identified for such construction methods.

12. The only roads allowed in areas designated for construction using helicopter techniques (i.e., all major construction tasks accomplished by helicopter except final pulling and tensioning of the conductors) will be access roads to the pulling sites. The only other surface disturbances will be where tower foundations are to be installed.

Effectiveness. Use of helicopters would keep surface disturbance to an absolute minimum in areas identified for such construction methods.

13. On agricultural land, towers will be set adjacent to or on field boundaries to reduce the impact to farm operations and agricultural production.

Where this is not possible, the towers will be set on or perpendicular to the row crops, where feasible, so that the transmission lines do not run diagonally to the crop rows.

Effectiveness. This measure would reduce impacts to farm operations by varying degrees, depending on the site specific situation.

14. Construction camps will be established only where the available community facilities cannot accommodate the construction work force. State sanitation laws will be adhered to if any such camps are established.

Effectiveness. This measure would prevent unnecessary surface disturbance and possible contamination which could result from such development.

15. Rights-of-way will parallel existing corridors wherever possible, reducing impacts to land use since use in these areas has been established.

Effectiveness. This measure would avoid the impact on aesthetic quality from the addition of another corridor through the areas involved.

16. After construction activities are completed, the grantee or permittee shall not prohibit the public in general from using the grant or permit area for all lawful purposes which are not inconsistent with the use for which the grant or permit was issued.

Effectiveness. The rights of the general public to use publicly owned land would be protected.

17. The grantee or permittee will be allowed to regulate access and vehicle traffic as required to insure security and public safety during construction operations.

Effectiveness. Allowing the grantee to regulate access and vehicle traffic would be 100-percent effective in insuring public safety and security during construction operations.

18. The grantee or permittee shall be responsible for providing and installing regulatory signs that are necessary for users of access roads. The location and type of sign shall be approved by the AO.

Effectiveness. The safety requirements on public roads would be met.

19. The grantee or permittee shall permit free and unrestricted access over public lands for all lawful and proper purposes, except in areas designated as restricted by the grantee or permittee with the consent of the AO, in order to protect public safety, health, and facilities constructed on the right-of-way.

Effectiveness. The rights of the general public to use publicly owned lands, consistent with safety requirements, would be protected.

20. The grantee or permittee acknowledges and agrees that the issuance of this permit or grant is subject to the express condition that the exercise thereof will not unduly interfere with the management, administration or disposal by the United States of lands affected thereby or the full and safe utilization thereof by the United States, for necessary operations incident to such management, administration, or disposal for purposes which are not inconsistent with or will not defeat the objective of the grant.

Effectiveness. Commitment to this stipulation would protect the prerogative of the United States to manage public lands of the United States.

21. The grantee or permittee agrees and consents to the occupancy and use by the United States, its grantees, permittees, or lessees of any part of the permit or grant area not actually occupied or required by the project for purposes which are not in conflict with the grantees' or permittees' activities and use.

Effectiveness. Commitment to this stipulation would protect the prerogative of the United States to manage public lands of the United States.

22. The grantee or permittee agrees that all operations under this grant or permit shall comply with State and Federal laws concerning the use of poisonous or hazardous substances, including insecticides, herbicides, fungicides, rodenticides, and other similar substances. Prior to the use of such substances on or near the permit or grant area, the grantee or permittee shall obtain from the AO approval of a written plan for such use. The plan shall state the method of application and other information as the AO may require. All use of such substances on or near the grant or permit area shall be in accordance with the approved plan. If the use of a poison is prohibited by the Secretary of the Interior, it shall not be used. If use of a poison is limited by the Secretary of the Interior, it shall only be used in accordance with that limitation.

Effectiveness. Commitment to this stipulation would insure 100-percent compliance with Federal and State laws in the use of poisonous or hazardous substances.

23. The grantee or permittee will avoid disturbance or removal of cadastral survey monuments and markers. Where construction operations require such removal and relocation, this will be accomplished by BLM or in accordance with detailed instructions prescribed by the AO. All costs for such operations will be borne by the grantee or permittee.

Effectiveness. This measure would be fully effective in protecting located survey monuments and markers. There would remain a chance that unidentified monuments could be destroyed.

Recreation And Aesthetics

1. Cut and/or spoil slopes will be shaped to existing land contours. All natural drainages will be preserved.

Effectiveness. Shaping of cut and/or spoil slopes would be 100-percent effective in blending these areas with the land form. However, visual impacts would remain due to vegetational differences.

2. All clearing of construction areas will be free form and will respond to the existing forms and shapes in the area (i.e., use of curvilinear shapes rather than rectilinear). Temporary sites will be kept as small as possible and will be located in areas of minimum vegetation and slope.

Effectiveness. This type of clearing would be effective in reducing visual impacts. However, degree would be site specific and cannot be determined at this time.

3. All exposed facilities will be painted with colors selected for compatibility with the surrounding environment except where human safety consideration would dictate otherwise.

Effectiveness. Visual impact of facilities would be lessened, though degree of effectiveness cannot be determined at this time.

4. Diversion dikes and liquid disposal pond berms will be constructed in such a manner as to slope gently into the adjacent undisturbed landscape. Slopes will not exceed 3:1. Berms will be revegetated, where possible with native vegetation. Riprapping with native rock will be utilized in those areas where berms and dikes may be eroded.

Effectiveness. A visual impact would remain, however, aesthetics would be improved to near existing conditions.

5. Blasting will not be done on Visual Resource Management (VRM) Class I and II lands if such activity is determined by the AO to have an adverse impact on VRM ratings.

Effectiveness. Impacts to VRM ratings would be 100-percent mitigated.

6. All conductors will be of nonspecular material unless otherwise approved by BLM/National Regulatory Commission. All lattice towers will be of steel with a dulled gray surface, or other "aesthetic towers" may be required in specific locations after the final tower locations are known. These measures are subject to overriding Federal Aviation Administration regulations.

Effectiveness. This measure would decrease visibility of wires and towers and would make them blend with the background.

7. Self-supporting lattice towers will be used instead of guyed delta towers in all areas of heavy off-road vehicle (ORV) use to eliminate collision with guy wires.

Effectiveness. The possibility of ORV collision with guy wires would be completely eliminated.

8. Reflective tape strips will be placed 2 feet (0.6 meters) above the ground on the outer sides of all tower legs, midway between tower legs on all four sides in areas of heavy recreational use.

Effectiveness. The towers would be more visible to nighttime users of the area, thus reducing the probability of a collision with towers. The possibility of collision would not be eliminated.

9. No paint or permanent discoloring agents will be applied to rocks or vegetation for indicating survey or construction activity limits, points, etc.

Effectiveness. This measure would be 100-percent effective in reducing impacts which would occur from such activity.

10. The AO will be consulted prior to construction on respective lands to select colors which help blend structures with the natural landscape.

Effectiveness. Through assurance that proper colors would be used, the visual impacts of structures upon the landscape would be lessened.

11. The applicant will use long spans to cross roads and highways with transmission lines and will cross at right angles where visual or environmental damage is not increased. Towers will be placed as far back from the highways as possible, at least 500 feet (150 meters) where technically feasible, and vegetation between towers and the highways will not be cleared

except for the access road. Requests for variances will be assessed on a case-by-case basis by the AO.

Effectiveness. Effectiveness would vary with the situation. Placing towers away from highways could help blend them with the landscape, or it could serve to make them a dominant feature of the landscape. Leaving vegetation would lessen impacts in either case.

12. The grantee will construct and maintain new communication sites only by helicopter on VRM Class I and II lands where no roads presently exist if road construction would affect VRM ratings. No new access roads will be allowed unless approved by the AO.

Effectiveness. Compatibility of new access roads with VRM guidelines would be 100-percent assured.

13. Baffling of air intakes on the boiler air feed fans will be required to reduce noise.

Effectiveness. Baffling of air intakes would reduce noise levels.

APPENDIX 7

Vegetation Species of Concern in the States of Arizona, California, Nevada, and Utah

	Common Name
ARIZONA	
Cactaceae	
Pediocactus sileri (E)	Siler pincushion cactus
CALIFORNIA	
Amaryllidaceae	
Androstephium breviflorum	Short-flowered androstephium
Apiacea	
Cymopterus deserticola (T)	Desert cymopterus
Cymupterus gilmannii	Gilman's cymopterus
Asteraceae	
Enceliopsis nudicaulis	Naked-stemmed daisey
Eriophyllum mohavense	Barstow eriophyllum
Hemizonia mohavensis (T)	Mojave tarweed
Perityle megalocephala	No common name
Tetradymia argyraea	No common name
Cactaceae	
Echinocactus polycephalus	Cottontop cactus
Opuntia basilaris var. *brachyclada* (T)	No common name
Caryophyllaceae	
Scopulophila rixfordii	Rixford rockwort
Ephedraceae	
Ephedra funerea (T)	Death Valley joint fir
Fabaceae	
Astragalus cimae var. *cimae*	Cima rattleweed
Dalea arborescens (T)	Mojave dalea
Liliaceae	
Calochortus striatus (T)	Alkali mariposa lily
Loasaceae	
Mentzelia leucophylla (E)	No common name
Loganiaceae	
Buddleja utahensis	Utah buddleia
Malvaceae	
Sphaeralcea rusbyi var. *eremicola* (T)	Rusby desert mallow

Papavaraceae	
Arctomecon merriamii (T)	Merriam bear poppy
Poaceae	
Bouteloua trifida	Mojave grama
Enneapogon desvauxii	Nine-awned pappus grass
Erioneuron pilosum	Hairy Allen tridens
Puccinellia parishii (T)	Parish alkali grass
Stipa arida	Needlegrass
Polemoniaceae	
Linanthus arenicola (T)	No common name
Polygonaceae	
Chorizanthe spinosa	Mojave spine-flower
Eriogonum heermannii var. floccosum	Clark Mountain eriogonum
Scrophulariaceae	
Penstemon stephensii (T)	Stephen's penstemon
Simaroubaceae	
Castela emoryi	Crucifixion thorn

NEVADA

Agavaceae	
Agave utahensis var. eborispina (T)	No common name
Agave utahensis var. nevadensis (T)	Pygmy agave
Asteraceae	
Enceliopsis nudicaulis var. corrugata (T)	Naked-stemmed daisey
Haplopappus brickcelliodes (T)	Brickellia-like goldenweed
Chenopodiaceae	
Atriplex hymenelytra	Desert Lolly
Boraginaceae	
Cryptantha tumulosa (T)	Pinyon forget-me-not
Cactaceae	
Coryphantha rosea (T)	No common name
Ephedraceae	
Ephedra funerea (T)	Death Valley joint fir
Fabaceae	
Astragalus geyeri var. triquetrus (T)	variety of Geyer's locoweed
Astragalus lentiginosus var. latus (T)	variety of Freckled milkvetch
Hydrophyllaceae	
Phacelia anelsonii	Aven Nelson scorpion weed
Nyctaginaceae	
Abronia orbiculata (T)	No common name

Papavarafeae	
Arctomecon merriamii (T)	Merriam bear poppy
Polemoniafeae	
Gilia ripleyi (T)	Ripley gilia

UTAH

Apiaceae	
Cymopterus minimus (E)	Least cymopterus
Asclepicdaceae	
Asclepias welshii	Welsh milkweed
Asteraceae	
Aloysia wrightii	Spicebush
Erigeron religiosus (E)	Religious fleabane
Hulsea heterochroma	Great hulsea
Parthenium tincanum	Mariola
Townsendia aprica (E)	Last chance townsendia
Brassicaceae	
Lesquerella rubicundula (T)	Bryce bladderpod
Cactacae	
Echinocactus polycephalus	Cottontop cactus
Echinocereus englemannii var. *purpureus* (E)	Purple-spined hedgehog cactus
Pediocactus sileri (E)	Siler pincushion cactus
Fabaceae	
Astragalus ampullarius (T)	Sumpo milkvetch
Astragalus striatiflorus (T)	Escarpment milkvetch
Astragalus subcinereus var. *basalticus*	Basaltic silver milkvetch
Hydrophyllaceae	
Phacelia anelsonii (T)	Aven Nelson scorpionweed
Phacelia cephalotes (T)	Virgin scorpion plant
Loasaceae	
Petalonyx parryi	Parry sandpaper bush
Onagraceae	
Epilobium nevadense (T)	Nevada willowherb
Papavaraceae	
Arctomecon humilis (E)	Dwarf bearclaw poppy

NOTE: (T) = Species designated as "candidate for threatened status" by the U.S. Fish and Wildlife Service (1975)
(E) = Species designated as "candidate for endangered status" by the U.S. Fish and Wildlife Service (1975)
E = Species designated as "officially listed as endangered" by the U.S. Fish and Wildlife Service

APPENDIX 8

Wildlife Species of Concern in the States of Arizona, California, Nevada, and Utah

ARIZONA	Scientific Name
Birds	
Bald Eagle - Federally listed	*Haliaeetus leucocephalus*
Peregrine Falcon - Federally listed	*Falco peregrinus anatum*
Black Hawk - State and BLM sensitive	*Buteogallus anthracinus*
Snowy Egret - State and BLM sensitive	*Egretta thula*
Black Crowned Night Heron - State and BLM sensitive	*Nycticorax nycticorax*
Mammals	
Bighorn Sheep - State and BLM sensitive	*Ovis canadensis*
Spotted Bat - State and BLM sensitive	*Euderma maculatum*
Fishes	
Virgin River Spinedace - State and BLM sensitive	*Lepidomeda mollispinis mollispinis*
Reptiles	
Desert Tortoise - State and BLM sensitive	*Gopherus agassizi*
Gila Monster - State and BLM sensitive	*Heloderma suspectum*

CALIFORNIA	
Birds	
Bald Eagle - Federally listed	*Haliaeetus leucocephalus*
Peregrine Falcon - Federally listed	*Falco peregrinus anatum*
Brown Pelican - Federally listed	*Pelecanus occidentalis*
Aleutian Canada Goose - Federally listed	*Branta canadensis leucopareia*
Yuma Clapper Rail - Federally listed	*Rallus longirostris yumanesis*
California Blackrail - State sensitive	*Laterallus jamaicensis*
California Yellow-Billed Cuckoo - State sensitive	*Coccyzus americanus*
Mammals	
Mojave Ground Squirrel - State sensitive	*Spermophilus mohavensis*
California Bighorn Sheep - State sensitive	*Ovis canadensis*
Fishes	
Mojave Chub - Federally listed	*Gila mohavensis*

Reptiles	Scientific Name
Desert Slender Salamander - Federally listed	*Batrachoseps aridus*
Tehachapi Slender Salamander - State sensitive	*Batrachoseps stebbinsi*
Black Toad - State sensitive	*Bufo exsul*
Desert Tortoise - BLM sensitive	*Gopherus agassizi*

NEVADA

Birds

Bald Eagle - Federally listed	*Haliaeetus leucocephalus*
Peregrine Falcon - Federally listed	*Falco peregrinus anatum*
Golden Eagle - State sensitive	*Aquila chrysaetos*
All Hawks and Owls - State protected	

Mammals

Spotted Bat - State and BLM sensitive	*Euderma maculatum*
Desert Bighorn Sheep - BLM sensitive	*Ovis canadensis*

Fishes

Moapa Dace - Federally listed	*Moapa coriacea*
Woundfin Minnow - Federally listed	*Plagopterus argentissimus*
Virgin River Spinedace - State and BLM sensitive	*Lepidomeda mollispinis mollispinis*

Reptiles

Gila Monster - State and BLM sensitive	*Heloderma suspectum*
Desert Tortoise - State and BLM sensitive	*Gopherus agassizi*

UTAH

Birds

Bald Eagle - Federally listed	*Haliaeetus leucocephalus*
Peregrine Falcon - Federally listed	*Falco peregrinus anatum*
Bell's Vireo - BLM sensitive	*Vireo bellii arizonae*

Mammals

Blackfooted Ferret - Federally listed	*Mustela nigripes*
Utah Prairie Dog - Federally listed	*Cynomys parvidens*

Fishes

Colorado Squawfish - Federally listed	*Ptychocheilus lucius*
Woundfin Minnow - Federally listed	*Plagopterus argentissimus*
Humpback Chub - Federally listed	*Gila cypha*

Virgin River Spinedace - BLM sensitive	Lepidomeda mollispinis mollispinis
Virgin River Roundtail Chub - BLM sensitive	Gila robusta seminuda
Reptiles	Sceintific Name
Gila Monster - State and BLM sensitive	Heloderma suspectum
Desert Tortoise - State and BLM sensitive	Gopherus agassizi
Desert Iguana - BLM sensitive	Dipsosaurus dorsalis
Snails	
St. George Snail - BLM sensitive	Fontelicella deserta

APPENDIX 9

Visual Resource Management System

To evaluate the scenic resource, BLM has developed the Visual Resource Management (VRM) system (BLM Manual 8400). Classification involves evaluation of scenic quality, visual sensitivity, and distance zones. These three factors determine the visual resource management class for an area. There are five visual management classes an area may fall into, and for each class there is a different management objective defined in terms of visual tolerance to surface disturbance. Management objectives for each class are described as follows:

Class I

This class provides primarily for natural ecological changes only. It is applied to wilderness areas, some natural areas, and other similar situations where management activities are to be restricted.

Class II

Changes in any of the basic landscape elements (form, line, color, or texture) should not be evident in the characteristic landscape.

Class III

Changes in the basic elements (form, line, color, or texture) caused by a management activity may be evident in the characteristic landscape. However, the changes should remain subordinate to the visual strength of the existing character.

Class IV

Contrasts may attract attention and be a dominant feature of the landscape in terms of scale, but the change should repeat the basic elements inherent in the characteristic landscape.

Class V

Change is needed. This class applies to areas where the naturalistic character has been disturbed to a point where rehabilitation is needed to bring it back into character with the surrounding landscape.

APPENDIX 10

Baseline Socioeconomic Statistics and Projections

The tables in this appendix present 1980 baseline socioeconomic and demographic statistics for Kane and Washington Counties of Utah and Clark County of Nevada. Projections of anticipated socioeconomic trends are also presented for 1980 through 2020.

TABLE 1

Baseline Population Projections, 1980-2020

County/City	1978	1980	1985	1990	1995	2000	2020	Average Annual Rate of Change 1978 - 2020 (%)
Kane County	4,086	4,200	4,500	5,100	5,550	6,000	7,800	1.6
Alton	40	55	49	46	42	37	19	-1.8
Glendale	280	173	157	152	142	131	89	-2.7
Kanab	2,330	3,041	3,335	3,842	4,243	4,643	4,245	2.4
Orderville	520	368	329	324	302	280	192	-2.3
Washington County	20,600	21,384	24,881	27,792	30,768	33,896	46,408	2.0
Hurricane	1,960	2,023	2,180	2,338	2,495	2,652	3,281	1.2
Ivins	413	442	518	582	646	714	986	2.1
LaVerkin	880	954	1,118	1,254	1,394	1,541	2,128	2.1
Leeds	280	290	316	342	369	395	500	1.4
St. George	9,930	10,946	12,828	14,394	15,997	17,681	24,416	2.2
Santa Clara	440	726	851	956	1,062	1,174	1,622	3.2
Toquerville	300	386	453	508	565	625	864	2.6
Washington	1,510	2,243	2,628	2,950	3,278	3,623	5,003	2.9
Clark County	432,834	474,485	578,614	682,743	786,872	891,000	1,307,514	2.7

Source: Centaur Associates, Inc., 1980

TABLE 2

Baseline Employment Projections, 1980-2020

Sector	1980		1985		1990		1985		2000		2020	
	Jobs	%Total	Jobs	%Total	Jobs	%Total	Jobs	%Total	Jobs	%Total	Jobs	%Total
Kane County												
Agriculture	180	13.8	170	11.7	170	10.2	163	8.9	158	7.9	138	5.1
Mining	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Construction	80	6.2	90	6.2	100	6.0	110	6.0	120	6.0	160	5.9
Manufacturing	90	6.9	110	7.6	140	8.4	163	8.9	188	9.4	288	10.5
TCU[a]	50	3.8	50	3.4	60	3.6	63	3.4	68	3.4	88	3.2
Trade	300	23.1	330	22.8	380	22.9	417	22.8	457	22.7	617	22.6
FIRE[b]	30	2.3	40	2.8	40	2.4	47	2.6	52	2.6	72	2.6
Services	300	23.1	350	24.1	400	24.1	450	24.6	500	24.9	700	25.6
Government	270	20.8	310	21.4	370	22.3	417	22.8	467	23.2	667	24.4
TOTAL[c]	1,300	100.0	1,450	100.0	1,660	100.0	1,830	100.0	2,010	100.0	2,730	100.0
Washington County												
Agriculture	486	6.7	475	5.8	461	5.1	449	4.5	437	4.1	387	2.7
Mining	14	0.2	13	0.2	13	0.1	12	0.1	12	0.1	10	0.1
Construction	477	6.5	524	6.4	568	6.3	614	6.2	660	6.1	842	5.9
Manufacturing	625	8.6	794	9.7	920	10.2	1,075	10.9	1,222	11.4	1,812	12.8
TCU[a]	268	3.7	296	3.6	322	3.6	349	3.5	376	3.5	484	3.4
Trade	2,303	31.6	2,513	30.8	2,705	30.0	2,909	29.4	3,110	29.0	3,914	27.6
FIRE[b]	332	4.6	388	4.8	443	4.9	499	5.1	554	5.2	776	5.5
Services	1,178	16.2	1,383	16.9	1,580	17.5	1,782	18.0	1,983	18.5	2,787	19.6
Government	1,601	22.0	1,774	21.7	1,999	22.2	2,189	22.2	2,388	22.2	3,184	22.4
TOTAL[c]	7,284	100.0	8,160	100.0	9,011	100.0	9,878	100.0	10,742	100.0	14,196	100.0
Clark County												
Agriculture	695	0.3	729	0.3	748	0.2	777	0.2	804	0.2	910	0.1
Mining	201	0.1	235	0.1	264	0.1	296	0.1	328	0.1	454	0.1
Construction	8,976	4.4	11,250	4.3	13,690	4.2	16,019	4.2	18,376	4.2	27,804	4.1
Manufacturing	7,585	3.7	10,270	3.9	12,930	4.0	15,607	4.1	18,279	4.1	28,969	4.2
TCU[a]	12,110	6.0	15,310	5.9	18,560	5.8	21,777	5.7	25,002	5.7	37,902	5.5
Trade	38,630	19.1	51,070	19.6	63,670	19.7	76,163	19.9	88,683	20.0	138,763	20.3
FIRE[b]	7,559	3.7	10,150	3.9	13,110	4.1	15,824	4.1	18,600	4.2	29,701	4.3
Services	92,740	45.8	120,100	46.0	148,600	46.0	176,340	46.1	204,270	46.2	315,990	46.3
Government	33,950	16.8	41,690	16.0	51,200	15.9	59,530	15.6	68,155	15.4	102,655	15.0
TOTAL[c]	202,446	100.0	260,804	100.0	322,772	100.0	382,333	100.0	442,497	100.0	683,148	100.0

Source: Centaur Associates, Inc., 1980

[a]TCU = transportation, communications, utilities
[b]FIRE = finance, insurance, and real estate
[c]Percentages may not add to 100.0 percent due to rounding.

TABLE 3

Baseline Earnings Projections 1980-2020 (In 1977 Dollars)

	1980		1985		1990		1985		2000		2020	
Sector	$	%Total	$	%Total	$	%Total	$	%Total	$	%Total	$	%Total
Kane County												
Agriculture	1,146,060	10.0	1,195,100	8.5	1,319,540	7.4	1,396,747	6.4	1,494,838	5.7	1,305,618	3.6
Mining	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Construction	1,826,400	15.9	2,180,430	15.4	2,674,900	15.0	3,249,070	15.0	3,912,840	14.8	5,217,120	14.5
Manufacturing	560,880	4.9	756,800	5.4	1,063,580	6.0	1,367,244	6.3	1,741,068	6.6	2,667,168	7.4
TCU[a]	562,550	4.9	621,100	4.4	822,900	4.6	953,946	4.4	1,136,892	4.3	1,471,272	4.1
Trade	2,016,000	17.6	2,448,270	17.3	3,112,580	17.5	3,771,348	17.4	4,563,145	17.3	6,160,745	17.2
FIRE[b]	259,860	2.3	382,520	2.7	422,360	2.4	547,926	2.5	669,292	2.5	926,712	2.6
Services	2,961,300	25.8	3,813,950	27.0	4,812,800	27.0	5,978,250	27.5	7,333,500	27.8	10,266,900	28.6
Government	2,142,450	18.7	2,715,600	19.2	3,578,640	20.1	4,461,483	20.5	5,506,397	20.9	7,864,597	21.9
Total[c]	11,475,500	100.0	14,113,770	100.0	17,807,300	100.0	21,726,014	100.0	26,357,972	100.0	35,880,132	100.0
Washington County												
Agriculture	12,005,172	15.2	12,954,675	13.4	13,881,632	11.9	14,927,454	10.6	16,040,522	9.6	14,205,222	6.5
Mining	209,062	0.3	214,331	0.2	236,639	0.2	241,164	0.2	266,268	0.2	221,890	0.1
Construction	6,536,808	8.3	7,928,120	8.2	9,487,304	8.1	11,327,686	8.1	13,439,580	8.0	17,145,645	7.9
Manufacturing	7,107,500	9.0	9,968,670	10.3	12,753,040	10.9	16,452,875	11.7	20,649,356	12.3	30,619,176	14.1
TCU[a]	5,133,808	6.5	6,260,400	6.5	7,519,344	6.4	8,997,918	6.4	10,702,840	6.4	13,777,060	6.3
Trade	18,143,034	23.0	21,855,561	22.7	25,976,115	22.3	30,841,218	22.0	36,405,660	21.7	45,817,284	21.0
FIRE[b]	3,476,704	4.4	4,408,456	4.6	5,654,895	4.8	7,032,906	5.0	8,620,794	5.1	12,075,366	5.5
Services	11,936,674	15.2	15,471,621	16.0	19,516,160	16.7	24,301,134	17.3	29,858,031	17.8	41,983,859	19.3
Government	14,216,880	18.0	17,392,296	18.0	21,639,175	18.5	26,160,739	18.6	31,509,660	18.8	42,012,880	19.3
Total[c]	78,765,642	100.0	96,454,130	100.0	116,664,304	100.0	140,283,094	100.0	167,492,711	100.0	217,838,383	100.0
Clark County												
Agriculture	16,372,115	0.6	18,960,561	0.5	21,479,568	0.4	24,145,275	0.3	28,144,020	0.3	31,854,550	0.2
Mining	3,220,824	0.1	4,157,620	0.1	5,156,712	0.1	6,383,536	0.1	7,810,008	0.1	10,810,194	0.1
Construction	182,132,016	6.6	252,033,750	6.5	338,622,150	6.4	437,462,871	6.3	554,606,056	6.3	839,152,524	6.1
Manufacturing	125,433,145	4.6	187,509,660	4.8	260,642,940	4.9	347,349,392	5.0	449,169,867	5.1	711,855,237	5.2
TCU[a]	234,219,510	8.5	326,929,740	8.4	441,264,000	8.3	571,646,250	8.2	724,607,964	8.2	1,098,475,764	8.0
Trade	412,877,440	15.1	602,626,000	15.5	829,492,760	15.6	1,095,528,592	15.8	1,408,374,723	15.9	2,203,695,203	16.1
FIRE[b]	107,307,564	3.9	159,091,100	4.1	226,842,330	4.3	302,349,168	4.4	392,367,000	4.4	626,542,595	4.6
Services	1,246,703,820	45.5	1,782,524,200	45.8	2,435,108,200	45.8	3,190,343,280	45.9	4,080,293,250	46.0	6,298,026,325	46.1
Government	411,440,050	15.0	557,812,200	14.3	756,377,600	14.2	970,993,830	14.0	1,227,335,240	13.8	1,848,611,240	13.5
Total[c]	2,739,706,484	100.0	3,891,644,831	100.0	5,314,986,260	100.0	6,946,202,194	100.0	8,872,708,128	100.0	13,669,023,632	100.0

Source: Centaur Associates, Inc., 1980

[a] TCU = transportation, communications, utilities
[b] FIRE = finance, insurance, real estate
[c] Percentages may not add to 100.0 due to rounding.

TABLE 4

Baseline Projections for Police Service Requirements, Police Officers

Community	Full Time Equivalent Officers 1978	1980	1985	1990	1995	2000	2020
Kane County							
Alton	N/A	a	a	a	a	a	a
Glendale	N/A	a	a	a	a	a	a
Kanab	3	6.5	7	8	8.5	9.5	12.5
Orderville	N/A	b	b	b	b	b	a
Washington County							
Hurricane	[c]3	4.5	4.5	5	5	5.5	7
Ivins	1	b	1.5	1.5	1.5	1.5	2
LaVerkin	pt	2	2.5	3	3	3.5	4.5
Leeds	1	b	b	b	b	b	1
St. George	20	19	22	24.5	27.5	30.5	42
Santa Clara	N/A	1.5	2	2	2.5	2.5	3.5
Toquerville	N/A	b	b	1.5	1.5	1.5	2
Washington	[d]4.5	4.5	5.5	6	7	7.5	10.5
Clark County							
Las Vegas Valley	[e]367	720	895	1,070	1,245	1,420	2,120

Source: Centaur Associates, Inc., 1980

[a]One officer working half time or less.

[b]One officer working more than half time.

[c]During the first half of 1978, the town also employed two part-time officers. A fourth full-time officer is to be hired in January, 1980.

[d]This figure is based on the assumption that the city's three part-time officers were employed half time. In July, 1979, the city disbanded its police department and contracted with the Washington County Sheriff's Department to have two deputies stationed in the city.

[e]This figure includes Las Vegas 289 officers, North Las Vegas 41 officers, Henderson 37 officers.

NOTE: For the four towns of over 500 persons (those needing more than one full-time officer), projected needs are rounded. Fractions less than 0.5 are rounded up to 0.5 and fractions greater than 0.5 rounded are up to 1.0. For towns under 10,000 population, projections are based on a standard of two full-time equivalent officers per 1,000 persons. For cities over 10,000 the standard for projections is 1.7 officers per 1,000 population.

N/A = not applicable
pt = one part-time officer

TABLE 5

Baseline Projections for Fire Service Requirements, Pumping Capacity in Gallons per Minute Pumped

Community	Available Pumping Capacity (gmp) 1978	1980	1985	1990	1995	2000	2020
Kane County							
Alton[a]	NA	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000
Glendale[b]	N/A	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000
Kanab	2,500	1,750-2,000	1,750-2,000	1,750-2,000	2,000-2,250	2,000-2,250	2,500-3,000
Orderville[b]	150	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000
Washington County							
Hurricane[c]	2,500	1,500-1,750	1,500-1,750	1,500-1,750	1,500-1,750	1,500-1,750	1,750-2,000
Ivins	[d]500	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000
LaVerkin	N/A	500-1,000	1,000-1,250	1,000-1,250	1,000-1,250	1,250-1,500	1,500-1,750
Leeds	[e]250	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000
St. George[f]	4,950	3,000-3,500	3,000-3,500	3,500-4,000	3,500-4,000	4,000-4,500	4,500-5,000
Santa Clara[f]	N/A	500-1,000	500-1,000	500-1,000	1,000-1,250	1,000-1,250	1,250-1,500
Toquerville[g]	N/A	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000
Washington	[h]1,250	1,500-1,750	1,500-1,750	1,500-1,750	1,750-2,000	1,750-2,000	2,250-2,500
Clark County							
Las Vegas Valley[i]							

Source: Centaur Associates, Inc., 1980

[a]A surplus forestry tanker with an unknown pumping capacity was acquired by the town in 1978. As of October 1979 a station was being built to house the vehicle but potential volunteers had not yet received required training.

[b]The Long Valley Fire Department, located in Orderville, provides for protection of Orderville, Glendale, and Mt. Carmel.

[c]In 1978 the service area of the Hurricane department included LaVerkin, Toquerville, and Virgin. In October 1979, a department was established in LaVerkin which has relieved Hurricane's department of responsibility for those three towns.

[d]Delivery of an additional vehicle with 1,000 gmp capacity is expected in October 1979.

[e]Two additional vehicles to be delivered in October 1979 will raise total pumping capacity to 1,000 gmp.

[f]The St. George department also provides fire protection to Santa Clara.

[g]LaVerkin, previously covered by Hurricane's department, established a volunteer department in October 1979. At that time, the department had borrowed a 750 gmp pump while awaiting delivery of the 1,250 gmp vehicle, expected in November, 1979. The department will provide fire protection for Toquerville and Virgin.

[h]An additional 1,000 gmp capacity vehicle was received in July 1979, raising total pumping capacity to 2,250 gmp.

[i]Fire protection in Las Vegas Valley is provided by four departments which together had 685 paid firefighters and pumping capacity of 51,800 gmp in 1978. The service area of these departments is all of Clark County except Boulder City. Under the baseline, future population can be expected to increase steadily from 423,020 in 1978, to 1,285,700 in 2020. In the baseline scenario, additional fire flow needs can be expected to be felt throughout the Las Vegas Valley. However, the highest population increases are expected in Henderson and the areas for which the Clark County Department is responsible. Henderson will need up to twice its present pumping capacity, a total of 11,000 gmp by 2020. The needs of the Clark County Department cannot be evaluated due to the mixture of the urban and rural areas under its protection. North Las Vegas will have to increase its 1978 pumping capacity by some 40 percent by 2020.

NOTE: gmp = gallons per minute pumped
N/A = not applicable (i.e., no fire department)
NA = not available

TABLE 6

Baseline Projections for Water Supply Requirements in Million Gallons per Day

Community	Supply 1978	1980	1985	1990	1995	2000	2020
Kane County							
Alton	[a]0.010	0.025	0.022	0.021	0.019	0.017	0.009
Glendale	0.250	0.078	0.071	0.068	0.064	0.059	0.040
Kanab[b]	1.750	1.368 (1.703)	1.501 (1.836)	1.729 (2.064)	1.909 (2.244)	2.089 (2.424)	2.810 (3.145)
Orderville	0.426	0.166	0.148	0.146	0.136	0.126	0.086
Washington County							
Hurricane	[c]0.504	0.910	0.981	1.052	1.123	1.193	1.476
Ivins	[d]0.036	0.199	0.233	0.262	0.291	0.321	0.444
LaVerkin	[e]NA	0.429	0.503	0.564	0.627	0.693	0.958
Leeds	0.233	0.131	0.142	0.154	0.166	0.178	0.225
St. George	[f]11.633	4.926	5.773	6.477	7.199	7.956	10.987
Santa Clara	[g]0.108	0.327	0.396	0.430	0.478	0.528	0.730
Toquerville	[h]0.162	0.174	0.204	0.229	0.254	0.281	0.389
Washington	[i]0.360	1.009	1.183	1.328	1.475	1.630	2.251
Clark County							
Las Vegas Valley[j]							

Source: Centaur Associates, Inc., 1980

[a] Improvement of the 1978 system and the addition of a well to be operational by spring 1980 is expected to increase the town's supply to 0.161 mgd.

[b] Approximately 200 homes (744 persons) outside the city limits purchased water from the city in 1978. No population projections are available for this population. Figures in parentheses represent peak demand for the projected city population and the assumed constant population of 744 persons outside the city.

[c] In May 1979, a new well supplying 1.44 mgd was added to the city's system.

[d] In 1978, Ivins produced approximately 19 percent of its water supply and purchased the remainder from the city of St. George. Completion of the Snow Canyon Water Project in December 1979 made Ivins, whose share of the new supply is approximately 0.85 cubic feet per second (0.549 mgd), independent of St. George.

[e] LaVerkin has 1.293 mgd in water rights, but this figure is well in excess of the capacity of the town's water system. Actual system capacity was unavailable.

[f] In 1978, St. George provided Bloomington and Bloomington Hills with their entire water supplies and supplemented the supplies of Ivins, Santa Clara, and Washington City. Completion of the Snow Canyon Water Project in December 1979, added approximately 2.424 mgd to the St. George supply and made both Santa Clara and Ivins independent of St. George, whose total supply has risen to approximately 14.057 mgd, sufficient for over 31,000 persons.

[g] In 1978, 0.09 mgd were purchased from St. George to supply the Santa Clara Heights area. Completion of the Snow Canyon Water Project in December 1979 will make Santa Clara, with a share of the new supply of approximately 0.905 mgd, independent of St. George.

[h] The stated figure is an estimate of the deliverable capacity of an unmetered system. As of October 1979, partial funding had been secured for planned improvement which would increase supply to 0.323 mgd.

[i] A new well producing some 1.44 mgd is to be operational by the end of 1979. The resulting total available supply of 1.8 mgd should be adequate through the year 2000.

[j] The primary source of water for the Las Vegas Valley is the Las Vegas Valley Water District, which presently can deliver 200 mgd. Its treatment facility will be expanded to a 400 mgd capacity by mid-1982. Under the baseline, the valley's population is expected to increase steadily from 414,977 in 1978 to 1,258,457 in 2020. By 1980, the area's peak demand should reach 204.8 mgd, or 102-percent capacity. Upon completion of planned expansion in mid-1982, the shortfall will be eliminated through 2000, when peak demand will be 385.6 mgd. By 2020, peak demand will have reached 566.3 mgd or 142-percent treatment capacity.

NOTE: Projections are based on the standard of 450 gallons per capita per day peak usage.
mgd = million gallons per day

TABLE 7

Baseline Projections for Sewage Treatment Requirements

Community	Million Gallons Per Day (mgd) 1978	1980	1985	1990	1995	2000	2020
Kane County							
Alton	N/A	0.009	0.008	0.008	0.007	0.006	0.003
Glendale	N/A	0.029 (0.017)	0.026 (0.016)	0.026 (0.015)	0.024 (0.014)	0.022 (0.013)	0.015 (0.009)
Orderville	N/A	0.062 (0.037)	0.055 (0.033)	0.054 (0.032)	0.051 (0.030)	0.047 (0.028)	0.032 (0.019)
Total[a]	-	0.091 (0.054)	0.082 (0.049)	0.080 (0.047)	0.075 (0.044)	0.069 (0.041)	0.047 (0.028)
Kanab	0.3	0.511	0.560	0.645	0.713	0.780	1.049
Washington County							
Hurricane	[b]0.12	0.340	0.366	0.393	0.419	0.466	0.551
LaVerkin	N/A	0.160	0.188	0.211	0.234	0.259	0.358
Toquerville	N/A	0.065	0.076	0.085	0.095	0.105	0.145
Total[c]	-	0.565	0.630	0.689	0.748	0.809	1.054
Ivins[d]	N/A	0.074	0.078	0.098	0.109	0.120	0.166
Leeds	N/A	0.049	0.053	0.057	0.062	0.066	0.084
St. George	-	1.839	2.155	2.418	2.687	2.970	4.102
Santa Clara	-	0.122	0.148	0.161	0.178	0.197	0.272
Total[e]	3.0	1.961	2.303	2.579	2.866	3.168	4.374
Washington[f]	0.12	0.377	0.442	0.496	0.551	0.609	0.841
Clark County							
Las Vegas[g]							

Source: Centaur Associates, Inc., 1980

[a]The Long Valley sewage system, designed for a population of 808 with average flow of 100 gpcpd or 0.081 mgd, is to be completed in July 1980. The facility is to serve Glendale, Orderville, and Mt. Carmel. Since no population projections are available for Mt. Carmel, the figures here designated "total need" represent less than the actual total load on the Long Valley system. Figures in parentheses represent demand calculated on a standard of 100 gpcd.

[b]The city was only partially sewered in 1978, the remainder of the population relies on individual septic tanks. As of October 1979, the existing centralized treatment facility had essentially reached capacity.

[c]A new lagoon system with design capacity for 7,300 persons (i.e., 1.226 mgd if a standard flow of 168 gpcd has been assumed by planners) had been planned and partially funded as of October 1979. Original plans to include Hurricane, LaVerkin, and Toquerville in the plant's service area had not been altered in spite of EPA's removal of Toquerville from its grant.

[d]See below, footnotes e and f.

[e]The service area of the St. George plant includes Santa Clara as well as St. George. Plans to construct outfall lines from the town of Ivins have been delayed indefinitely for lack of funding. See also below, footnote f.

[f]As of October, 1979, EPA's funded study of the city's seriously overloaded sewage system was drawing to a close. Under discussion was a multiple lagoon system to be constructed south of Bloomington, with a service area comprising Washington City, St. George, Santa Clara, Ivins, Bloomington, and Bloomington Hills. Design capacity would be based on the year 2000 population estimates for the participating communities. Completion of such a system could not be expected before 1982.

[g]In 1978, Las Vegas Valley had three sewage treatment facilities with a combined capacity of 64.5 mgd. By mid-1980, the combined capacity will be 73.5 mgd but the valley's 1980 population will have reached 455,143 and have a total peak flow of 76.5 mgd. Under the baseline, population growth will be steady. If this population would all be served by a centralized sewage system, there would be a need for 211.4 mgd. Henderson will be severely affected, reaching 23.1 mgd by 2020, 367 percent of the projected capacity of the facility to be built in 1982. Also by 2020, Las Vegas and North Las Vegas will be at 147-percent capacity and unincorporated Las Vegas Valley, if entirely on the sewer system, will be at 333-percent capacity.

NOTE: All projections are based on a standard flow of 168 gpcd.
N/A = not applicable (i.e., no centralized sewer system)
mgd = million gallons per day
gpcd = gallons per capita per day

TABLE 8

Baseline Projections for School District Enrollment and Teachers

School District Enrollment/ Teachers	1978	1980	1985	1990	1995	2000	2020
Kane County							
Enrollment	1,022	1,050	1,125	1,275	1,388	1,500	1,950
Teachers	52	53	57	65	71	76	99
Washington County							
Enrollment	5,385	5,581	6,494	7,254	8,030	8,847	12,113
Teachers	212	220	256	286	316	348	477
Clark County							
Enrollment	86,200	94,495	115,232	135,970	156,708	177,445	260,395
Teachers	4,136	4,534	5,524	6,524	7,520	8,515	12,495

Source: Centaur Associates, Inc., 1980

NOTE: Projected enrollment is based on the assumption that enrollment will remain in the same proportional relationship to population as in 1978. Projected need for teachers is based on the assumption that the student/teacher ratio will remain the same in the future as in 1978. The 1978 student/teacher ratio in Clark County is based upon the number of certified employees in the district. Since certified employees include guidance counselors and deans, and therefore the projected need for teachers in Clark County may be overstated.

TABLE 9

Baseline Projections for Health Care Facilities

County/Type of Facility	Number of Beds 1978	1980	1985	1990	1995	2000	2020
Kane County							
Hospital	20	6	7	7	8	9	11
Nursing Home	13	24	25	27	28	30	35
Washington County							
Hospital	65	54	63	70	77	85	117
Nursing Home	207	193	223	248	273	300	407
Clark County							
Hospital	1,429	1,252	1,528	1,803	2,087	2,352	3,452
Nursing Home	923	978	1,190	1,403	1,615	1,827	2,677

Source: Centaur Associates, Inc., 1980

NOTE: Projected needs are based on the following standards:

Hospital Beds:

1) $\frac{\text{Patient days per year}}{\text{Current population}}$ = Current use rate

2) $\frac{\text{Current use rate x projected population}}{365}$ = Average bed need per day

3) $\frac{\text{Average bed need per day}}{.80}$ = Bed need for projected year

Nursing Home Beds:

1) $\frac{\text{Patient days per year}}{\text{Current population}}$ = Current use rate

2) $\frac{\text{Current use rate x projected population}}{365}$ = Average bed need per day

3) $\frac{\text{Average bed need per day}}{.90}$ + 10 = Bed need for projected year

APPENDIX 11

Photographic Simulations of Visibility Impacts - Technical Specifications

The photograph for Observation Point was taken at 9:00 a.m. MST on June 13, 1979.

The photograph for Watchman Point was taken at 9:53 a.m. MST on June 17, 1979.

The estimated visual range for each day was 125 kilometers (km). This visual range was using the distance to skyline features and the contrast with the sky. It should be noted that the visual range under Rayleigh conditions (light scattering by gaseous molecules in air) is three times the visual range represented by the three photographs. Thus the visibility was significantly poorer than for a Rayleigh atmosphere. Visibility data for July through November 1979 indicates that the median visual range was approximately 190 kms when viewing Mt. Trumbull from Lava Point (105 kms to the south-southwest). It is also significant to note that the visual range exceeded 125 kms 95 percent of the time period to the same target.

The powerplant plume is most likely to cause plume blight during thermally stable, light wind conditions with a small sun angle between the observer and the plume axis. In the dry desert areas of the southwest, stable conditions with light winds are most apt to occur in the fall during cooler times of the day. The photographs were taken during the late spring, in the morning, with a sun angle approximating that which occurs in the fall.

In the scenes identified, the position of an observer with respect to the plume in early morning would give relatively large scattering angles because the sun would be east to east-southeast of the observer while the plume would be south to southwest of the observer. This is important because small angle scattering has a much greater effect on plume visibility impairment than large angle scattering (for example, McClatchey reports normalized scattering functions of approximately 2, .3, 0.7, 0.3 for the scattering angles of 10°, 30°, 60°, and 90° respectively). Thus for small scattering angles the effects of atmospheric pollutants will be greatly enhanced. However, with the fly ash controls used for the Warner Valley plant and the scattering angles between the observation points and plume axis, the role of fly ash pollutants on visibility impairment as compared to secondary aerosols is very limited. As a consequence, small changes in the scattering angle between early summer and fall are unlikely to be important during morning hours. Thus, based on the above discussion, the base photographs are expected to provide a representative simulation.

The frequency of any particular set of meteorological conditions at this remote site in the southwest is very difficult to determine. This is particularly true for stable flow at the effective plume height for a large coal-fired powerplant. During stable conditions, wind directions and wind speeds vary greatly with height so that surface data or data collected by a 100-meter tower may not be representative of conditions at a typical plume height of 300 to 500 meters. In the morning hours when mixing heights are changing rapidly, meteorological measurements made near the surface will not be representative of conditions at higher altitudes.

A further complication is that upper air data are collected at only 12-hour intervals at locations spaced widely apart and may not be representative over the terrain and distances between stations found in the southwest. These difficulties make it virtually impossible without a great deal of further work to assign frequencies of occurrence of specific meteorological conditions at Zion National Park.

There has been some data collected in other locales in the southwest which provide some information on frequencies of wind speed and stability in the southwest. Near Capitol Reef National Park, two-thirds of the mornings exhibited stable conditions based on temperature distributions measured 1,000 to 1,300 feet above ground level (Intermountain Power Proect, 1975). Approximately 50 percent of the winds measured at a height of 1,000 feet above ground near Lake Powell exhibited speeds less than 2.5 m/s (Dames and Moore, 1972). On this basis the combination of 2 m/s winds and stable conditions is not an unlikely one. The winds and stabilities assumed in this visibility simulation study would be expected with a high pressure system to the southwest.

Intervening terrain could play a very important role in the appearance of the plume. If the plume height upwind of the terrain is less than the height of the terrain, the terrain is apt to provide additional mixing which would have the effect of a much more rapid dispersion. One such situation was encountered in the Lake Powell studies (Williams, 1977). On this occasion a well-defined plume, visually evident for 55 kilometers, interacted with high terrain and was no longer detectable visually or with instruments. In this analysis, it is assumed that the powerplant plume is unaffected by the intervening terrain. This is an appropriate assumption when the air upwind of the terrain stagnates with consequent higher plume rise so that the plume passes over the intervening terrain. Recent tracer studies conducted in the vicinity of the proposed powerplant may provide additional data or lead to additional analyses that will assist with determining the effect of intervening terrain and possible frequency of occurrence of meteorological conditions.

The meteorological conditions which prevailed on the days the photographs were taken are not likely to be the same as those assumed in the visibility simulation. It is desirable to assess the effects these differences would have on the final results. Assessing these differences is not possible because the background atmospheric particulate matter loading for the conditions in this case is unknown. Even though additional simulations are not possible, it is expected that the sun angle, which is appropriately simulated, will have a more significant effect on plume blight than the use of different base photographs.

Slides corresponding to the base photographs of scenes to be analyzed were digitized and provide the basis for the simulated pictures. Additionally, background particulate matter concentration were estimated and the background radiative transfer was calculated for the sun angles corresponding to the time the pictures were taken. Plume simulations were then possible once the background conditions were calculated. Two cases, one for each original picture were simulated. In each case, simulations were prepared for each geometry and with the converted aerosols sufficiently large to be effective light scatterers (0.2 μmmD). In both cases, light winds were presumed to carry the pollutants in the general direction of the observer.

In each case, the wind speed chosen was 2 meters per second and the Tennessee Valley Authority (TVA) stable conditions were assumed. Relevant emission and source parameters are summarized. In order to simulate the effects of lighter winds below the height of the terrain, and permit plume transport without intervening terrain influencing plume dispersion and transport, an artificially large stack radius of 8 meters was used to permit sufficient plume rise above nearby terrain obstacles. The source characteristics used for the Warner Valley plant are shown in table 1.

TABLE 1

Source Characteristics for the Warner Valley Plant

NO_x emission rate	504 grams per second
SO_2 emission rate	108 grams per second
Fly ash emission rate	6.8 grams per second
Stack gas temperature	350 Kelvin degrees
Stack gas velocity	20.9 meters per second
Stack height	152 meters
Stack radius	8 meters
Base of stack elevation	989 meters above sea level
Background visual range	96 kilometers

The viewing geometries are presented in the context of a topographic map which illustrates various points of interest (figs. 4-3 and 4-4 located at the back of Chapter 4).

The modeling techniques employed for dispersion, radiative transfer and simulated photograph construction in the Zion cases are described in Williams et al., (1978) and Williams et al., (1979). The conversion half-lives and light scattering properties of te pollutants are reported in table 2. Table 3 reports plume transmission (TR) and additional scattering (Bsky') for each color at the point of minimal intensities at the horizon nearest the center of the picture.

TABLE 2

Parameters Used in Zion Simulations

	All	Blue ($m^2/\mu g$)	Green ($m^2/\mu g$)	Red ($m^2/\mu g$)
Fly ash scattering to mass ratio	.....	0.687	0.705	0.719
Nitrogen oxide to nitrogen dioxide conversion half life	2.8h	.....	.....	.....
Nitrogen oxide to nitrate conversion half life	46h	.....	.....	.....
Sulfur dioxide to sulfate conversion half life	96h	.....	.....	.....
Secondary aerosol scattering to mass ratio	.....	4.36	2.86	1.94
Nitrogen dioxide absorption to mass ratio	.....	0.62	0.30	0.02

TABLE 3

Plume Transmissions and Light Scattering for Cases
Observation Point and Watchman Point, Zion National Park

Simulation	Bearing Angle	Blue Tr	Blue Bsky'	Green Tr	Green Bsky'	Red Tr	Red Bsky'
Observation Point	214.3	0.258	0.750	0.379	0.877	0.682	0.562
Watchman Point	219.5	0.104	0.719	0.282	0.495	0.614	0.458

Appendix 12

Trace Element Information

This appendix contains trace element information concerning the proposed Harry Allen and Warner Valley powerplants. The tables presented in this appendix:

Table Number	Title
1	Predicted Release of Trace Elements at the Proposed 2,000-MW Harry Allen Powerplant
2	Predicted Release of Selected Trace Elements at the Proposed 500-MW Warner Valley Powerplant
3	Highest Calculated Ground-Level Concentrations of Trace Elements at the Proposed 2,000-MW Harry Allen Powerplant
4	Maximum Ground-Level Concentrations of Trace Elements at the Proposed 500-MW Warner Valley Powerplant
5	Predicted Release of Selected Trace Elements at the Proposed 250-MW Warner Valley Powerplant
6	Maximum Ground-Level Concentrations of Trace Elements at the Proposed 250-MW Warner Valley Powerplant
7	Average Composition and Observed Range of 20 Trace Elements in Coal Ash and 7 Additional Trace Elements in 48 Wasatch Plateau Field Coal Samples

TABLE 1

Predicted Release of Trace Elements
at the Proposed 2,000-MW Harry Allen Powerplant

Element	Coal Analysis (ppm)	Element Availability After Coal Combustion (lb/day)	Fractionation After Coal Combustion[a] (lb/day)		Location After Fractionation[a] (lb/day)		
			Bottom Ash	Fly Ash	Bottom Ash	Precipitation Capture	Stack Emission[b]
Arsenic	11.0	687.0	6.0	681.0	6.0	680.7	0.3
Beryllium	5.4	338.0	57.0	281.0	57.0	274.0	7.0
Boron	210.0	13,125.0	1,580.0	11,537.0	1,588.0	10,920.0	617.0
Cadmium	0.27	17.0	3.0	14.0	3.0	13.4	0.6
Chromium	6.2	338.0	54.0	334.0	54.0	286.0	48.0
Cobalt	14.0	875.0	136.0	739.0	136.0	726.0	13.0
Copper	8.0	500.0	64.0	436.0	64.0	432.0	4.0
Fluorine	85.0	5,312.0	58.0	5,254.0	58.0	4,850.0	404.0
Lead	6.4	400.0	41.0	359.0	41.0	329.0	30.0
Manganese	38.0	2,375.0	411.0	1,964.0	411.0	1,936.0	28.0
Mercury	0.05	3.0	0.1	2.9	0.1	0.0	2.9
Nickel	15.0	938.0	128.0	810.0	128.0	639.0	171.0
Selenium	1.0	62.0	1.0	61.0	1.0	38.0	23.0
Uranium	4.0	250.0	45.0	205.0	45.0	201.0	12.0
Vanadium	7.8	488.0	75.0	413.0	75.0	401.0	12.0

Source: Nevada Power Company, 1975

[a] Based on trace element analysis according to EPA (1975).
[b] Assumes no capture by sulfur dioxide scrubber.

NOTE: Calculations based on 31,250 tons of coal burned per day, plant operating on full load, ash content 8.2 percent.

ppm = parts per million
lb/day = pounds per day

TABLE 2

Predicted Release of Selected Trace Elements at the Proposed 500-MW Warner Valley Powerplant

Element	Coal Analysis (ppm)	Elements Generated (lb/day)	Percentage Released to Atmosphere[a]	Stack Emission[b] (lb/day)
Arsenic	11.0	178.0	0.1	0.2
Beryllium	5.4	87.4	2.0	1.8
Boron	210.0	3,397.0	4.7	160.0
Cadmium	0.27	4.4	4.5	0.2
Chromium	6.2	10.0	12.0	1.2
Cobalt	14.0	226.5	1.5	3.4
Copper	8.0	129.4	0.8	1.0
Fluorine	85.0	1,375.0	7.6	105.0
Lead	6.4	103.5	7.5	7.8
Manganese	38.0	614.9	1.2	7.5
Mercury	0.05	0.8	98.8	0.8
Nickel	15.0	242.6	18.2	44.1
Selenium	1.0	16.1	37.9	6.1
Uranium	4.0	64.7	1.4	0.9
Vanadium	7.8	126.2	2.4	3.1

Source: EPA, 1975; Nevada Power Company, 1975

[a]Based on trace element study, EPA, 1975.
[b]Assumes no capture by sulfur dioxide scrubber.

Note: Calculations based on maximum operating capacity, 8,090 tons of coal burned per day.

ppm = parts per million
lb/day = pounds per day

TABLE 3

Highest Calculated Ground Level Concentrations of Trace Elements at the Proposed 2,000-MW Harry Allen Powerplant

Element	Emission Rate (lb/day)	Maximum 24-hour Concentration[a] ($\mu g/m^3$)	Annual Average[b] ($\mu g/m^3$)
Arsenic	0.3	0.0002	0.00002
Beryllium	7.0	0.004	0.0006
Boron	617.0	0.33	0.053
Cadmium	0.6	0.0003	0.00005
Chromium	48.0	0.026	0.004
Cobalt	13.0	0.007	0.001
Copper	4.0	0.002	0.0003
Fluorine	404.0	0.21	0.035
Lead	30.0	0.016	0.0026
Manganese	28.0	0.015	0.0024
Mercury	2.9	0.0015	0.0002
Nickel	171.0	0.09	0.015
Selenium	23.0	0.012	0.002
Uranium	4.0	0.002	0.0003
Vanadium	12.0	0.006	0.001

Source: Nevada Power Company, 1975

[a] Based on maximum plant operating capacity.
[b] Based on 80-percent average plant operating capacity.

NOTE: Assumes 99.75-percent precipitator and scrubber capture.

$\mu g/m^3$ = micrograms per cubic meter

TABLE 4

Maximum Ground-Level Concentrations of Trace Elements at the Proposed 500-MW Warner Valley Powerplant

	$\mu g/m^3$				
	Calculated			Background	
Element	Annual	Maximum 24-Hour	Maximum 3-Hour	Average[a]	Maximum 24-Hour[b]
Arsenic	0.00007	0.0007	0.003	0.001	....
Beryllium	0.0006	0.006	0.02	0.00004	....
Boron	0.06	0.6	2.1	0.007	....
Cadmium	0.00007	0.0007	0.003	0.0001	NM
Chromium	0.0004	0.004	0.02	0.008	0.01
Cobalt	0.001	0.01	0.04	0.0006	0.03
Copper	0.0004	0.004	0.01	0.03-0.09[b]	0.27
Fluorine	0.04	0.4	1.4	0.3	....
Lead	0.003	0.03	0.1	0.01-0.04[b]	0.24
Manganese	0.003	0.03	0.1	0.1	0.04
Mercury	0.0003	0.003	0.01	....	....
Nickel	0.02	0.2	0.6	0.004	0.03
Selenium	0.002	0.02	0.08	0.0003	....
Uranium	0.0003	0.003	0.01	....	....
Vanadium	0.001	0.01	0.04	0.004	....

Source: Adapted from ERT, 1976 and EPA, 1976.

[a]Based on 6 days of sampling at Warner Valley site, 1975.
[b]Based on 8 months of sampling by EPA at Bloomington and Pipe Spring, 1976.

Note: $\mu g/m^3$ = micrograms per cubic meter
NM = not measurable

TABLE 5

Predicted Release of Selected Trace Elements
at the Proposed 250-MW Warner Valley Powerplant

Element	Coal Analysis (ppm)	Elements Generated (lb/day)	Percentage Released to Atmosphere[a]	Stack Emission[b] (lb/day)
Arsenic	11.0	89.0	0.1	0.1
Beryllium	5.4	43.7	2.0	0.9
Boron	210.0	1,698.5	4.7	80.0
Cadmium	0.27	2.2	4.5	0.1
Chromium	6.2	5.0	12.0	0.6
Cobalt	14.0	113.2	1.5	1.7
Copper	8.0	64.7	0.8	0.5
Fluorine	85.0	687.5	7.6	52.5
Lead	6.4	51.7	7.5	3.9
Manganese	38.0	307.4	1.2	3.7
Mercury	0.05	0.4	98.8	0.4
Nickel	15.0	121.3	18.2	22.1
Selenium	1.0	8.1	37.9	3.1
Uranium	4.0	32.4	1.4	0.5
Vanadium	7.8	63.1	2.4	1.5

Source: EPA, 1975 and Nevada Power Company, 1975

[a]Based on trace element study, EPA, 1975.
[b]Assumes no capture by sulfur dioxide scrubber.

NOTE: Calculations based on maximum operating capacity, 4,045 tons of coal burned per day, 99.75-percent electrostatic precipitator and scrubber capture.

ppm = parts per million
lb/day = pounds per day

TABLE 6

Maximum Ground-Level Concentrations of Trace Elements at the Proposed 250-MW Warner Valley Powerplant

	μg/m³				
	Calculated			Background	
Element	Annual	Maximum 24-Hour	Maximum 3-Hour	Average[a]	Maximum 24-Hour[b]
Arsenic	0.000035	0.00035	0.0015	0.001	....
Beryllium	0.0003	0.003	0.01	0.00004	....
Boron	0.03	0.3	1.1	0.007	....
Cadmium	0.000035	0.00035	0.0015	0.0001	NM
Chromium	0.0002	0.002	0.01	0.008	0.01
Cobalt	0.0005	0.005	0.02	0.0006	0.03
Copper	0.0002	0.002	0.005	0.03-0.09[b]	0.27
Fluorine	0.02	0.2	0.7	0.3	....
Lead	0.0015	0.015	0.05	0.01-0.04[b]	0.24
Manganese	0.0015	0.015	0.05	0.1	0.04
Mercury	0.00015	0.0015	0.005	....	....
Nickel	0.01	0.1	0.3	0.004	0.03
Selenium	0.001	0.01	0.04	0.003	....
Uranium	0.00015	0.0015	0.005	....	....
Vanadium	0.0005	0.005	0.02	0.004	....

Source: Adapted from ERT, 1976 and EPA, 1976, and adjusted to 250-MW capacity plant.

[a]Based on 6 days of sampling at Warner Valley site, 1975.
[b]Based on 8 months of sampling by EPA at Bloomington and Pipe Spring, 1976.

NOTE: There is an assumed 99.75 percent capture by electrostatic precipitator and SO_2 scrubber.

μg/m³ = micrograms per cubic meter
NM = not measurable

TABLE 7

Average Composition and Observed Range Of 20 Trace Elements in Coal Ash and 7 Additional Trace Elements in 48 Wasatch Plateau Field Coal Samples

Oxide or Element	Average[a] (ppm)	Observed Range Minimum (ppm)	Observed Range Maximum (ppm)
Trace Elements In Ash			
Boron (B)	1,000.0	200.0	3,000.0
Barium (Ba)	700.0	70.0	3,000.0
Beryllium (Be)	15.0	<3.0	50.0
Cadmium (Cd)	0.9	1.0	2.0
Cobalt (Co)	15.0	<10.0	50.0
Chromium (Cr)	100.0	30.0	200.0
Copper (Cu)	95.0	32.0	266.0
Gallium (Ga)	30.0	10.0	70.0
Lithium (Li)	111.0	15.0	288.0
Molybdenum (Mo)	10.0	<7.0	20.0
Niobium (Nb)	20.0	<20.0	50.0
Nickel (Ni)	50.0	10.0	200.0
Lead (Pb)	55.0	<25.0	195.0
Scandium (Sc)	20.0	<10.0	50.0
Strontium (Sr)	1,000.0	100.0	5,000.0
Vanadium (V)	100.0	70.0	300.0
Yttrium (Y)	70.0	30.0	300.0
Ytterbium (Yb)	7.0	3.0	15.0
Zinc (Zn)	84.0	19.0	237.0
Zirconium (Zr)	200.0	100.0	500.0
Trace Elements In Whole Coal			
Arsenic (As)	1.0	<0.5	3.0
Fluorine (F)	70.0	<20.0	240.0
Mercury (Hg)	0.05	0.01	0.21
Antimony (Sb)	0.3	<0.1	0.7
Selenium (Se)	1.7	0.8	5.7
Thorium (Th)	1.7	<3.0	5.2
Uranium (U)	1.3	0.2	3.5

Source: USDI, 1979.

[a]Arithmetic mean.

NOTE: ppm = parts per million

APPENDIX 13

U.S. Fish and Wildlife Service Official Biological Opinion on the Allen-Warner Valley Energy System, April 3, 1978

United States Department of the Interior

FISH AND WILDLIFE SERVICE

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:
10597 West Sixth Avenue
Lakewood, Colorado
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IN REPLY REFER TO:
FA/SE/Coop. FED--BLM--
Allen-Warner Valley
Energy Projects

APR 3 1978

MEMORANDUM

To: State Director, Bureau of Land Management
Salt Lake City, Utah

From: Regional Director, Region 6
Fish and Wildlife Service, Denver, Colorado

Subject: Formal Consultation on the Allen-Warner Valley Energy Projects

Please consider this our official biological opinion on the effects of these projects on the endangered species listed in your August 26, 1977, request for formal consultation.

The projects would not affect the Yuma clapper rail or the unarmored three-spine stickleback, which do not occur in any of the project areas. We also have concluded that the projects would not jeopardize the continued existence of the American peregrine falcon, which is not known to nest in the area. Effects on other species will be discussed for each project as follows:

<u>Warner Valley Water Project</u>
Following the October 18, 1977, field review, the U.S. Fish and Wildlife Service has spent considerable time reviewing the available biological and project data. It is our opinion that the Warner Valley Project as now proposed[1] will be likely to jeopardize the continued existence of the endangered woundfin by adversely modifying its present habitat in the Virgin River. This habitat is considered essential for survival of the species and has been proposed for designation as "Critical Habitat," as

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[1]Project features and descriptions were evaluated from the BLM Preliminary Draft Environmental Impact Statement, June 1977, and the Vaughn Hansen Associates Report, entitled, Impact of Warner Valley Water Project on Endangered Fish of the Virgin River, October 1977.

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provided for by the Endangered Species Act of 1973, in the Federal Register, Vol. 42, No. 211, Wednesday, November 2, 1977.

When we evaluated the impact of this project on the woundfin, we did not attempt to determine the absolute minimal biological and physical conditions which the species could withstand without passing into extinction. Rather, we reviewed all the data to determine what conditions are needed in order to maintain a healthy population of woundfin in the Virgin River. We based our analysis on the premise that the historic conditions which have occurred in the Virgin River have provided the environmental and biological conditions for a viable self-sustaining population of the woundfin.

Although very low flow conditions have occurred in the Virgin River in past years, which undoubtedly affected the woundfin population, these did not persist for extended periods of months or years and thus did not significantly affect the long-term viability of the woundfin populations. For a short-lived minnow like the woundfin (life expectancy of 3 or 4 years), a long-term reduction of flow which adversely affects reproduction and survival of young has the potential of drastically reducing population numbers.

The primary environmental parameter the Warner Valley Project would affect is stream flow. Secondary impacts associated with stream flow alteration are changes in water quality, including temperature, and reduction of available aquatic space for both fish and other associated aquatic life. Another factor evaluated was the potential impact of the proposed Warner Reservoir as a possible source for introduction of exotic fish species into the Virgin River. Our detailed analyses of these factors are as follows:

A. Flow--The project will cause a significant reduction in flow of the Virgin River between LaVerkin Springs and the California Pacific Power Plant outflow which will reduce presently occupied woundfin habitat by approximately 1/4 mile of stream. (See additional detail under water quality).

The project will cause a significant flow reduction of the Virgin River between the Power Plant outflow and the Washington Fields Diversion. This reduction has been estimated at the Hurricane Gaging Station as up to one-half of the average flow in cubic feet per second (cfs) during winter and spring. These flow reductions during the critical spring reproduction period and the overwinter survival period will reduce the quality of this habitat for the woundfin. The reduced post-project winter and spring flows will result in a smaller, less viable woundfin population in this river section.

Conclusions for this flow-related population reduction are based upon the findings of Dr. James Deacon of the University of Nevada, Las Vegas, in the Vaughn Hansen Associates Report (1977) that the 1977 flow condition resulted in very restricted survival of young woundfins above the Virgin River Narrows. Although we recognize that post-project minimum flows are not projected to be as low as those which occurred in 1977, the stream flow/woundfin reproduction relationship suggests that low flow does affect the woundfin population. Even though low-flow conditions occur naturally, and 1976 and 1977 were both low water years, the post-project conditions would increase the frequency of these low flow conditions. Therefore, with increased occurrence of low flow in this river section, woundfin reproduction would be more frequently affected, and the overall population would be reduced. We do not know the population level at which the woundfin would face possible extinction. We do know, however, that once any species is reduced to a certain low point, the extinction process is greatly hastened. Therefore, we must view any major reduction in population numbers and in essential habitat as adverse and likely to contribute to the eventual extinction of the species.

The project will increase the frequency and duration of no-flow conditions immediately downstream of the Washington Fields Diversion for approximately 2 miles. This area is now occupied by woundfin for the 2- to 3-month period when water is available.

The project will decrease winter and spring flows in the Virgin River from Washington Fields Diversion to the Virgin River Narrows area. Average post-project flows in this area are projected to be decreased during winter and spring by one-third to one-half. These flow reductions are believed to be significant enough to affect the available habitat of the woundfin and would result in a general decrease in the woundfin population numbers above the Virgin River Narrows.

We recognize the project would have a beneficial impact during the low flow months of July through September from irrigation return flow downstream of the Washington Fields Diversion. This would, in all probability, improve conditions for woundfin during the summer months and would probably result in a larger woundfin population surviving the summer in this river section. However, this beneficial impact would be negated by the reduced habitat available during the winter and spring periods.

Impacts of the project on streamflow below the Virgin River Narrows cannot be adequately addressed because of the limited understanding of the hydrologic relationship between upstream Virgin River flow and the Littlefield Springs recharge. However, it is important for the woundfin below the Narrows that the integrity and consistency of the spring discharge be maintained. Any action which would result in less recharge from the Littlefield Springs would adversely affect the woundfin habitat below the Virgin River Narrows.

B. Water Quality--The proposed project alteration in base flow conditions during the year may cause a change in duration and/or frequency of critical water temperature conditions. Because water temperature of the Virgin River is highly dependent upon ambient air temperature and local atmospheric conditions, it fluctuates quite extensively. Past records have indicated fluctuations of up to 14-16° C. in a 24 hour period. With less flow under post-project conditions, there is a possibility of an increased rate of temperature change. It has been reported by Lockhart (unpublished masters thesis, University of Nevada, Las Vegas) that the upper temperature limit for woundfin is near 35° C. Deacon (Vaughn Hansen Associates Report, 1977) has reported that temperatures over 30° C. are undesirable for woundfin. Lockhart also stated he did not collect woundfin in waters less than 7° C. Based upon these reports and discussions with Dr. Deacon concerning critical water temperatures for woundfin, we believe the occurrence of temperature extremes, both high and low, may increase under the project and adversely affect the woundfin. The Vaughn Hansen Associates Report (1977) concluded there was no relationship between flow and water temperature, and thus there would be no project impact on water temperature. We cannot agree with this conclusion at this time because of the questionable nature of the temperature data analyzed by the Vaughn Hansen Associates Report. These data were recorded by the U.S. Geological Survey in conjunction with the taking of sediment samples and were published in the U.S. Geological Survey Water Quality Records for Utah. Upon closer examination of the actual field data sheets, we found these U.S. Geological Survey data were unsuitable for detailed analysis and yearly comparisons because of variation in the time of day measurements were taken, which ranged from 6:00 A.M. to 10:00 P.M., and also because different people, possibly using different procedures, had taken these temperatures.

With flows in the Virgin River reduced by the project, the toxic effects of the LaVerkin Springs water will extend for a longer distance downstream. The toxicity of these springs has been reported by various researchers including Williams (1977) and Lockhart (unpublished M.S. thesis). The distribution of fishes of the Virgin River, as given in Cross (1975), shows no fish exist in close proximity to the LaVerkin Springs. If less flow is permitted past the Hurricane Diversion under post-project conditions, there will generally be less water in the Virgin River at LaVerkin Springs for dilution and moderation of the toxic chemical qualities of the spring water. Therefore, the presently occupied river section upstream of the California Pacific Power Plant outflow, approximately 1/4 mile, will be lost as available woundfin habitat.

C. Exotic Species Competition--There are numerous documented records of exotic fish species causing the reduction or extinction of native fish fauna. This has been reported by Minckley and Deacon (1968). It was concluded by biologists at a meeting in Las Vegas (Vaughn Hansen Associates Report, 1977) that exotic species will be introduced into the Virgin River drainage by the proposed Warner Valley Reservoir. The impact of this exotic fish introduction will depend upon whether the exotics can become established in the Virgin River. Because the post-project conditions, as the project is now proposed, will reduce base flows and cause the Virgin River to become more intermittent, we believe exotic species, such as green sunfish and red shiner, will become better established. This conclusion is based upon past reports which state that green sunfish and red shiner prefer river habitat of an intermittent nature including sluggish flows and no-flow conditions (Minckley, 1973 and Cross, 1967). Therefore, the Warner Valley Reservoir, in conjunction with reduced, intermittent base flows, would provide environmental conditions favoring establishment of additional exotic fish into the Virgin River system.

Recommendation:
Since the Warner Valley portion of the project as now proposed is likely to jeopardize the continued existence of the woundfin, we have provided recommendations which we believe would eliminate the adverse impacts. In order to fully understand our recommendations, we believe it is necessary to review past recommendations and what organizations or individuals made them.

Table 1 - Past Flow Recommendations for the Virgin River

Date	Organization or Individual	Flow Recommendation
2/77	Bio/West Inc. authored by J.E. Deacon and P.B. Holden (1977)	60-90 cfs for winter and summer flows
10/77	Vaughn Hansen Associates Report (1977)	
	1. Under general summary findings	40 cfs minimum
	2. R.N. Winget and R.W. Baumann section	30-40 cfs minimum
	3. J.E. Deacon section	80-100 cfs April-mid-July 60 cfs after mid-July 80-100 cfs for winter

As seen from the above table, past flow recommendations for the Virgin River have ranged from 30 to 100 cfs. Also, the point or points at which these flows are needed was not indicated except for those by Deacon in the Vaughn Hansen Associates Report.

In our analysis, we used the past flow records plus the available biological data contained in various reports. We have made our flow recommendations based upon the best data available. If and when more data become available, both hydrological and biological, we reserve the option of adjusting these recommendations.

Basic years analyzed were 1967 through 1977. Key years were: 1968--near average water year for the 10 years of record; 1973--above average water year with available biological data; 1977--below average water year with available biological data. Other flow records and additional biological data were also inspected and coordinated with the data cited above.

Our streamflow recommendations for the endangered woundfin are divided into three periods, based upon the biology of the species:

1. The fall-winter period of November through February when the adults are overwintering;

2. The spring-early summer period of March through June when spawning occurs; and

3. The summer-early fall period of July through October when growth and development of young occur.

Because of the variation in flow along the Virgin River, we have chosen a specific point, the Hurricane Gage, to which we have related our flow recommendation. This point was chosen because: the past flow records are available, it is located in good woundfin habitat, and it is only about 12 miles downstream from the Hurricane Diversion.

The following are our flow recommendations for the Hurricane Gaging Station:

November through February--110 cfs or natural flow, whichever is less.

March through June--110 cfs or natural flow, whichever is less.

July through October--70 cfs or natural flow, whichever is less.

If these flow recommendations can be maintained at the Hurricane Gaging Station, which is downstream of the diversion site, we believe the project's adverse impacts on the woundfin can be eliminated.

Our recommended flows agree quite closely with those of Deacon in the 1977 Vaughn Hansen Associates Report. They should be considered as refinements of Deacon's data, since we used additional flow records and additional years of data. Deacon's recommendations were derived from interpretation of two years of flow data, 1973 and 1977, as presented in hydrographs. He correlated this graphic flow data with the woundfin reproduction from above and below the Virgin River Narrows to make his estimates. To arrive at our recommendations, we used basically the same biological data as Deacon, but we expanded the flow data base by using tabular and actual U.S. Geological Survey daily flow records.

We have recommended 70 cfs for July through October, while Deacon recommended 60 cfs after mid-July for the summer months. The actual low flow for this period during the 1973 water year when woundfin fared well, was 64 cfs, but the 1973 mean monthly low flow for the period was approximately 70 cfs. Therefore we feel that Deacon's interpretation of the graphic data was slightly low. Our recommendation of 110 cfs, where Deacon has recommended 80-100 cfs, should not be viewed as conflicting recommendations. Deacon interpreted graphic material and presented an estimate of 80-100 cfs. We used the additional data available and refined this figure to 110 cfs. From the period of flow record, 1967-77, the most common low flow for the March-June period was 110-120 cfs. In 1968, the average water year, the mean monthly flow for the March-June period ranged from 115-406 cfs. Although in 9 out of the past 11 years flows of 91-100 cfs occurred for short periods, these lower flows usually occurred in June, a late spring month impacted significantly by irrigation diversions. Data from the winter flow period also contributed to the formulation of the final 110 cfs spring recommendation. The winter period of November to February had low minimum flows 8 out of 10 years of 101-110 cfs. Although other hydrological statistics indicated higher average winter flows we do not believe this period is as critical as the spring period, and therefore recommended 110 cfs for winter flows. Because of the spring reproduction period of the woundfin we do not believe that a flow greater than 110 cfs for the winter should be dropped just prior to spring spawning. On the contrary, winter to spring flows normally would increase or at least remain constant. Because of this we have recommended a constant flow of 110 cfs for both winter and spring.

The recommended flows of Bio/West Inc., February 2, 1977, were partially computed by Deacon. These flows were estimates and later were revised by Deacon in the Vaughn Hansen Associates Report.

We cannot accept the 40 cfs and 30-40 cfs recommended flows of Winget and Bauman in the Vaughn Hansen Associates Report. We understand these flows were estimated by indirect methods not having any real connection with the biology of the woundfin. Because the expertise of the authors is in invertebrates, much of their flow rationale is related to invertebrate production. Invertebrates differ from fish by having relatively short life cycles, with certain life stages, i.e. eggs, able to aestivate through short severe periods such as droughts. In many cases they also prefer different habitat. The river channel cross-sectional data presented to show that 40 cfs is sufficient flow is deceptive since the break-off point of 40 cfs is very arbitrary. The few cross sections of stream may or may not be representative of the actual situation. Also, the authors looked at only one year, 1977, a very low water year. We suspect that the invertebrate communities they analyzed were in a stress situation, not representative of the normal water year situation.

Harry Allen Power Plant

No endangered or threatened species occur within the immediate area of the plant site; therefore, there will be no adverse impact on these species because of construction activities.

The operation of the Harry Allen Plant will result in the emission from the stacks of an estimated 0.8 lb/day of mercury which would be approximately 292 lb/year. Other trace elements such as arsenic and selenium will also be emitted from the power plant stacks. There is presently insufficient data in the literature to determine the impacts of long-term trace element accumulation on the environment. However, because of the presence of the endangered moapa dace, the woundfin, bald eagle, and peregrine falcon in the general emission fallout area, the Fish and Wildlife Service does have concerns about the impacts of fallout from the stack emissions.

Therefore, we recommend that trace element accumulation in the soil, vegetation, water, aquatic invertebrates, and aquatic vertebrates in the fallout area be monitored. In addition, we are proposing that the project assist in sponsoring concurrent bioassay work on acute and chronic toxicity levels of the various trace elements on the different life stages of the native fishes of the fallout area. Data from fish could then be evaluated for potential impact on fish-eating birds such as eagles.

If trace element problems develop in the environment, the operation of the Harry Allen Power Plant would have to be modified to eliminate these effects.

Coal Slurry Pipeline
If the procedures which have been recommended in the Preliminary Draft Environmental Impact Statement are followed, it is our opinion there will be no adverse impact on the woundfin or other endangered species.

Power Transmission Line
If the procedures which have been recommended in the Preliminary Draft Environmental Impact Statement are followed, it is our opinion there will be no adverse impact on the woundfin. The path of the power line given in the statement is below moapa dace habitat and therefore construction of the power line would not be likely to have any effect on the moapa dace.

Also, if electrical transmission lines less than 230 KV are constructed according to Rural Electrification Administration standards for the prevention of raptor electrocution and the 1975 publication "Suggested Practices for Raptor Protection on Power Lines," by the Raptor Research Foundation, it is our opinion that there will be no significant impact on bald eagles. The larger voltage transmission lines are not expected to cause any problems to the bald eagles.

Because of the complexity of these situations, a large volume of material was reviewed and analyzed, not all of which is included in this memorandum. However, feel free to contact us for any additional information or clarification of this opinion.

As we noted in our September 15, 1977, acknowledgement to your request for consultation, we cannot formally consult on proposed or candidate species in the project areas. Technical information on proposed plants will be supplied informally in a separate memorandum in the near future.

We appreciate your cooperation and interest in conserving endangered species.

Harvey Willoughby

cc: Area Manager, Salt Lake City
ARD, Environment
RD, Region 1
RD, Region 2

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APPENDIX 14

State of Utah, Division of Water Rights - Status of Water Applications and Allocations, Alton Coal Field

STATE OF UTAH

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER RIGHTS

DEE C. HANSEN
STATE ENGINEER

JOHN BENE
DEPUTY

P.O. BOX 506
CEDAR CITY, UTAH 84720
586-4231

GERALD W. STOKER
AREA ENGINEER

June 30, 1977

U. S. Dept. of the Interior
Bureau of Land Management
Cedar City District Office
P. O. Box 729
Cedar City, Utah 84720

Attention: J. Kent Giles RE: AWV 1792. U-040

Dear Sir:

In response to your inquiry concerning water and water rights for a proposed coal project near Alton, Utah we have examined our records and make the following statements.

Utah International, aka, Utah Construction Company have made application with the Division of Water Rights for an appropriation of water in both the Kanab and Johnson Creek drainages. The applications are in good standing and are presently listed as Pending - Not Approved. In a policy meeting held in the Kane County Courthouse several years ago a determination was made to withhold further action on the approval of new applications to appropriate water in this drainage area. There are a number of approved applications that have not been completely developed and it is not known at this time what effect total development will have on the existing water supplies. Additional hydrologic study will have to be conducted in this area.

Based on the present administrative policy of the State Engineer it is not anticipated at this time that a decision can be made concerning an allocation of water for the subject project. The approval could not be made if there is known or even suspected interference possible. The test wells developed by Utah Internation have not been test pumped and without this data it would be impossible to complete our analysis. Additional information, as it developes, will be sent to your office for consideration.

Yours truly,

Gerald W. Stoker
Area Engineer

GWS/sm

APPENDIX 15

U.S. Fish and Wildlife Service Confirmation of Consultation on Threatened and Endangered Plant Species

United States Department of the Interior

FISH AND WILDLIFE SERVICE

MAILING ADDRESS
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION
134 Union Blvd.
Lakewood, Colorado 80228

IN REPLY REFER TO
FA/SE/BLM-Allen-Warner
Valley (6-5-77-F-18)

JAN 16 1980

MEMORANDUM

To: State Director, Bureau of Land Management
Salt Lake City, Utah

From: Regional Director, Region 6
U.S. Fish & Wildlife Service, Denver, Colorado

Subject: Section 7 Consultation--Allen-Warner Valley Energy System

This acknowledges your December 28, 1979, memorandum concerning the subject project. We are presently reviewing the changes in the project and alternatives and will respond further as soon as possible. Since two other Regions are involved, their input is necessary.

Several plant species, which may occur in the project area, have been recently added to the endangered species list. In Utah, these plants include:

<u>Arctomecon</u> <u>humilis</u> (Dwarf bear poppy; listed November 6, 1979)
<u>Echinocereus</u> <u>engelmannii</u> var. <u>purpureus</u> (Purple-spined hedgehog cactus; listed October 11, 1979)
<u>Pediocactus</u> <u>sileri</u> (Siler pincushion cactus; listed October 26, 1979)

There may be other endangered plant species in Regions 1 and 2. We will enclose any additional species as soon as we have input from the other Regions.

A biological assessment should be prepared on the above species if construction had not commenced before they were listed. This requirement is pursuant to Section 7(c) of the Endangered Species Act Amendments of 1978 which were signed into law November 10, 1978.

Don W. Minnich

DON W. MINNICH

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

APPENDIX 16

Cultural Resources Memorandums of Understanding - Advisory Council on Historic Preservation and States of Arizona, California, Nevada, and Utah

Advisory Council On Historic Preservation

1

1522 K Street N.W.
Washington D.C.
20005

July 18, 1979

Mr. Paul Howard
State Director
Bureau of Land Management
University Club Building
136 East South Temple
Salt Lake City, Utah 84111

Dear Mr. Howard:

This is to acknowledge receipt of the draft environmental statement for the proposed Intermountain Power Project, Wayne County, Utah on July 16, 1979. We regret that we will be unable to review and comment on this document in a timely manner pursuant to Section 102(2)(C) of the National Environmental Policy Act of 1969.

Nevertheless, the Bureau of Land Management is reminded that, if the proposed undertaking will affect properties included in or eligible for inclusion in the National Register of Historic Places, it is required by Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. Sec. 470f, as amended, 90 Stat. 1320) to afford the Council an opportunity to comment on the undertaking prior to the approval of the expenditure of any Federal funds or prior to the issuance of any license. The Council's regulations, "Protection of Historic and Cultural Properties" (36 CFR Part 800.4) detail the steps an agency is to follow in requesting Council comment.

1 Generally, the Council considers environmental evaluations to be adequate when they contain evidence of compliance with Section 106 of the National Historic Preservation Act, as amended. The environmental documentation must demonstrate that either of the following conditions exists:

1. No properties included in or that may be eligible for inclusion in the National Register are located within the area of environmental impact, and the undertaking will not affect any such property. In making this determination, the Council requires:

--evidence that the agency has consulted the latest edition of the National Register (Federal Register, February 6, 1979, and its monthly supplements);

1 --evidence of an effort to ensure the identification of properties eligible for inclusion in the National Register, including evidence of contact with the State Historic Preservation Officer, whose comments should be included in the final environmental statement.

2. Properties included in or that may be eligible for inclusion in the National Register are located within the area of environmental impact, and the undertaking will or will not affect any such property. In cases where there will be an effect, the final environmental statement should contain evidence of compliance with Section 106 of the National Historic Preservation Act through the Council's regulations, "Protection of Historic and Cultural Properties".

Should you have any questions, please call Jane King at (303) 234-4946, an FTS number.

Sincerely,

for Louis S. Wall
Chief, Western Division
of Project Review

CULTURAL RESOURCES
MEMORANDUM OF UNDERSTANDING
ALLEN-WARNER VALLEY ENVIRONMENTAL IMPACT STATEMENT

BETWEEN

THE BUREAU OF LAND MANAGEMENT
AND
THE STATE OF ARIZONA

I. PURPOSE

The Bureau of Land Management, hereinafter referred to as the Bureau, is preparing the Environmental Impact Statement under the provisions of the National Environmental Policy Act of 1969. The Bureau has determined that cultural values could be damaged or lost as a result of actions proposed in the AWV EIS. The following kinds of actions are proposed on public lands administered by the Bureau:

a. Non-Bureau Energy Initiative (NBEI) proposals submitted to the Bureau. These include proposals for rights-of-way and other land uses involving the surface of public lands

b. Major transportation network proposals in connection with powerplant operation.

c. Alternatives to the proposals.

The Arizona State Historic Preservation Office, hereinafter referred to as the State, is interested in assuring that cultural values in Arizona be protected. The Bureau and the State have consulted and agree as to the measures, outlined in this agreement, which should be undertaken to protect these values should authorization be granted to use public lands in Arizona administered by the Bureau for the purpose of any of the above mentioned proposed actions. In this agreement, "cultural resources" mean data and sites which have archaeological, historical, architectural, or cultural importance and interest.

Investigators will be qualified to evaluate these "cultural resources." Qualifications of investigators will be submitted to the State Historic Preservation Officer.

II. AUTHORITY

This agreement is authorized under the Federal Land Policy and Management Act of 1976 and the National Historic Preservation Act of 1966. It is in accord with Bureau policies and programs. It does not abrogate nor amend any other agreement between the Bureau and the State.

III. RESPONSIBILITIES AND PROCEDURES

The Bureau will comply with 36 CFR 800 in identifying sites which are listed in or eligible for inclusion in the National Register of Historic Places.

A. As part of the planning and environmental analysis required prior to any decision to authorize right-of-way, the Bureau will search for archaeological and historical literature concerning the AWV area.

B. After completing the planning and environmental analysis process, should the proposed management be implemented, the Bureau will inform project participants of, monitor compliance with, and enforce the following stipulations:

1. Prior to initiation of ground-disturbing activities, literature searches and intensive surveys will be undertaken on all areas which would be disturbed.

2. Wherever possible and feasible, cultural resources will be avoided by construction and related activities. This will be accomplished mainly by rerouting linear facilities such as transmission lines, roads, fences, and pipelines, and adjusting locations of other facilities.

3. A professional archaeologist may be required to be present when ground-disturbing operations are underway.

4. Subsurface cultural remains that are encountered during any construction will be professionally recovered if there is no other recourse in such a situation.

C. Wherever it is not possible and feasible to avoid sites that contain cultural values, the Bureau will consult with the State to determine the most satisfactory means of mitigating damage, as required by 36 CFR 800.

D. The Bureau will provide cultural resources reports, technical reports, and other pertinent material to the State.

IV. The attached project description identifies the actions that the Bureau anticipates will be included in the description. This may be brought up to date, as necessary, without amending this agreement in any way.

V. IMPLEMENTATION

A. This agreement will become effective on the date of the last signature on this agreement.

B. Either party may request revision or cancellation of this agreement by written notice, not less than 30 days prior to the time when such action is proposed.

C. Any problems resulting from this agreement which cannot be resolved by the Bureau and the State will be dealt with pursuant to the regulations of the Advisory Council on Historic Preservation, 'Protection of Historic and Cultural Properties' (36 CFR Part 800)."

FEB 14 1980	Tom Allen Acting
Date	Arizona State Director Bureau of Land Management Department of the Interior
28 Mar 1980	J. Ayres
Date	Arizona State Historic Preservation Officer

CULTURAL RESOURCES
MEMORANDUM OF UNDERSTANDING
INTERMOUNTAIN POWER PROJECT ENVIRONMENTAL STATEMENT

BETWEEN

THE BUREAU OF LAND MANAGEMENT
AND
THE STATE OF CALIFORNIA

I. PURPOSE

The Bureau of Land Management, hereafter referred to as the Bureau, is preparing the Intermountain Power Project Environmental Statement (IPP ES) under the provisions of the National Environmental Policy Act of 1969. The Bureau has determined that cultural values could be damaged or lost as a result of actions proposed in the IPP ES. The following kinds of actions are proposed on public lands administered by the Bureau:

a. Non-Bureau Energy Initiative (NBEI) proposals submitted to the Bureau. These include proposals for rights-of-ways and other land uses involving the surface of public lands.

b. Major transportation network proposals in connections with power plant operation.

The California State Historic Preservation Officer, hereinafter referred to as the State, is interested in assuring that cultural values in California be protected. The Bureau and the State have consulted and agree as to the measures, outlined in this agreement, which should be undertaken to protect these values should authorization be granted to use public lands in California administered by the Bureau for the purpose of any of the above mentioned proposed actions. In this agreement, "cultural resources" mean data and sites which have archeological, historical, architectural, or cultural importance and interest.

Investigators will be qualified (per 36 CFR 66) to evaluate these "cultural resources." Qualifications of investigators will be submitted to the State.

II. AUTHORITY

This agreement is authorized under the Federal Land Policy and Management Act of 1976 and the National Historic Preservation Act of 1966. It is in accord with Bureau policies and programs. It does not abrogate nor amend any other agreement between the Bureau and the State.

III. RESPONSIBILITIES AND PROCEDURES

The Bureau will comply with 36 CFR 800 in identifying sites which are listed in or eligible for inclusion in the National Register of Historic Places and determining potential effects and appropriate impact mitigation measures.

A. As part of the planning and environmental analysis required prior to any decision to authorize rights-of-way for the proposed IPP, the Bureau will consult with the State and will search for archeological, historical and ethnographic literature concerning the IPP area. Consultation with local Native American groups to identify areas of cultural significance will be completed (per P.L. 95-341). Class II studies (designed sampling inventories) have been conducted on all public lands that would be affected by the IPP proposal and alternatives. Reports and resource management plans generated at this stage will be reviewed by the State.

B. Wherever it is determined to be not possible and feasible to avoid sites that contain cultural values, the Bureau will consult with the State and the local Native American community to determine the most satisfactory means of mitigating damage, as required by (36 CFR 800). The Native American Heritage Commission shall be consulted to determine the most satisfactory means of mitigating damage, when local Native Americans are not available. Cultural materials will be curated in accordance with current curation standards (per 1906 Antiquity Act) and in accordance with the desires of the local Native Americans for prehistoric materials. Human remains and objects determined to be sacred to the local Native Americans shall be treated in accordance with their desires.

C. After completing the planning and environmental analysis process, should the proposed management be implemented, the Bureau will inform project participants of, monitor compliance with, and enforce the following stipulations:

    1. Prior to initiation of ground-disturbing activities, literature searches and intensive surveys will be undertaken on all areas which would be disturbed. The potential affects of the undertaking on National Register eligible properties will be evaluated (per 36 CFR Part 800).

    2. Whevever possible and feasible, cultural resources will be avoided by construction and related activities. This will be accomplished mainly by rerouting linear facilities such as transmission lines, roads, fences and pipelines, and adjusting locations of other facilities.

    3. A professional archaeologist and a Native American representative (from the appropriate group) will be required to be present when ground fisturbing operations are underway in culturally significant areas, i.e., burial places and cemeteries, places of spiritual or social importance, sacred hot springs, obsidian outcrops, ceremonial sites, and shrines.

4. Subsurface cultural resources that are encountered during any construction will be preserved through data recovery if there is no other recourse in such a situation.

D. The Bureau will provide cultural resources reports, technical reports, and other pertinent materials to the State, local Native Americans and the California Native American Heritage Commission.

E. The State will provide the Bureau with a letter, for use as an exhibit in the IPP ES, to the effect that the procedures herein proposed by the Bureau, if correctly implemented, will satisfy the State's interest.

IV. The attached list identifies the specific actions that the Bureau anticipates will be included in the IPPES. The list may be brought up to date, as necessary, without amending this agreement in any way.

V. IMPLEMENTATION

A. This agreement will become effective on the date of the last signature on this agreement.

B. Either party may request revision or cancellation of this agreement by written notice, not less than 30 days prior to the time when such action is proposed.

September 6, 1979
Date:

California State Director
Bureau of Land Management
Department of Interior

9/12/79
Date:

Knox Mellon
California State Historic
Preservation Officer

STATE OF CALIFORNIA—THE RESOURCES AGENCY EDMUND G. BROWN JR., Governor

OFFICE OF HISTORIC PRESERVATION
DEPARTMENT OF PARKS AND RECREATION
POST OFFICE BOX 2390
SACRAMENTO, CALIFORNIA 95811

September 18, 1979

Mr. Craig Harmon
Richfield District Office
Bureau of Land Management
P.O. Box 768
Richfield, Utah 84701

RE: Intermountain Power Project Memorandum of Understanding

Dear Mr. Harmon:

My staff has reviewed the referenced Memorandum of Understanding for Cultural Resources between the BLM and the State of California (SHPO).

I feel that through cooperative application of the conditions in this Agreement, the cultural resources within the IPPs area of potential environmental impact can be adaquately preserved.

If you have any questions or concerns, please feel free to contact Jeffery Bingham, Staff Archeologist, at (916) 322-8701.

Sincerely,

K Mellon

Dr. Knox Mellon
State Historic Preservation Officer
Office of Historic Preservation

FJ04
(N-921)

Memorandum of Understanding
Between
The Bureau of Land Managment
and
The State of Nevada

Allen-Warner Valley Environmental Impact Statement

Cultural Resources

This agreement, effective on the date of last signature, is made by and between the United States of America, acting by and through the Bureau of Land Management, herein referred to as the "Bureau," and the State of Nevada, acting by and through the Division of Historic Preservation and Archeology, herein referred to as the "State."

WHEREAS, pursuant to Executive Order 11593 the Bureau is to institute procedures to assure that federal plans and programs contribute to the preservation and enhancement of non-federally owned properties of historical, architectural, archeological, or paleontological in a cultural context significance; and

WHEREAS, pursuant to 36 Code of Federal Regulations Part 60.5 and Nevada Revised Statutes 383.021 the State is to develop effective working relationships with other agencies that participate in the identification and management of cultural resources;

Now, therefore, in consideration of these facts and premises, it is mutually agreed that:

The Bureau and the State will maintain an open dialogue relative to the planning of cultural resource related activities on the Allen-Warner Valley Energy System in order that duplication of effort and the inefficient expenditure of public funds are minimized. All opportunities for the coordination of programs will be fully explored in an expeditious manner.

14 Feb. 80
Date

Associate Nevada State Director
Bureau of Land Management
Department of the Interior

6 February 1980
Date

Nevada State Historic
Preservation Officer

CULTURAL RESOURCES
MEMORANDUM OF UNDERSTANDING
ALLEN-WARNER VALLEY ENVIRONMENTAL IMPACT STATEMENT

BETWEEN

THE BUREAU OF LAND MANAGEMENT
AND
THE STATE OF UTAH

I. PURPOSE

The Bureau of Land Management, hereinafter referred to as the Bureau, is preparing the Environmental Impact Statement under the provisions of the National Environmental Policy Act of 1969. The Bureau has determined that cultural values could be damaged or lost as a result of actions proposed in the AWV EIS. The following kinds of actions are proposed on public lands administered by the Bureau:

a. Non-Bureau Energy Initiative (NBEI) proposals submitted to the Bureau. These include proposals for rights-of-way and other land uses involving the surface of public lands

b. Major transportation network proposals in connection with powerplant operation.

c. Alternatives to the proposals.

The Utah State Historic Preservation Office, hereinafter referred to as the State, is interested in assuring that cultural values in Utah be protected. The Bureau and the State have consulted and agree as to the measures, outlined in this agreement, which should be undertaken to protect these values should authorization be granted to use public lands in Utah administered by the Bureau for the purpose of any of the above mentioned proposed actions. In this agreement, "cultural resources" mean data and sites which have archaeological, historical, architectural, or cultural importance and interest.

Investigators will be qualified to evaluate these "cultural resources." Qualifications of investigators will be submitted to the State Historic Preservation Officer.

II. AUTHORITY

This agreement is authorized under the Federal Land Policy and Management Act of 1976 and the National Historic Preservation Act of 1966. It is in accord with Bureau policies and programs. It does not abrogate nor amend any other agreement between the Bureau and the State.

III. RESPONSIBILITIES AND PROCEDURES

The Bureau will comply with 36 CFR 800 in identifying sites which are listed in or eligible for inclusion in the National Register of Historic Places.

A. As part of the planning and environmental analysis required prior to any decision to authorize right-of-way, the Bureau will search for archaeological and historical literature concerning the AWV area.

B. After completing the planning and environmental analysis process, should the proposed management be implemented, the Bureau will inform project participants of, monitor compliance with, and enforce the following stipulations:

1. Prior to initiation of ground-disturbing activities, literature searches and intensive surveys will be undertaken on all areas which would be disturbed.

2. Wherever possible and feasible, cultural resources will be avoided by construction and related activities. This will be accomplished mainly by rerouting linear facilities such as transmission lines, roads, fences, and pipelines, and adjusting locations of other facilities.

3. A professional archaeologist may be required to be present when ground-disturbing operations are underway.

4. All cultural resources that are encountered during any construction will be salvaged if there is no other recourse in such a situation.

C. Wherever it is not possible and feasible to avoid sites that contain cultural values, the Bureau will consult with the State to determine the most satisfactory means of mitigating damage, as required by 36 CFR 800.

D. The Bureau will provide cultural resources reports, technical reports, and other pertinent material to the State.

IV. The attached project description identifies the actions that the Bureau anticipates will be included in the description. This may be brought up to date, as necessary, without amending this agreement in any way.

V. IMPLEMENTATION

A. This agreement will become effective on the date of the last signature on this agreement.

B. Either party may request revision or cancellation of this agreement by written notice, not less than 30 days prior to the time when such action is proposed.

C. Any problems resulting from this agreement which cannot be resolved by the Bureau and the State will be referred to the Secretary of the Interior and the Governor of Utah for resolution.

JAN 23 1980 Date	Gary J. Wicks Utah State Director Bureau of Land Management Department of the Interior
30 Jan 1980 Date	Melvin T. Smith Utah State Historic Preservation Officer

APPENDIX 17

Socioeconomic Impact Projections

The tables in this appendix present major socioeconomic impact projections for Kane and Washington Counties of Utah. Tables 1 through 8 correspond with discussions for Kane County in ALTERNATIVES 1 and 2, Chapter 4. Tables 9 through 15 correspond with discussions for Washington County in ALTERNATIVE 1, Chapter 4. Tables 16 through 22 correspond with discussions for Kane County in ALTERNATIVE 3, Chapter 4. Tables 23 through 25 correspond with discussions for Washington County in ALTERNATIVE 3, Chapter 4.

TABLE 1

ALTERNATIVES 1 and 2: Population Impact Projections for Kane County

County/City	1980 Baseline Population	1980 Population With Project	1980 Increment Due To Project	1985 Baseline Population	1985 Population With Project	1985 Increment Due To Project	1990 Baseline Population	1990 Popultaion With Project	1990 Increment Due To Project
Kane County	4,200	4,200	0	4,500	7,166	2,666	5,100	8,459	3,359
Alton	55	55	0	49	124	75	46	141	95
Glendale	173	173	0	157	689	532	152	822	670
Kanab	3,041	3,041	0	3,335	4,712	1,377	3,842	5,578	1,736
Orderville	368	368	0	329	1,011	682	324	1,182	858
	1995			2000			2020		
Kane County	5,550	9,424	3,874	6,000	10,065	4,065	7,800	11,919	4,119
Alton	42	152	110	37	154	117	19	139	120
Glendale	142	907	765	131	944	813	89	917	828
Kanab	4,243	6,214	1,971	4,643	6,740	2,097	6,245	8,382	2,137
Orderville	302	1,330	1,028	280	1,318	1,038	192	1,246	1,054

Source: Centaur Associates, Inc. 1980

TABLE 2

ALTERNATIVES 1 and 2: Cumulative Employment Impact Projections for Kane County

Sector	1985 Without Project		1985 With Project		1990 Without Project		1990 With Project		1995 Without Project		1995 With Project	
Agriculture	170	(11.7)	170	(6.8)	170	(10.2)	170	(5.7)	163	(8.9)	163	(4.7)
Mining	0	(0.0)	510	(20.4)	0	(0.0)	840	(28.0)	0	(0.0)	1,015	(29.4)
Construction	90	(6.2)	253	(10.1)	100	(6.0)	133	(4.4)	110	(6.0)	150	(4.3)
Manufacturing	110	(7.6)	110	(4.0)	140	(8.4)	140	(4.7)	163	(8.9)	163	(4.7)
TCU[a]	50	(3.4)	117	4.7)	60	(3.6)	132	(4.4)	63	(3.4)	138	(4.0)
Trade	330	(22.8)	430	(17.2)	380	(22.9)	506	(16.9)	417	(22.8)	570	(16.5)
FIRE[b]	40	(2.8)	52	(2.1)	40	(2.4)	53	(1.8)	47	(2.6)	65	(1.9)
Services	350	(24.1)	466	(18.6)	400	(24.1)	532	(17.7)	450	(24.6)	617	(17.9)
Government	310	(21.4)	404	(16.1)	370	(22.3)	492	(16.4)	417	(22.8)	570	(16.5)
TOTAL[c]	1,450	(100.0)	2,512	(100.0)	1,660	(100.0)	2,998	(100.0)	1,830	(100.0)	3,451	(100.0)

Sector	2000				2020			
Agriculture	158	(7.9)	158	(4.3)	138	(5.1)	138	(3.1)
Mining	0	(0.0)	1,080	(29.1)	0	(0.0)	1,100	(24.7)
Construction	120	(6.0)	161	(4.3)	160	(5.9)	200	(4.5)
Manufacturing	188	(9.4)	188	(5.1)	288	(10.5)	288	(6.5)
TCU[a]	68	(3.4)	143	(3.9)	88	(3.2)	162	(3.6)
Trade	457	(22.7)	612	(16.5)	617	(22.6)	771	(17.3)
FIRE[b]	52	(2.6)	70	(1.9)	72	(2.6)	90	(2.0)
Services	500	(24.9)	671	(18.1)	700	(25.6)	876	(19.7)
Government	467	(23.2)	625	(16.9)	667	(24.4)	833	(18.7)
TOTAL[c]	2,010	(100.0)	3,708	(100.0)	2,730	(100.0)	4,458	(100.0)

Source: Centaur Associates, Inc., 1980

[a]TCU = transportation, communications, utilities
[b]FIRE = finance, insurance, real estate
[c]Totals may not add to 100.0 percent due to rounding.

NOTE: Numbers in parentheses denote percent share in total employment.

TABLE 3

ALTERNATIVES 1 and 2: Police Service Requirement Impact Projections for Kane County

Community	Full Time Equivalent Officers 1978	1980 Total Need Without the Action	1980 Total Need With the Action	1980 Additional Need Due to the Action	1985 Total Need Without the Action	1985 Total Need With the Action	1985 Additional Need Due to the Action	1990 Total Need Without the Action	1990 Total Need With the Action	1990 Additional Need Due to the Action
Kane County										
Alton	N/A	<1	<1	0	<1	<1	<1	<1	<1	<1
Glendale	N/A	<1	<1	0	<1	1.5	1.0	<1	2	1.5
Kanab	3	6.5	6.5	0	7.0	9.5	2.5	8.0	11.5	3.5
Orderville	N/A	1.0	1.0	0	1.0	2.5	1.5	1	2.5	1.5
Kane County		1995			2000			2020		
Alton	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1
Glendale	N/A	<1	2.0	1.5	<1	2.0	1.5	<1	2	1.5
Kanab	3	8.5	12.5	4.0	9.5	13.5	4.0	12.5	17.5	4.5
Orderville	N/A	1.0	3.0	2.0	1.0	3.0	2.0	1.0	2.5	2.0

Source: Centaur Associates, Inc., 1980

NOTE: All figures represent numbers of police officers.
N/A = not applicable

TABLE 4

ALTERNATIVES 1 and 2: Fire Service Requirement Impact Projections for Kane County

Community	Available Pumping Capacity (gmp) 1978	1980			1985			1990		
		Total Need Without the Action (gmp)	Total Need With the Action (gmp)	Additional Need Due to the Action (gmp)	Total Need Without the Action (gmp)	Total Need With the Action (gmp)	Additional Need Due to the Action (gmp)	Total Need Without the Action (gmp)	Total Need With the Action (gmp)	Additional Need Due to the Action (gmp)
Kane County										
Alton	N/A	500-1,000	500-1,000	0	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500
Glendale	N/A	500-1,000	500-1,000	0	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500
Kanab	2,500	1,750-2,000	1,750-2,000	0	1,750-2,000	2,000-2,250	0-500	1,750-2,000	2,250-2,500	250-750
Orderville	150	500-1,000	500-1,000	0	500-1,000	1,000-1,250	0-750	500-1,000	1,000-1,250	0-750
Kane County		1995			2000			2020		
Alton	N/A	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500
Glendale	N/A	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500
Kanab	2,500	2,000-2,250	2,500-3,000	250-1,000	2,000-2,250	2,500-3,000	250-1,000	2,500-3,000	2,500-3,000	0-500
Orderville	150	500-1,000	1,000-1,250	0-750	500-1,000	1,000-1,250	0-750	500-1,000	1,000-1,250	0-750

Source: Centaur Associates, Inc., 1980

NOTE: gmp = gallons per minute pumped
N/A = not applicable

TABLE 5

ALTERNATIVES 1 and 2: Water Supply Requirement Impact Projections for Kane County

Community	1978 Supply (mgd)	1980 Total Need Without the Action (mgd)	1980 Total Need With the Action (mgd)	1980 Additional Need Due to the Action (mgd)	1985 Total Need Without the Action (mgd)	1985 Total Need With the Action (mgd)	1985 Additional Need Due to the Action (mgd)	1990 Total Need Without the Action (mgd)	1990 Total Need With the Action (mgd)	1990 Additional Need Due to the Action (mgd)
Kane County										
Alton	0.010	0.025	0.025	0	0.022	0.056	0.034	0.021	0.063	0.043
Glendale	0.250	0.078	0.078	0	0.071	0.310	0.239	0.068	0.370	0.302
Kanab	1.750	1.368	1.368	0	1.501	2.120	0.620	1.729	2.510	0.781
Orderville	0.426	0.166	0.166	0	0.148	0.455	0.307	0.146	0.532	0.386
Kane County		1995			2000			2020		
Alton	0.010	0.019	0.068	0.050	0.017	0.069	0.053	0.009	0.063	0.054
Glendale	0.250	0.064	0.408	0.344	0.059	0.425	0.366	0.040	0.413	0.373
Kanab	1.750	1.909	2.796	0.887	2.089	3.033	0.944	2.810	3.772	0.962
Orderville	0.426	0.136	0.599	0.463	0.126	0.593	0.467	0.086	0.561	0.474

Source: Centaur Associates, Inc., 1980

NOTE: mgd = million gallons per day

TABLE 6

ALTERNATIVES 1 and 2: Water Supply Requirement Impact Projections for Kane County

Community	1978 Treatment Capacity (mgd)	1980 Total Need Without the Action (mgd)	1980 Total Need With the Action (mgd)	1980 Additional Need Due to the Action (mgd)	1985 Total Need Without the Action (mgd)	1985 Total Need With the Action (mgd)	1985 Additional Need Due to the Action (mgd)	1990 Total Need Without the Action (mgd)	1990 Total Need With the Action (mgd)	1990 Additional Need Due to the Action (mgd)
Kane County										
Alton	N/A	0.009	0.009	0	0.008	0.021	0.013	0.008	0.024	0.016
Glendale	N/A	0.029	0.029	0	0.026	0.116	0.089	0.026	0.138	0.113
Orderville	N/A	0.062	0.062	0	0.055	0.170	0.115	0.054	0.199	0.144
Total	...	0.091	0.091	0	0.082	0.286	0.204	0.080	0.337	0.257
Kanab	0.3	0.511	0.511	0	0.560	0.792	0.231	0.645	0.937	0.292
Kane County		1995			2000			2020		
Alton	N/A	0.007	0.026	0.018	0.006	0.026	0.020	0.003	0.023	0.020
Glendale	N/A	0.024	0.152	0.129	0.022	0.159	0.137	0.015	0.154	0.139
Orderville	N/A	0.051	0.223	0.173	0.047	0.221	0.174	0.032	0.209	0.177
Total	...	0.075	0.376	0.301	0.069	0.380	0.311	0.047	0.363	0.316
Kanab	0.3	0.0713	1.044	0.331	0.780	1.132	0.352	1.049	1.408	0.359

Source: Centaur Associates, Inc., 1980

NOTE: mgd = million gallons per day
N/A = not applicable

TABLE 7

ALTERNATIVES 1 and 2: School District Enrollment and Teacher Impact Projections

School District/ Enrollment and FTE[a] Teachers	1978 Enrollment and FTE[a] Teachers	1980			1985			1990		
		Total Need Without the Action	Total Need With the Action	Additional Need Due to the Action	Total Need Without the Action	Total Need With the Action	Additional Need Due to the Action	Total Need Without the Action	Total Need With the Action	Additional Need Due to the Action
Kane County										
Enrollment	1,022	1,050	1,050	0	1,125	1,792	667	1,275	2,115	840
Teachers	52	53	53	0	57	91	34	65	108	43
Kane County		1995			2000			2020		
Enrollment	1,022	1,388	2,356	968	1,500	2,516	1,016	1,950	2,980	1,030
Teachers	52	71	120	49	76	128	52	99	152	53

Source: Centaur Associates, Inc., 1980

[a]FTE = full time equivalent

NOTE: Projected enrollment is based on the assumption that enrollment would remain the same proportion of the county's population in the future as it was in 1978. Projected need for teachers is based on the assumption that the student/teacher ratio would remain the same in the future as it was in 1978.

TABLE 8

ALTERNATIVES 1 and 2: Health Care Facilities Impact Projections for Kane County

County/ Type of Facility	1978 Number of Beds	1980 Total Need Without the Action	1980 Total Need With the Action	1980 Additional Need Due to the Action	1985 Total Need Without the Action	1985 Total Need With the Action	1985 Additional Need Due to the Action	1990 Total Need Without the Action	1990 Total Need With the Action	1990 Additional Need Due to the Action
Kane County										
Hospital (Beds)	20	6	6	0	7	10	3	7	12	5
Nursing Home (Beds)	13	24	24	0	25	33	8	27	38	11
Kane County		1995			2000			2020		
Hospital (Beds)	20	8	14	6	9	15	6	11	17	6
Nursing Home (Beds)	13	28	41	13	30	43	13	35	49	14

Source: Centaur Associates, Inc., 1980

NOTE: Projected needs are based on the following standards:

Hospital Beds:

1) $\frac{\text{Patient days per year}}{\text{Current population}}$ = Current use rate

2) $\frac{\text{Current use rate x projected population}}{365}$ = Average bed need per day

3) $\frac{\text{Average bed need per day}}{.80}$ = Bed need for projected year

Nursing Home Beds:

1) $\frac{\text{Patient days per year}}{\text{Current population}}$ = Current use rate

2) $\frac{\text{Current use rate x projected population}}{365}$ = Average bed need per day

3) $\frac{\text{Average bed need per day}}{.90}$ + 10 = Bed need for projected year

TABLE 9

ALTERNATIVE 1: Population Impact Projections for Washington County

Community	1980 Baseline Population	1980 Population With Project	1980 Increment Due to Project	1985 Baseline Population	1985 Population With Project	1985 Increment Due to Project	1990 Baseline Population	1990 Population With Project	1990 Increment Due to Project
Hurricane	2,023	2,023	0	2,180	2,798	618	2,338	2,400	62
Ivins	442	442	0	518	662	144	582	592	10
LaVerkin	954	954	0	1,118	1,385	267	1,254	1,283	29
Leeds	290	290	0	316	406	90	342	350	8
St. George	10,946	10,946	0	12,828	18,614	5,786	14,394	16,239	1,845
Santa Clara	726	726	0	881	1,054	173	956	978	22
Toquerville	386	386	0	453	543	90	508	516	8
Washington	2,243	2,243	0	2,628	3,473	845	2,950	3,045	95
	1995			2000			2020		
Hurricane	2,495	2,557	62	2,652	2,714	62	3,281	3,343	62
Ivins	646	656	10	714	724	10	986	996	10
LaVerkin	1,394	1,423	29	1,541	1,570	29	2,128	2,157	29
Leeds	369	377	8	395	403	8	500	508	8
St. George	15,997	18,019	2,022	17,681	19,797	2,116	24,416	26,560	144
Santa Clara	1,062	1,084	22	1,174	1,196	22	1,622	1,644	22
Toquerville	565	573	8	625	633	8	864	872	8
Washington	3,278	3,373	95	3,623	3,718	95	5,003	5,098	95

Source: Centaur Associates, Inc., 1980

TABLE 10

ALTERNATIVE 1: Cumulative Employment Impact Projections for Washington County

Sector	1985				1990				1995			
	Without Project		With Project		Without Project		With Project		Without Project		With Project	
Agriculture	475	(5.8)	475	(4.6)	461	(5.1)	461	(4.8)	449	(4.5)	449	(4.3)
Mining	13	(0.2)	13	(0.1)	13	(0.1)	13	(0.1)	12	(0.1)	12	(0.1)
Construction	524	(6.4)	1,538	(14.8)	568	(6.3)	602	(6.3)	614	(6.2)	653	(6.2)
Manufacturing	794	(9.7)	794	(7.6)	920	(10.2)	920	(9.6)	1,075	(10.9)	1,075	(10.2)
TCU[a]	296	(3.6)	458	(4.4)	322	(3.6)	456	(4.8)	349	(3.5)	484	(4.6)
Trade	2,513	(30.8)	2,956	(28.4)	2,705	(30.0)	2,863	(29.9)	2,909	(29.4)	3,093	(29.4)
FIRE[b]	388	(4.8)	457	(4.4)	443	(4.9)	469	(4.9)	499	(5.1)	531	(5.0)
Services	1,383	(16.9)	1,627	(15.6)	1,580	(17.5)	1,674	(17.5)	1,782	(18.0)	1,895	(18.0)
Government	1,774	(21.7)	2,086	(20.0)	1,999	(22.2)	2,129	(22.2)	2,189	(22.2)	2,328	(21.2)
Total[c]	8,160	(100.0)	10,404	(100.0)	9,011	(100.0)	9,582	(100.0)	9,878	(100.0)	10,515	(100.0)

Sector	2000				2020			
Agriculture	437	(4.1)	437	(3.8)	387	(2.7)	387	(2.6)
Mining	12	(0.1)	12	(0.1)	10	(0.1)	10	(0.1)
Construction	660	(6.1)	700	(6.1)	842	(5.9)	881	(5.9)
Manufacturing	1,222	(11.4)	1,222	(10.7)	1,812	(12.8)	1,812	(12.2)
TCU[a]	376	(3.5)	512	(4.5)	484	(3.4)	619	(4.2)
Trade	3,110	(29.0)	3,300	(28.9)	3,914	(27.6)	4,099	(27.6)
FIRE[b]	554	(5.2)	588	(5.2)	776	(5.5)	813	(5.5)
Services	1,983	(18.5)	2,104	(18.4)	2,787	(19.6)	2,917	(19.6)
Government	2,388	(22.2)	2,533	(22.2)	3.184	(22.4)	3,333	(22.9)
Total[c]	10,742	(100.0)	11,408	(100.0)	14,196	(100.0)	14,871	(100.0)

Source: Centaur Associates, Inc., 1980

[a]TCU = transportation, communications, utilities
[b]FIRE = fire, insurance, real estate
[c]Totals may not add to 100.0 percent due to rounding.

NOTE: Numbers in parentheses denote percent share in total employment.

TABLE 11

ALTERNATIVE 1: Incremental Earning Projections for Washington County (Thousands of 1977 Dollars)

Type of Employment	1985	1990	1995	2000	2020
Temporary Construction	13,949.9	0	0	0	0
Operating	2,326.5	2,638.7	2,913.4	3,216.5	3,216.5
Indirect	13,021.9	5,814.6	6,711.8	7,794.1	7,859.5
Total	29,198.3	8,453.3	9,625.2	11,010.6	11,076.0

Source: Centaur Associates, Inc. 1980

TABLE 12

ALTERNATIVE 1: Police Service Requirement Impact Projections for Washington County

Washington County	Hurricane	Ivins	LaVerkin	Leeds	St. George	Santa Clara	Toquerville	Washington
1978								
Full Time Equivalent Officers	[a]3	1	pt	1	20	N/A	N/A	[b]4.5
1980								
Total Need Without Action	4.5	**	2	**	19	1.5	**	4.5
Total Need With Action	4.5	**	2	**	19	1.5	**	4.5
Additional Need Due to Action	0	0	0	0	0	0	0	0
1985								
Total Need Without Action	4.5	1.5	2.5	**	22	2	**	5.5
Total Need With Action	6	1.5	3	**	32	2.5	1.5	7
Additional Need Due to Action	1.5	*	**	*	10	*	*	1.5
1990								
Total Need Without Action	5	1.5	3	**	24.5	2	1.5	6
Total Need With Action	5	1.5	3	**	28	2	1.5	6.5
Additional Need Due to Action	*	*	*	*	3.5	*	*	*
1995								
Total Need Without Action	5	1.5	3	**	27.5	2.5	1.5	7
Total Need With Action	5.5	1.5	3	**	31	2.5	1.5	7
Additional Need Due to Action	*	*	*	*	3.5	*	*	*
2000								
Total Need Without Action	5.5	1.5	3.5	**	30.5	2.5	1.5	7.5
Total Need With Action	5.5	1.5	3.5	**	34	2.5	1.5	7.5
Additional Need Due to Action	*	*	*	*	3.5	*	*	*
2020								
Total Need Without Action	7	2	4.5	1	42	3.5	2	10.5
Total Need With Action	7	2	4.5	1.5	45.5	3.5	2	10.5
Additional Need Due to Action	*	*	*	*	3.5	*	*	*

Source: Centaur Associates, Inc., 1980

[a]During the first half of 1978 the town also employed two part-time officers. A fourth full-time officer was to be hired in January, 1980.

[b]This figure is based on the assumption that the city's three part-time officers were employed half time. In July 1979, the city disbanded its police department and contracted with the Washington County Sheriff's Department to have two deputies stationed in the city.

NOTE: All figures represent numbers of police officers. For towns of over 500 persons (i.e., those needing more than one full-time officer), projected needs are rounded. Fractions less than 0.5 are rounded up to 0.5 and fractions greater than 0.5 are rounded up to 1.0. For towns under 10,000 population, projections are based on a standard of two full-time equivalent officers per 1,000 persons. For cities over 10,000, the standard for projections is 1.7 officers per 1,000 population.

pt = one part-time officer
N/A = not applicable (i.e., no town police force)
* = one officer working half time or less
** = one officer working more than half time

TABLE 13

ALTERNATIVE 1: Sewage Treatment Requirement Impact Projections for Washington County
(Million Gallons Per Day)

	Hurricane	LaVerkin	Toquer-ville	Total	Ivins	Leeds	St. George	Santa Clara	Total	Washington
1978										
Treatment Capacity	0.12	N/A	N/A	-	N/A	N/A	-	-	3.0	0.12
1980										
Total Need Without Action	0.340	0.160	0.065	0.565	0.074	0.049	1.839	0.122	1.961	0.377
Total Need With Action	0.340	0.160	0.065	0.565	0.074	0.049	1.839	0.122	1.961	0.377
Additional Need Due to Action	0	0	0	0	0	0	0	0	0	0
1985										
Total Need Without Action	0.366	0.188	0.076	0.630	0.087	0.053	2.155	0.148	2.303	0.442
Total Need With Action	0.470	0.233	0.091	0.794	0.111	0.068	3.127	0.177	3.304	0.583
Additional Need Due to Action	0.104	0.045	0.015	0.164	0.024	0.015	0.972	0.029	1.001	0.142
1990										
Total Need Without Action	0.393	0.211	0.085	0.689	0.098	0.057	2.418	0.161	2.579	0.496
Total Need With Action	0.403	0.216	0.087	0.705	0.099	0.059	2.728	0.164	2.892	0.512
Additional Need Due to Action	0.010	0.005	0.001	0.017	0.002	0.001	0.310	0.004	0.314	0.016
1995										
Total Need Without Action	0.419	0.234	0.095	0.748	0.109	0.062	2.687	0.178	2.866	0.551
Total Need With Action	0.430	0.239	0.096	0.765	0.110	0.063	3.027	0.182	3.209	0.567
Additional Need Due to Action	0.010	0.005	0.001	0.017	0.002	0.001	0.340	0.004	0.343	0.016
2000										
Total Need Without Action	0.446	0.259	0.105	0.809	0.120	0.066	2.970	0.197	3.168	0.609
Total Need With Action	0.456	0.264	0.106	0.826	0.122	0.068	3.326	0.201	3.527	0.625
Additional Need Due to Action	0.010	0.005	0.001	0.017	0.002	0.001	0.355	0.004	0.359	0.016
2020										
Total Need Without Action	0.551	0.358	0.145	1.054	0.166	0.084	4.102	0.272	4.374	0.841
Total Need With Action	0.562	0.362	0.146	1.070	0.167	0.085	4.462	0.276	4.738	0.856
Additional Need Due to Action	0.010	0.005	0.001	0.017	0.002	0.001	0.360	0.004	0.364	0.016

Source: Centaur Associates, Inc., 1980

TABLE 14

ALTERNATIVE 1: School District Enrollment and Teacher Impact Projections for Washington County

	Enrollment[a]	Teachers
1978		
Enrollment and FTE Teacher	5,385	212
1980		
Total Need Without Action	5,581	220
Total Need With Action	5,581	220
Additional Need Due to Action	0	0
1985		
Total Need Without Action	6,494	256
Total Need With Action	8,609	339
Additional Need Due to Action	2,115	83
1990		
Total Need Without Action	7,254	286
Total Need With Action	7,794	307
Additional Need Due to Action	540	21
1995		
Total Need Without Action	8,030	316
Total Need With Action	8,617	339
Additional Need Due to Action	587	23
2000		
Total Need Without Action	8,847	348
Total Need With Action	9,458	372
Additional Need Due to Action	611	24
2020		
Total Need Without Action	12,113	477
Total Need With Action	12,731	501
Additional Need Due to Action	618	24

Source: Centaur Associates, Inc., 1980

[a]Projected enrollment is based on the assumption that enrollment would remain the same proportion of the county's population in the future as it was in 1978.

NOTE: FTE = full time equivalent

TABLE 15

ALTERNATIVE 1: Health Care Facilities Impact Projections for Washington County

	Hospital Beds	Nursing Home Beds
1978		
Number of Beds	65	207
1980		
Total Need Without Action	54	193
Total Need With Action	54	193
Additional Need Due to Action	0	0
1985		
Total Need Without Action	63	223
Total Need With Action	83	292
Additional Need Due to Action	20	69
1990		
Total Need Without Action	70	248
Total Need With Action	75	265
Additional Need Due to Action	5	17
1995		
Total Need Without Action	77	273
Total Need With Action	83	292
Additional Need Due to Action	6	19
2000		
Total Need Without Action	85	300
Total Need With Action	91	320
Additional Need Due to Action	6	20
2020		
Total Need Without Action	117	407
Total Need With Action	123	427
Additional Need Due to Action	6	20

Source: Centaur Associates, Inc., 1980

NOTE: Projected needs are based on the following standards:

Hospital Beds:

1) $\frac{\text{Patient days per year}}{\text{Current population}}$ = Current use rate

2) $\frac{\text{Current use rate x projected population}}{365}$ = Average bed need per day

3) $\frac{\text{Average bed need per day}}{.80}$ = Bed need for projected year

Nursing home: Beds

1) $\frac{\text{Patient days per year}}{\text{Current population}}$ = Current use rate

2) $\frac{\text{Current use rate x projected population}}{365}$ = Average bed need per day

3) $\frac{\text{Average bed need per day}}{.90}$ + 10 = Bed need for projected year

TABLE 16

ALTERNATIVE 3: Population Impact Projections for Kane County

	Kane County	Alton	Glendale	Kanab	Orderville
1980					
Baseline Population	4,200	55	173	3,041	368
Increment Due to Project	0	0	0	0	0
1985					
Baseline Population	4,500	49	157	3,335	329
Population With Project	5,283	67	273	3,826	486
Increment Due to Project	783	18	116	491	157
1990					
Baseline Population	5,100	46	152	3,842	324
Population With Project	6,022	68	296	4,505	517
Increment Due to Project	1,022	22	144	563	193
1995					
Baseline Population	5,550	42	142	4,243	302
Population With Project	6,575	67	305	4,853	529
Increment Due to Project	1,025	25	163	610	227
2000					
Baseline Population	6,000	37	131	4,643	280
Population With Project	7,063	63	304	5,278	509
Increment Due to Project	1,063	26	173	635	229
2020					
Baseline Population	7,800	119	89	6,245	192
Population With Project	8,874	146	265	6,888	424
Increment Due to Project	1,074	27	176	643	232

Source: Centaur Associates, Inc., 1980

TABLE 17

ALTERNATIVE 3: Incremental Employment Impact Projections for Kane County

Type of Employment	1985	1990	1995	2000	2020
Temporary Construction	65	0	0	0	0
Operating					
Alton Mine	210	210	210	210	210
Truck Fleet	100	100	100	100	100
Indirect	188	188	188	188	188
Total	563	498	498	498	498

Source: Centaur Associates, Inc., 1980

TABLE 18

ALTERNATIVE 3: Cumulative Employment Impact Projections for Kane County

Sector	1985 Without Project		1985 With Project		1990 Without Project		1990 With Project		1995 Without Project		1995 With Project	
Agriculture	170	(11.7)	170	(8.6)	170	(10.2)	170	(7.8)	163	(8.9)	163	(6.8)
Mining	0	(0.0)	210	(10.6)	0	(0.0)	210	(9.6)	0	(0.0)	210	(8.8)
Construction	90	(6.2)	154	(7.8)	100	(6.0)	110	(5.0)	110	(6.0)	110	(4.6)
Manufacturing	110	(7.6	110	(5.5)	140	(8.4)	140	(6.4)	163	(8.9)	163	(6.8)
TCU[a]	50	(3.4)	150	(7.6)	60	(3.6)	165	(7.6)	63	(3.4)	167	(7.0)
Trade	330	(22.8)	380	(19.1	380	(22.9	443	(20.3)	417	(22.8)	494	(20.7)
FIRE[b]	40	(2.8)	46	(2.3)	40	(2.4)	47	(2.2)	47	(2.6)	56	(2.3)
Services	350	(24.1)	408	(20.6)	400	(24.1)	466	(21.4)	450	(24.6)	534	(22.3)
Government	310	(21.4)	357	(18.0)	370	(22.3)	431	(19.8)	417	(22.8)	494	(20.7)
TOTAL[c]	1,450	(100.0)	1,985	(100.0)	1,660	(100.0)	2,182	(100.0)	1,830	(100.0	2,391	(100.0)

Source: Centaur Associates, Inc., 1980

[a]TCU = transportation, communication, utilities
[b]FIRE = finance, insurance, real estate
[c]Totals may not add to 100.0 percent due to rounding.

NOTE: Numbers in parentheses denote percent share in total employment.

TABLE 19

ALTERNATIVE 3: Incremental Earnings Impact Projections for Kane County (Thousands of 1977 Dollars)

Type of Employment	1985	1990	1995	2000	2020
Temporary Construction	1,524.8	0	0	0	0
Operating	7,125.2	9,262.8	12,041.6	15,654.1	26,455.4
Indirect	2,034.9	2,645.4	3,439.0	4,470.7	7,555.4
Total	10,734.9	11,908.2	15,480.6	20,124.8	34,010.8

Source: Centaur Associates, Inc., 1980

TABLE 20

ALTERNATIVE 3: Sewage Treatment Requirement Impact Projections for Kane County (Million Gallons Per Day)

Kane County	Alton	Glendale	Kanab	Orderville	Total[a]
1978					
Treatment Capacity	NA	NA	NA	0.3	.....
1980					
Total Need Without Action	0.009	0.029	0.062	0.091	0.511
Total Need With Action	0.009	0.29	0.062	0.091	0.511
Additional Need Due to Action	0	0	0	0	0
1985					
Total Need Without Action	0.008	0.026	0.055	0.082	0.560
Total Need With Action	0.021	0.116	0.170	0.286	0.792
Additional Need Due to Action	0.013	0.089	0.115	0.204	0.231
1990					
Total Need Without Action	0.008	0.026	0.054	0.080	0.645
Total Need With Action	0.024	0.138	0.199	0.337	0.937
Additional Need Due to Action	0.016	0.113	0.144	0.257	0.292
1995					
Total Need Without Action	0.007	0.024	0.051	0.075	0.0713
Total Need With Action	0.026	0.152	0.223	0.376	1.044
Additional Need Due to Action	0.018	0.129	0.173	0.301	0.331
2000					
Total Need Without Action	0.006	0.022	0.047	0.069	0.780
Total Need With Action	0.026	0.159	0.221	0.380	1.132
Additional Need Due to Action	0.020	0.137	0.174	0.311	0.352
2020					
Total Need Without Action	0.003	0.015	0.032	0.047	1.049
Total Need With Action	0.023	0.154	0.209	0.363	1.408
Additional Need Due to Action	0.020	0.139	0.177	0.316	0.359

Source: U.S. Department of the Interior, Bureau of Reclamation, Economic Demographic Assessment Manual, 1977

[a]The Long Valley sewage system, designed for a population of 808 with average flow of 0.081 million gallons per day, is to be completed in July 1980. The facility is to serve Glendale, Orderville, and Mt. Carmel. Since no population projections are available for Mt. Carmel, the figures here designated "total need" represent less than the actual total load on the Long Valley system.

NOTE: NA = not available.

TABLE 21

ALTERNATIVE 3: Health Care Facilities Impact Projections for Kane County

Kane County Facility	Hospital Beds	Nursing Home Beds
1978		
Number of Beds	20	13
1980		
Total Need Without Action	6	24
Total Need With Action	6	24
Additional Need Due to Action	0	0
1985		
Total Need Without Action	7	25
Total Need With Action	9	29
Additional Need Due to Action	2	4
1990		
Total Need Without Action	7	27
Total Need With Action	10	33
Additional Need Due to Action	3	6
1995		
Total Need Without Action	8	28
Total Need With Action	11	35
Additional Need Due to Action	3	7
2000		
Total Need Without Action	9	30
Total Need With Action	12	37
Additional Need Due to Action	3	7
2020		
Total Need Without Action	11	35
Total Need With Action	14	42
Additional Need Due to Action	3	7

Source: Centaur Associates, Inc., 1980

NOTE: Projected needs are based on the following standards:

Hospital Beds:

1) $\frac{\text{Patient days per year}}{\text{Current population}}$ = Current use rate

2) $\frac{\text{Current use rate x projected population}}{365}$ = Average bed need per day

3) $\frac{\text{Average bed need per day}}{.80}$ = bed need for projected year

Nursing Home Beds:

1) $\frac{\text{Patient days per year}}{\text{Current population}}$ = Current use rate

2) $\frac{\text{Current use rate x projected population}}{365}$ = Average bed need per day

3) $\frac{\text{Average bed need per day}}{.90}$ + 10 = Bed need for projected year

TABLE 22

ALTERNATIVE 3: School District Enrollment and Teacher Impact Projections for Kane County

Kane County	Enrollment	Teachers
1978		
Enrollment and FTE Teachers	1,022	52
1980		
Total Need Without Action	1,050	53
Total Need With Action	1,050	53
Additional Need Due to Action	0	0
1985		
Total Need Without Action	1,125	57
Total Need With Action	1,459	74
Additional Need Due to Action	334	17
1990		
Total Need Without Action	1,275	65
Total Need With Action	1,695	87
Additional Need Due to Action	420	22
1995		
Total Need Without Action	1,388	71
Total Need With Proposed Action	1,872	96
Additional Need Due to Action	484	25
2000		
Total Need Without Proposed Action	1,500	76
Total Need With Action	2,008	102
Additional Need Due to Action	508	26
2020		
Total Need Without Action	1,950	99
Total Aeed With Action	2,465	126
Additional Need Due to Action	515	27

Source: Centaur Associates, Inc., 1980

NOTE: Projected enrollment is based on the assumption that enrollment will remain the same proportion of the county's population in the future as it was in 1978.

FTE = full time equivalent

TABLE 23

ALTERNATIVE 3: Population Impact Projections for Washington County

	Washington County	Hurricane	Ivins	LaVerkin	Leeds	St. George	Santa Clara	Toquer-ville	Washington
1980									
Baseline Population	21,384	2,023	442	954	290	10,946	726	386	2,243
Population With Project	21,384	2,023	442	954	290	10,945	726	386	2,243
Increment Oue to Project	0	0	0	0	0	0	0	0	0
1985									
Baseline Population	24,881	2,180	518	1,118	316	12,828	881	453	2,628
Population With Project	32,984	2,798	662	1,385	406	18,614	1,054	543	3,473
Increment Oue to Project	8,103	618	144	267	90	5,786	173	90	845
1990									
Baseline Population	27,792	2,338	582	1,254	342	14,394	956	508	2,950
Population With Project	29,861	2,400	592	1,283	350	16,239	978	516	3,045
Increment Oue to Project	2,069	62	10	29	8	1,845	22	8	95
1995									
Baseline Population	30,768	2,495	646	1,394	369	15,997	1,062	565	3,278
Population With Project	33,014	2,557	656	1,423	377	18,019	1,084	573	3,373
Increment Due to Project	2,246	62	10	29	8	2,022	22	8	95
2000									
Baseline Population	33,896	2,652	714	1,541	395	17,681	1,174	625	3,623
Population With Project	36,236	2,714	724	1,570	403	19,797	1,196	633	3,718
Increment Oue to Project	2,340	62	10	29	8	2,116	22	8	95
2020									
Baseline Population	46,408	3,281	986	2,128	500	24,416	1,622	864	5,003
Population With Project	48,776	3,343	996	2,157	508	26,560	1,665	872	5,098
Increment Due to Project	2,368	62	10	29	8	144	22	8	95

Source: Centaur Associates, Inc., 1980

TABLE 24

ALTERNATIVE 3: Incremental Employment Impact Projections for Washington County

Type of Employment	1985	1990	1995	2000	2020
Temporary Construction	922	0	0	0	0
Operating					
Warner Valley Powerplant	100	100	100	100	100
Slurry Pipeline	10	10	10	10	10
Warner Valley Dam	0	3	3	3	3
Indirect	1,212	458	529	553	562
Total	2,244	571	642	666	675

Source: Centaur Associates, Inc., 1980

TABLE 25

ALTERNATIVE 3: Cumulative Employment Impact Projections for Washington County

Sector	1985				1990				1995			
	Without Project		With Project		Without Project		With Project		Without Project		With Project	
Agriculture	475	(5.8)	475	(4.6)	461	(4.8)	461	(4.8)	449	(4.5)	449	(4.3)
Mining	13	(0.2)	13	(0.1)	13	(0.1)	13	(0.1)	12	(0.1)	12	(0.1)
Construction	524	(6.4)	1,538	(14.8)	568	(6.3)	602	(6.3)	614	(6.2)	653	(6.2)
Manufacturing	794	(9.7)	794	(7.6)	920	(10.2)	920	(9.6)	1,075	(10.9)	1,075	(10.2)
TCU[a]	296	(3.6)	458	(4.4)	322	(3.6)	456	(4.8)	349	(3.5)	484	(4.6)
Trade	2,513	(30.8)	2,956	(28.4)	2,705	(30.0)	2,863	(29.9)	2,909	(29.4)	3,093	(29.4)
FIRE[b]	388	(4.8)	457	(4.4)	443	(4.9)	469	(4.9)	499	(5.1)	531	(5.0)
Services	1,383	(16.9)	1,627	(15.6)	1,580	(17.5)	1,674	(17.5)	1,782	(18.0)	1,895	(18.0)
Government	1,774	(21.7)	2,086	(20.0)	1,999	(22.2)	2,129	(22.2)	2,189	(22.2)	2,328	(21.2)
Total[c]	8,160	(100.0)	10,404	(100.0)	9,011	(100.0)	9,582	(100.0)	9,878	(100.0)	10,515	(100.0)

Source: Centaur Associates, Inc., 1980

[a] TCU = transportation, communications, utilities
[b] FIRE = finance, insurance, real estate
[c] Totals may not add to 100.0 percent due to rounding.

NOTE: Numbers in parentheses denote percent share of total employment.

APPENDIX 18

State of Utah, Community Development Division -
Mitigation of Impacts in Kane and Washington
Counties

COMMUNITY DEVELOPMENT DIVISION

231 EAST 400 SOUTH, SUITE 100
SALT LAKE CITY, UTAH 84111
(801) 533-5396

SCOTT M. MATHESON
GOVERNOR

STATE OF UTAH
DEPARTMENT OF COMMUNITY AND
ECONOMIC DEVELOPMENT

MEMORANDUM

TO: Bureau of Land Management
U.S. Department of the Interior

FROM: Community Development Division
Department of Community and Economic Development
State of Utah

SUBJECT: Mitigation of Impacts Due to the Development of the Alton Coal Field and the Warner Valley Project in Kane and Washington Counties

DATE: April 14, 1980

The primary potential impacts and problems from subject developments will be social, cultural, and environmental. The positive effects will include added employment opportunities, public revenues, and personal income benefits related to the general stimulus of the local economies. Anticipated negative impacts will include urban sprawl, septic tank contamination, and inadequate water supplies to serve the population. The state has some capacity to address the following: (1) financing through prepayment of sales taxes to supply certain services due to impacts; (2) social and health services; and (3) capital facilities financing.

Prefinancing of Public Services

As soon as the Warner Valley Project and the Alton Coal Field have received necessary approvals, the financing of front-end public facilities will be the major problem faced by local governments in the area. To mitigate front-end financial problems associated with growth, federal and state assistance should address the primary problem of the affected local governments' ability to secure adequate facilities during the development period. The following are suggested solutions to community development front-end financial problems:

(1) Creation of a Federal/State/Local Revolving Loan Fund. This would provide capital for the planning and construction of major local government facilities and services, i.e., water, sewer, solid waste collection and disposal, roads, classrooms, and health facilities. The fund would be replenished with revenues derived from user fees.

(2) Rectifying Local Tax Imbalances. Several options are available whereby Washington and Kane Counties could transfer portions of their county tax bases from the projects to the cities:

a. Special Services District Act. This Act allows two jurisdictions to join together as one governmental entity to pool their resources in providing public services and facilities. In addition, this Act provides exceptions to the debt limitations on municipal bonds for cities and counties. The debt limitation is set by the Act at 12 percent of the reasonable fair cash value, or 40 percent of the assessed value within the jurisdiction. This is higher than other existing statutory provisions which allow a debt limitation of 2 percent for counties and 4 percent for cities.

b. Interlocal Cooperation Act. This Act, passed in 1965, enables counties and cities to associate in providing necessary public services. The Act permits use of a broader tax base for provision of services.

c. Revenue Sharing. The Utah State Constitution should be amended to enable the State to share revenue with local governments and to allow counties to share revenues with municipalities.

(3) Prepayment of Sales and Use Taxes. State statute permits the prepayment of future sales and use taxes. A tax credit is given to the company at a time when the firm would normally pay the taxes. The revenues received from prepayment are earmarked for financing the construction of highways and schools within the impacted areas. This has a shortcoming, though, because revenues from this source will be collected by Kane and Washington Counties and will therefore not inure to the cities for municipal services.

(4) Other Sources of Capital for Public Improvements:

a. Cities Water Loan Fund (Division of Water Resources.

Interest-free loans to incorporated municipalities, water improvement districts, and special service districts to help construct culinary water systems in areas of critical need throughout the state.

b. Four Corners Regional Commission (Department of Community and Economic Development).

Supplemental and technical assistance (planning and study) grants to local governments in order to enhance the overall economy of the state and the Four Corners Region.

c. Farmers Home Administration.

Financial assistance (grants and loans) for water and waste disposal facilities in communities with a population up to 10,000.

d. Community Impact Account (Department of Community and Economic Development).

Assistance for communities impacted or potentially impacted by natural resource development where the need for public facilities and services is beyond the financial capability of local government.

e. Environmental Protection Agency (Sewer Work Grants).

Funds to municipalities which have the most severe waste water disposal problems.

Note: Currently, one has to be mindful that the above programs will be affected by proposed federal budgetary cuts.

(5) Ability to Absorb Population Increases due to the Warner Valley Project. Because of the proximity of Warner Valley to St. George, it can be anticipated that some in-migration due to its development can be absorbed in the St. George area. However, further planning should be engaged to determine exactly how much of that growth can be absorbed by St. George.

CPB/bob

APPENDIX 19

Energy Efficiency Summary of Alternatives 1, 2, 3, and 4

Component	Input of Resources (Btu per MW)			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Harry Allen Powerplant	9.35×10^{10}	1.17×10^{11}	9.35×10^{10}	1.17×10^{11}
Harry Allen Water Supply	1.23×10^{8}	1.54×10^{8}	1.23×10^{8}	1.54×10^{8}
Warner Valley Powerplant	2.32×10^{10}	N/A	2.32×10^{10}	N/A
Alton Coal Mine and Preparation Plant	1.49×10^{10}	1.50×10^{10}	2.65×10^{9}	N/A
Coal Slurry Pipeline	5.98×10^{8}	6.94×10^{8}	N/A	N/A
Transmission Lines	1.16×10^{8}	1.30×10^{8}	1.82×10^{8}	1.28×10^{8}
Line Loss	2.60×10^{9}	2.60×10^{9}	2.60×10^{9}	2.60×10^{9}
Warner Valley Water Project	8.57×10^{7}	N/A	1.71×10^{8}	N/A
Truck Transportation of Coal, Alton to Warner Valley	N/A	N/A	1.12×10^{9}	N/A
Central Utah Coal, Mining	N/A	N/A	3.97×10^{9}	4.96×10^{9}
Southwestern Wyoming Coal, Mining	N/A	N/A	4.67×10^{9}	5.83×10^{9}
Total Energy Input (Btu per MW)	1.35×10^{11}	1.35×10^{11}		
Using Central Utah Coal			1.28×10^{11}	1.25×10^{11}
Using Southwestern Wyoming Coal			1.28×10^{11}	1.26×10^{11}
Total Electrical Energy Output (MW)[a]	1,610	1,288	805	1,288
Energy Output (Btu per MW)[b]	2.98×10^{10}	2.98×10^{10}	2.99×10^{10}	2.98×10^{10}
Energy Efficiency (Percent Output of Input)[c]	22.1	22.1		
Using Central Utah Coal			23.4	24.0
Using Southwestern Wyoming Coal			23.3	23.8

Source: Bureau of Land Management, Utah State Office, Unpublished, 1980

[a]One MW = 2.99×10^{10} Btu

[b]Output of powerplants computed at substations; quantities reflect transmission line losses of 8 percent.

[c]Energy Efficiency = $\dfrac{\text{Output (Btu per MW)}}{\text{Input (Btu per MW)}}$

Example: Energy Efficiency of Alternative 1 = $\dfrac{2.98 \times 10^{11}}{1.35 \times 10^{11}}$ = 22.1 percent

NOTE: Btu = British thermal unit
MW = megawatt
N/A - not applicable

GLOSSARY

Acre-foot. The volume of water (43,560 cubic feet) required to cover 1 acre to a depth of 1 foot.

Active Solar Space Heating Systems. Equipment designed to absorb the sun's energy and to use this energy to heat building space by use of mechanically-forced energy transfer such as fans or pumps.

Air Quality. The condition of the air usually expressed by the content of various chemicals and particles naturally or artificially occurring in the area.

Air Quality Classes. Classes established by the Environmental Protection Agency (EPA) that define the amount of air pollution considered significant within an area. Class I applies to areas where almost any change in air qualtiy would be considered significant; Class II applies to areas where the deterioration normally accompanying moderate well-controlled growth would be considered insignificant; and Class III applies to areas where deterioration up to the national standards would be considered insignificant.

Air Quality Modeling. A quantitative technique of estimating the effects of emissions from a polluting source (e.g., a powerplant) on the existing local or regional air quality.

Alluvial Valleys. Unconsolidated stream-laid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities.

Alluvium. Clay, silt, sand, and gravel or other rock material transported by flowing water and deposited as sorted or semi-sorted sediments.

Ambient Air. The air encompassing or surrounding a particular region.

Ambient Air Quality. Concentration levels in the ambient air for a specified pollutant within a specified averaging time period.

Ambient Pollutant Concentrations. Existing levels of contaminants in the local or regional air, usually pertaining to concentrations of particulate matter, sulfur dioxides, nitrogen oxides, ozone, and trace elements.

Appliance and Motor Efficiency. Improving the seasonal efficiency of the energy consuming equipment and distribution systems by modification, maintenance, or replacement.

Aquifer. A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Artesian (confined) Aquifer. A water-yielding zone in which ground water is confined under pressure by impervious or semipervious strata.

Atmosphere Chemical Transformation. A phenomenon which occurs when certain chemical emissions from an industrial or powerplant source combine with other chemicals already existing in the air to form still another chemical or compound which may or may not be considered a pollutant.

Base Flow. The flow of water entering stream channels from ground water sources.

Baseload. The minimum load of a utility over a given period of time.

Berm. An earthen terrace or low linear ridge which can be formed by natural processes or construction activities.

Best Available Control Technology (BACT). Various methods and equipment available within the current technology to best control air pollutants and dust generated during construction, mining, or industrial (including powerplant) activities.

Biomass Energy Technology. A process of generating energy utilizing biomass (solid waste, agriculture, and forest residues, etc.) as the source. The biomass can be burned to generate heat which warms a boiler and creates steam or it can be fermented and distilled to make clean-burning fuels such as methanol.

Borrow Material. Material (sand, gravel, etc.) excavated in order to provide fill elsewhere.

British Thermal Unit (Btu). The quantity of heat required to raise the temperature of 1 pound of water 1°F at or near 39.2°F.

Building Controls. Equipment designed to provide a constant surveillance of the building and to make the most effective use of physical plant systems and personnel.

Building Efficiency Codes. Mandatory measures adopted by local governments for energy conservation and maximum building efficiency.

Building Envelope. The elements of a building which enclose conditioned spaces through which thermal energy may be transferred to or from the exterior.

Cambrian. The first period of the Paleozoic era, thought to have included the span of time from 570 million years ago to 500 million years ago.

Capacity. Maximum power output, expressed in kilowatts or megawatts. Equivalent terms: peak capability, peak generation, firm peakload, and carrying capability. In transmission, the maximum load a transmission line is capable of carrying.

Capacity Factor. The ratio of the average power load of an electrical powerplant to its rated capacity.

Caulking. Pliable materials used to reduce the passage of air and moisture by filling small gaps: (1) at fixed joints on a building, (2) underneath baseboards inside a building, (3) in exterior walls at electrical outlets, and (4) around pipes and wires entering a building.

Clean Air Act (42 USC 1857 et. seq.). An act for air pollution prevention and control: (1) to protect and enhance public health and welfare and the productive capacity of its population, (2) to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution, (3) to provide technical and financial assistance to State and local governments in connection with the development and execution of their air pollution prevention and control programs, (4) to encourage and assist the development and operation of regional air pollution control programs.

Clock Thermostat. A device which is designed to reduce energy consumption by regulating the demand on the heating or cooling system in which it is installed, by using: (1) a temperature control device for interior spaces incorporating more than one temperature control level, and (2) a clock or other automatic mechanism for switching from one control level to another.

Closed Basin. The depressed topographic feature in which water can run by means of surface drainage, but from which there is no surface outlet.

Coal Processing Facility. A facility used to clean, sort, and pulverize coal for purposes of mixing it with water to form a coal slurry.

Coal Slurry. A mixture consisting of approximately 50-percent water and 50 percent pulverized coal.

Cogeneration. A system to make more efficient use of the heat potential of the exhaust gases (resulting from combustion of fossil fuels for electric generation) to supply process heat for industry.

Cogeneration Systems. The simultaneous production of process steam and electricity by the industrial firms or utilities.

Conditioned Space. The portion of interior space which is contained within exterior walls and which is conditioned directly or indirectly by an energy-using system.

Cone of Depression. A depression in the water table (roughly conical) caused by pumping.

Conservation. Improving the efficiency of energy use; using less energy to produce the same product.

Continuous Miners. Machinery used to mine coal underground, employing a system of shovels mounted on a revolving wheel that scrape coal from the mine walls and deposit it on a conveyor for transport.

Cost-Effective. An economic criteria for comparing alternatives in terms of the net benefits they produce per dollar value.

Cultural Resources. Nonrenewable remains of human activities, occupations, and endeavors as reflected in sites, buildings, structures, or objects, including works of art, architecture, and engineering. Cultural resources are commonly discussed as prehistoric and historic values, but each period represents a part of the full continuum of cultural values from the earliest to the most recent.

Decommissioning. The act of taking a power generating or industrial facility out of service, sometimes referred to as mothballing.

Degree Day, Heating. A unit, based upon the temperature difference and time, used in estimating fuel consumption and specifying nominal heating load of a building in winter. For any one day, when the mean temperature is less than 65°F, there exists as many degree days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and 65°F.

Demographics. Characteristics of human populations such as size, growth, density, distribution, and vital statistics.

Depositional Valleys. Topographic valleys formed or being formed by deposition of sediments.

Direct Heat Gain. The south-facing panels of insulated glass, or similar transparent substances admitting the sun's rays into the building space where heat is stored in a thermal storage mass. Thus, the actual building space is directly heated by the sun.

Direct Load Management Systems. Customer-owned or leased devices that reduce the maximum kilowatt demand on an electric utility, and which are either:

(1) Part of a radio, ripple, or other utility controlled-load switching system on the customer's premises.

(2) Clock-controlled load-switching devices.

(3) Interlocks and other load-actuated, load-limiting devices.

(4) Energy storage devices with control systems.

Directional Drilling. A method of locating oil and gas reserves which do not lie directly under the drilling surface.

Dragline Mining. A method of surface mining incorporating the use of large "steamshovels" or draglines which remove overlying layers of earth until reaching the ore or coal-bearing formation. The ore or coal is then removed with front-loading equipment.

Duct Insulation. A material primarily designed to resist heat flow which is installed on a heating or cooling duct in an unconditioned area of a building.

Econometrics. The use of sophisticated mathematical, statistical, and other analytic methods to make quantitative economic analyses.

Economy of Scale. The reduction in unit costs as large quantities of a product are made.

Efficiency. The ratio of useful energy to the thermal energy input for a designated time period, expressed in percent.

Effluent. The mixture of substances, gases, liquids, and suspended matter discharged into the atmosphere (or ground, river, ocean) as the result of a given process.

Electrostatic Precipitator. A means of removing particulates from gases. Particles are given an electrical charge and attracted to a plate with an opposite charge.

Endangered Species. Any animal or plant species in danger of extinction throughout all or a significant portion of their range.

End-Use. An appliance or item of equipment which uses energy to perform a useful function in a house, business, or industry (e.g., a dishwasher).

Energy Conservation. Reducing the amount of energy which a building uses during a period of time.

Entry Heading. A main tunnel for initiating underground mining entries into a coal-bearing strata.

Ephemeral Surface Water. Surface water directly resulting from rainfall or snowmelt, with flows of limited duration.

Evaporative Cooling. The use of a device which utilizes the heat absorbed by the evaporation of water as the primary source of cooling.

Facade Lighting. The lighting of the exterior of a building for decorative purposes.

Fifty-Year (50-year) Storm. A storm intensity with a 2-percent probability of occurring within any given year based on past recorded storms or computed drainage flows.

Flocculation. The aggregation of fine particles of a medium into a mass.

Floodlighting. A lighting system designed to light an area using projector-type luminaires usually capable of being pointed in any direction.

Floodplain. Lands that are periodically covered by flood waters.

Formation. A body of rock large enough to be shown on a geologic map as a practical unit for mapping and having easily recognizable upper and lower boundaries that can be traced in the field.

Fossil Fuels. Coal, oil, natural gas, and other fuels originating from fossilized geologic deposits and depending on oxidation for release of energy.

Fugitive Dust. The solid, airborne particulate matter emitted from any source other than through a stack.

Gaging Station. A particular site on a stream or reservoir where systematic observations of height, discharge, or water quality parameters are obtained, usually by an automatic device.

Gaussian Dispersion Model. A quantitative technique for predicting the behavior and effects of emissions in the atmosphere from an industrial or powerplant source.

Geothermal Systems. Equipment that uses the natural heat in the earth's crust to produce electricity.

Ground Water. That part of the subsurface water that is the zone of saturation, supplies water to wells, and provides water that sustains the low flow of perennial streams.

Ground Water Accretion. Water added to the subsurface water supply from recharge by overlaying streams, adjacent aquifers, injection wells etc.

Head. The difference in elevation between two points in a body or column of fluid. With respect to hydrology, the head is the height of the water level within a column that equals the pressure of a confined aquifer at the point where the column enters that aquifer.

Heat Pumps. A device which can provide heating and cooling to a building space. The four basic types of heat pumps are air-to-air, water-to-air, water-to-water, and earth-to-air.

Heat Reflecting and Heat Absorbing Window or Door Material. A window or door glazing material with exceptional heat-absorbing or heat-reflecting properties, or reflective or absorptive films and coatings applied to an existing window or door which results in exceptional heat-absorbing or heat-reflecting properties.

Highwall. The unexcavated face of exposed overburden and coal in a surface mine or the face or bank on the uphill side of a contour strip mine excavation.

HVAC System. A system that provides either collectively or individually the processes of comfort heating, ventilating, and/or air conditioning within or associated with a building.

Hydraulic Conductivity. The rate at which water will move through a cross section of unit area under a unit hydraulic gradient. The usual units in the United States are cubic feet per day per square foot under a hydraulic gradient of one foot per foot, abbreviated to feet per day. Also known as "permeability."

Hydroelectric Plant. An electric powerplant in which the turbine-generator units are driven by falling water.

A conventional hydroelectric plant is one in which all the power is produced from natural streamflow as regulated by available storage.

A pumped storage hydroelectric plant is one in which power is produced during peakload periods by using water previously pumped from a lower reservoir to an upper reservoir during offpeak periods.

Indirect Heat Gain. The use of panels of insulated glass or similar transparent material to direct the sun's rays onto specially-constructed thermal walls, ceilings, rock beds, or containers of water or other fluids where heat is stored and radiated.

Infiltration. Unwanted outside air coming into a building through inadvertent openings in the building envelope, open doors, etc.

Infrastructural Services. Basic services such as police protection, fire protection, sewage disposal, water supply, etc., provided by local governments.

Insulation. A material primarily designed to resist heat flow which is installed within or on the spaces between conditioned areas of a building and unconditioned areas of a building or on the outside (including floors, walls, ceiling, crawl spaces, and foundations).

Intermittent Stream. A stream or portion of a stream that flows only at certain times of the year, usually in response to direct precipitation or an elevated water table.

Kilovolt (kV). The electromotive unit of force equal to 1,000 volts.

Kilowatt (kW). One thousand watts.

Kilowatt-hour (kWh). A basic unit of elecrical energy which equals 1 kilowatt of power applied for 1 hour.

Lithic Scatter. An archaeological site characterized by the presence of flaked tools, chips, cores, or flakes only.

Load. The amount of electrical power that is drawn from a power line, generator, or other power source.

Load Management. A technique used by utilities to reduce the disparity between low electricity demand (troughs) and high electricity demand (peaks) in a given period of time.

Load Shedding. A method to shut off selected equipment according to the measurement of peak load to maintain the load below a given level.

Longwall Mining. A method of underground mining in which large panels are first developed by mining openings around the periphery of the panel. The longwall equipment, consisting of hydraulic shields, a pan conveyor, and a shear or plow mechanism, is installed at one end of the panel and progressively mines out the entire panel. The roof caves immediately behind the hydraulic shields. Ventilation is maintained through the previously developed openings and across the mining face under hydraulic shields. The coal, as mined, falls from the longwall face onto the pan conveyors that then move it to a conveyor established on one side of the panel.

Macro-Econometrics. The study of an entire economic system using econometric techniques.

Megawatt (MW). One million watts or 1 thousand kilowatts.

Micro-Econometrics. The study of individual portions of an economic system using econometric techniques.

Microwave Station. A communications station incorporating microwaves as the mode of message transport.

Mine Drainage. Any water forming on or discharging from a mining operation.

Motor Retrofit Measures. The replacement of the existing motor with a smaller or more efficient motor.

National Ambient Air Quality Standards (NAAQS). The allowable concentrations of air pollutants in the ambient air specified by the Federal government and found in Title 40, Code of Federal Regulations, Part 50. The ambient air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety, the primary standards are requisite to protect the public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety, the secondary standards are requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of air pollutants in the ambient air).

National Environmental Policy Act (NEPA). An act to declare a national policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, to enrich the understanding of the ecological systems and natural resources important to the Nation, and to establish a Council on Environmental Quality (CEQ).

National Historic Preservation Act of 1966. An act that declares a national policy of historic preservation including the encouragement of preservation on the State and private levels.

National Register of Historic Places. A list of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture, maintained by the Secretary of the Interior.

Nephelometer. A general name for instruments which measure, at more than one angle, the scattering function of particles suspended in a medium.

New Source Performance Standards. A set of standards which limit the quantities of pollutants released into the atmosphere from plant stacks.

Night-Time Temperature Setback (residential). Manually or automatically lowering the thermostat control setting for the furnace during the heating season to a maximum of 55°F during sleeping hours.

Nitrogen Oxides (NO_x). Compounds produced by combustion, particularly when there is an excess of air or when combustion temperatures are very high. Nirtogen oxides are primary air pollutants.

Nonattainment Area. An area already characterized by significant levels of air pollution. Such areas are restrictive of any significant increases in certain pollutants caused by new sources (industrial or powerplant).

Off-Road Vehicle (ORV). A vehicle (including four wheel drive, trail bikes, hovercraft, snowmobiles, etc., but excluding helicopters, fixed wing aircraft and boats) capable of travelling off roads over land, water, ice, snow, sand, marshes, etc.

Opacity. The degree to which emissions reduce the transmission of light and obscure the view of an object in the background. A state which renders material partially or wholly impervious to rays of light and causes obstruction of an observer's view.

Overburden. The earth, rock, and other materials that lie above a mineral deposit.

Paleontology. A science that deals with the life of past geological periods and is based on the study of fossil remains of plants and animals.

Particulate Matter. Any material, except water in a chemically uncombined form, that is or has been airborne and exists as a liquid or a solid at standard temperature and pressure conditions. Minute particles of coal dust, fly ash, and oxides temporarily suspended in the atmosphere.

Passive Solar System. A solar heating and/or cooling system using natural means of heat distribution. Generally the building structure itself forms the heat distribution system.

Peaking Capacity. Generating equipment normally operated only during the hours of highest daily, weekly, or seasonal loads. Some generating equipment may be operated at certain times as peaking capacity and at other times to serve loads on a round-the-clock basis.

Peak Demand. The maximum electrical load needed or produced in a stated period of time. It may be the maximum instantaneous lead (or the maximum average load) within a designated interval of the stated period of time.

Peak Load. Maximum power load (megawatts) for a given period.

Perennial Stream. A stream or reach of a stream that flows continuously throughout the year and whose upper surface generally stands lower than the water table in the region adjoining the stream.

Permeability. The property or capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure. The customary unit of measurement is the millidarcy.

Petroglyph. Figures, symbols, or scenes pecked or etched in rock.

pH. A number that represents the negative logarithm, base 10, of the hydrogen-ion activity of a solution. A pH less than 7 indicates an acid solution; a pH greater than 7 indicates an alkaline solution.

Photometer. An instrument for measuring luminous intensity.

Photochemical Oxidants. Chemicals which result from oxidation caused by exposure to sunlight.

Pipe Insulation. A material primarily designed to resist heat flow installed on a heating or cooling pipe in an unconditioned area of a building.

Plume. The volume of air space containing any of the substance emitted from a point source. For practical purposes, the limits of a plume have to be arbitrarily defined according to some minimum concentrations of the substance.

Point Source. An emitter of substances into the environment.

Pooling (Power). Operation of two or more inter-connected electric systems to supply power in the most reliable and economical manner for their combined load requirements and maintenance program.

Potentiometric Surface. The potential level within or above an aquifer that water would rise to as a result of the hydraulic head within the formation.

Power. In connection with machines, power is the time rate of doing work. In connection with the transmission of energy of all types, power refers to the rate at which energy is transmitted, usually measured in watts.

Prevention of Significant Deterioration (PSD) Regulations. Regulations intended to protect uniquely clean air quality by not allowing further significant degradation. Areas may be designated Class I, II, or III. Industries or powerplants must apply for a Prevention of Significant Deterioration (PSD) permit from the Environmental Protection Agency.

Quaternary Alluvium. Water deposited sediments characterized by particle size sorting, rounded grains, and recent depositional origin (less than 3 million years).

Radioactive Nuclides. Radioactive particles which are emitted from powerplant stacks when coal is burned (all coal contains radioactive material).

Raptors. A group of carnivorous birds consisting of hawks, eagles, falcons, vultures, and owls.

Rate Structure Adjustments. Offering daily off-peak rates to each customer who is willing to pay metering costs.

Recharge Area. An area in which water is absorbed and eventually reaches the zone of saturation in one or more aquifers.

Reserve Capacity. Extra generating capacity available to meet unanticipated demands for power or to generate power in the event of loss of generation resulting from scheduled or unscheduled outages of regularly used generating capacity. Reserve capacity provided to meet the latter is also known as forced outage reserve.

"R-Value" Insulation. The heat resistant quality of an insulator as expressed by the R-value (the ability of a material to resist heat flow).

Scour Line. The level to which a stream may erode its own channel or floodplain.

Secondary Pollutants. New pollutants formed during the transport of emissions from a source.

Seismic Risk. Risk due to earthquakes or earth vibration, often measured logarithmically (Richter scale).

Slurry Pipeline. A pipeline usually constructed underground to transport coal in slurry form from the coal mine to the point of consumption (e.g., a powerplant).

Solar Domestic Hot Water Systems. Equipment designed to absorb the sun's energy and to use this energy to heat water for use in a building other than for space heating.

Solid Waste/Resource Recovery Systems. Systems which completely or partially combust municipal solid waste for the purpose of generating electrical power and/or steam (a biomass technology).

Specific Yield. The ratio of the volume of water a saturated specimen of rock will yield to its own total volume.

Spoil Pile. A pile or accumulation of dirt or rock which has been removed from its original location by mining operations.

Standard Industrial Classification (SIC). A system established by the Federal government to classify industrial, commercial, and agricultural enterprises by the products or services they provide.

Storage Coefficient. The volume of water an aquifer releases or takes into storage per unit surface area of the aquifer per unit changes in head.

Strip Mining. Any operation in connection with prospecting for, excavating, or mining minerals which results in a large-scale surface or stream bottom disturbance from stripping, trenching, dredging, rim cutting, or open-pit digging.

Subsidence. Movement in which surface material is displaced vertically downward.

Sulfur Oxides (SO_x). Compounds of sulfur combined with oxygen that have a significant influence on air pollution.

Sun Space Systems. A passive solar heating system whereby the solar collection and storage are thermally isolated from the living spaces of the building. The collector and storage function somewhat independently of the building, while the building can draw from the sunspace as its thermal requirements dictate. An atrium, a sunporch, a greenhouse, and a sunroom all represent potential examples of a sunspace.

Surface Mining. Mining method whereby the overlying materials are removed to expose the mineral for extraction.

Surface Mining Control and Reclamation Act of 1977 (PL 95-87 August 3, 1979). An act to establish the Office of Surface Mining Reclamation and Enforcement (OSM). The goals of the Act and OSM are to insure that coal is mined in an environmentally sound fashion and that previously mined-out areas are reclaimed and restored.

Suspended Sediment. Sediment which remains suspended in a water current.

Synfuels. Combustible fuels which must be processed, distilled, or refined from their naturally occurring state before they can be readily used. These include oil from oil shale and tar sands, and gas from coal.

Tailings Pond. A reservoir used as a depository for slurried wastes.

Tertiary. The first period of the Cenozoic era, thought to have included the span of time from 65 million years ago to about 2 to 1 million years ago.

Thermal Window. A window unit with improved thermal performance through the use of two or more sheets of glazing material affixed to a window frame to create one or more insulated air spaces. It may also have an insulating frame and sash.

Thermostat. An instrument which measures changes in temperature and controls devices for maintaining a desired temperature.

Threatened Species. Any animal or plant species likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Total Dissolved Solids (TDS). An aggregate of carbonates, bicarbonates, chlorides, sulfates, phosphates, and nitrates of calcium, magnesium, manganese, sodium, potassium, and other cations that form salts and are dissolved in water. High TDS values can adversely affect humans, animals, and plants. TDS is often used as a measure of salinity.

Trace Element. A chemical element found in small quantities (less than 1 percent) in a mineral or compound.

Transmissivity. The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient. The usual units in the

United States are cubic feet per day per foot width of aquifer, usually expressed as square feet per day. Also known as transmissibility.

Turbidity. The quality of opaqueness due to the presence of suspended material. It is commonly expressed in Jacson Trubidity Units (JTU). These units are roughly proportional to miligrams per litre of suspended sediment: a range in JTU of 3 to 440 corresponds to a range in concentration of suspended sediment of about 5 to 1,000.

Valve Station. A station with shutoff capability strategically placed at a point along a coal slurry pipeline. Such stations are included in pipeline designs for safety and maintenance reasons.

Ventilation. That portion of supply air which comes from outside (outdoors) plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

Visual Resource Management System (VRM). Classification containing specific objectives for maintaining or enhancing visual resources, including the kinds of structures and modifications acceptable to meet established visual goals.

Visual Sensitivity. As applied to visual resource management, that degree of concern expressed by the user toward scenic quality and existing or proposed visual change in a particular characteristic landscape.

Vortex Sediment Ejection System. A sediment removal system using a vortex flow settling technique to remove heavier particles.

Waste Heat Recovery Systems. Equipment that uses waste heat as a substitute for a portion of the heat energy that would normally be required for heating/ cooling or domestic hot water systems.

Water Heater and Storage Tank Insulation. A material primarily designed to resist heat flow which is suitable for wrapping around the exterior surface of the storage tank or water heater casing.

Water Table. The surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

Watt. The absolute unit of power equal to the rate of work represented by a current of one ampere under a pressure of one volt.

Wetlands. Lands containing significant amounts of soil moisture.

Wet-Lime Scrubber. A technology of removing air pollutants from powerplant emissions before their transmission into the atmosphere.

Wilderness Study Areas (WSAs). Areas determined through BLM's wilderness inventory to meet the definition of wilderness established by Congress.

Wind Energy Systems. Equipment that uses wind energy to produce energy in any form for personal purpose, agriculture, or other uses.

LIST OF ABBREVIATIONS

AC	alternating current
AO	Authorized Officer
AQMA	Air Quality Maintenance Area
AWT	Advanced Wastewater Treatment
AWV	Allen-Warner Valley
BACT	Best Available Control Technology
BAQ	Bureau of Air Quality
BLM	Bureau of Land Management
Btu	British thermal unit
Btu/lb	British thermal units per pound
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO_2	carbon dioxide
CO	carbon monoxide
COP	Coefficient of Performance
CPUC	Californa Public Utilities Commission
CU	Development of Coal Resources in Central Utah Environmental Statement, U.S. Department of the Interior, 1979
DEP	Department of Environmental Protection
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EMSL	Environmental Monitoring and Support Laboratory
EPA	Environmental Protection Agency
ERT	Energy Research and Technology
ES	Environmental Statement
FIRE	finance, insurance, and real estate
ft^3/s	cubic feet per second
gmp	gallons per minute pumped
gpm	gallons per minute
HVAC	heating, ventilating, and air conditioning
ICPA	Intermountain Consumer Power Association

IPA	Intermountai Power Association
IPP	Intermountain Power Project
JTU	Jacson Trubidity Units
km	kilometer
kV	kilovolt
kW	kilowatt
kWh	kilowatt hours
LASL	Los Alamos Scientific Laboratory
m	meter
m/s	meters per second
M&I	municipal and industrial
mg/ℓ	milligrams per liter
mgd	million gallons per day
mty	million tons per year
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_x	nitrogen oxides
NO_2	nitrogen dioxide
NPC	Nevada Power Company
NPS	National Park Service
NSPS	New Source Performance Standards
ORV	off-road vehicle
OSM	Office of Surface Mining Reclamation and Enforcement
O_3	ozone
Pb	lead
PG&E	Pacific Gas and Electric
PSD	Prevention of Significant Deterioration
SMUD	Sacramento Municipal Utility District
SCE	Southern California Edison
SHPO	State Historic Preservation Officer
SIC	Standard Industrial Classification
SO_2	sulfur dioxide
SU	*Development of Coal Resources in Southern Utah Environmental Statement*, U.S. Department of the Interior, 1979

SW	Development of Coal Resources in Southwestern Wyoming Environmental Statement, U.S. Department of the Interior, 1978
TCU	transportation, communications, and utilities
TDS	total dissolved solids
TVA	Tennessee Valley Authority
UII	Utah International Incorporated
UP	Union Pacific
UP&L	Utah Power and Light
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VRM	visual resource management
WSA	Wilderness Study Area
$\mu g/m^3$	micrograms per cubic meter

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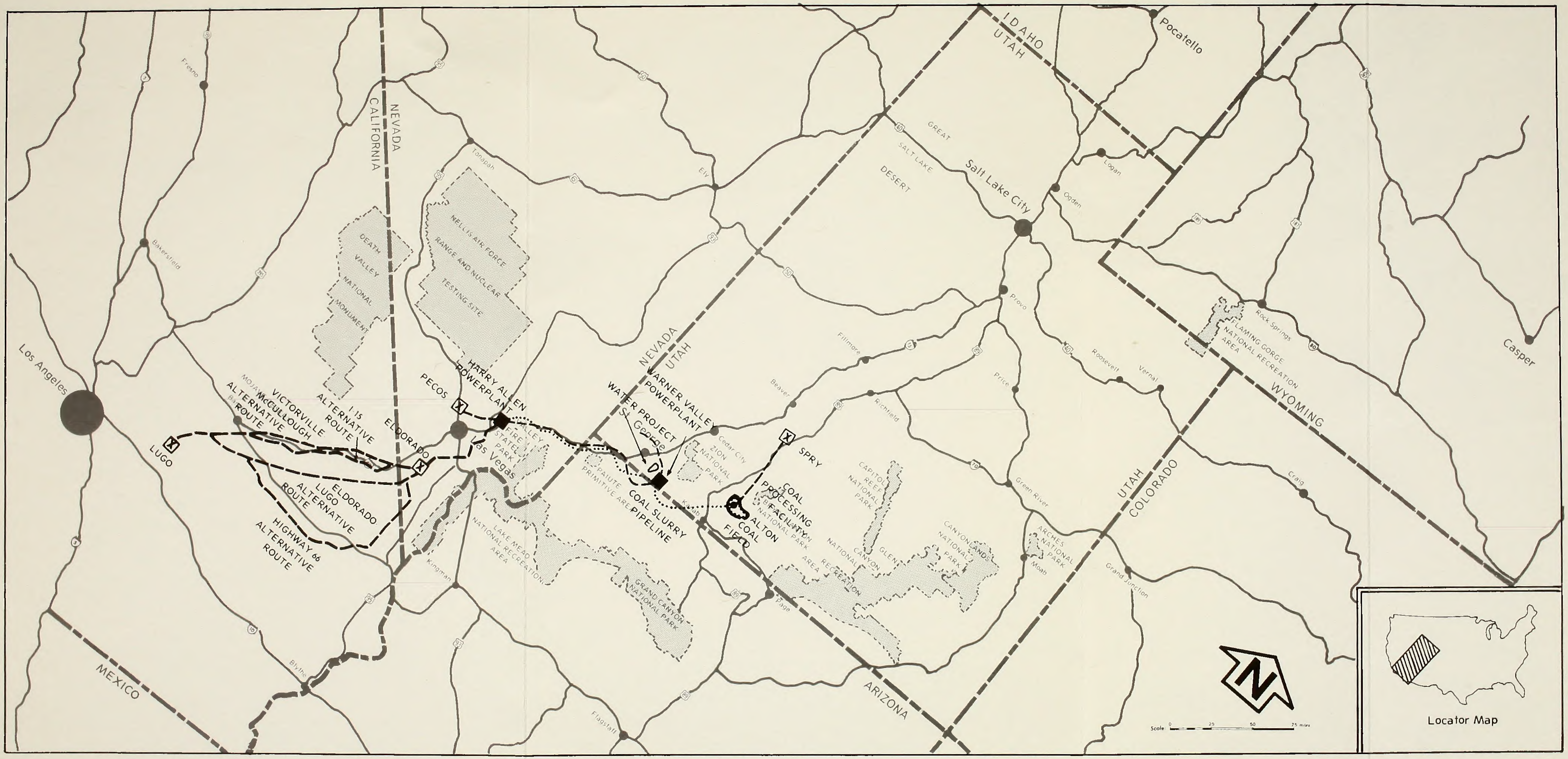

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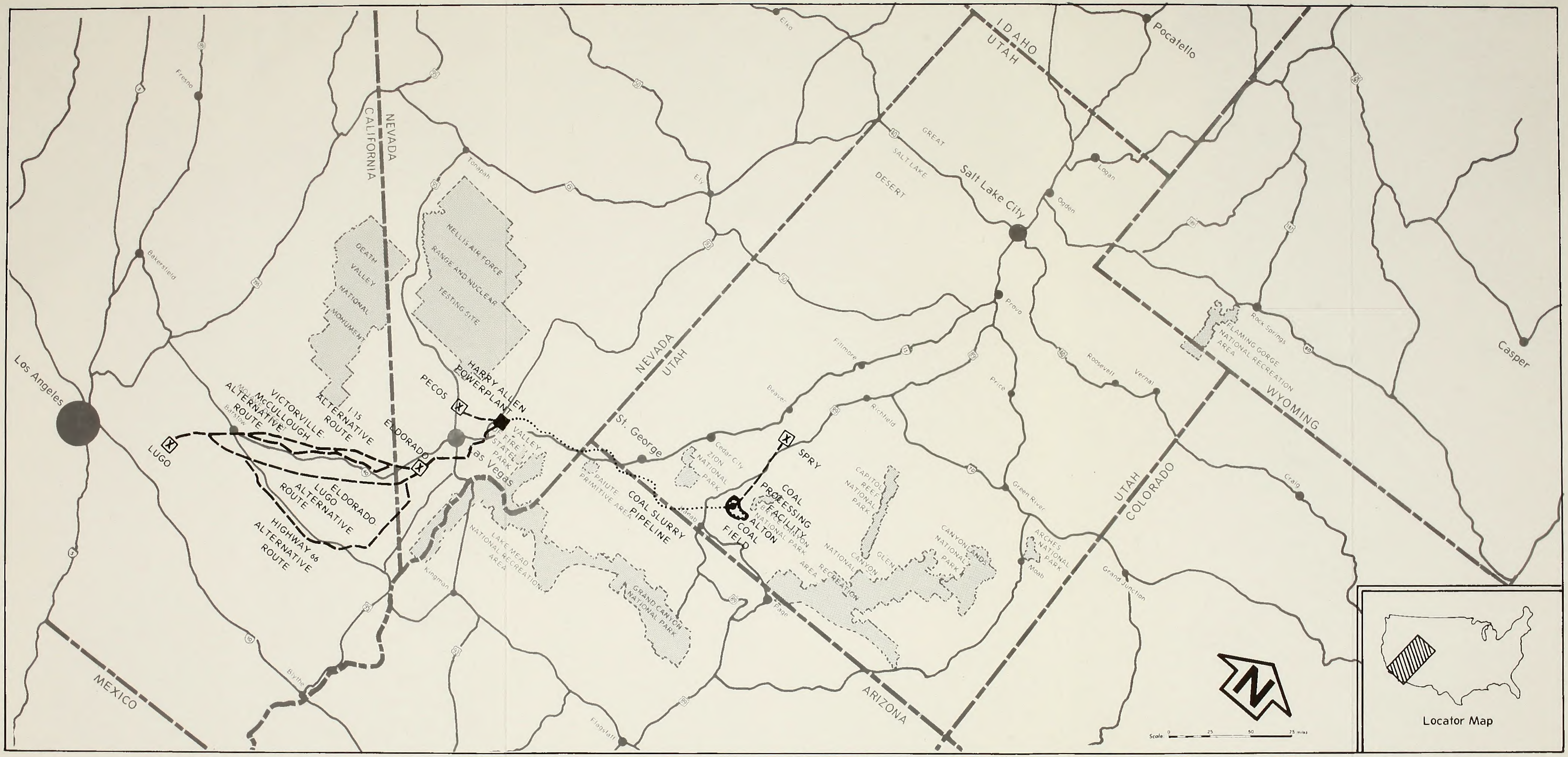
ALLEN-WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

LEGEND

- Transmission Route
- Coal Source
- Substation
- Powerplant
- Coal Slurry Pipeline

FIGURE 2-1

ALTERNATIVE 1
SYSTEM COMPONENTS



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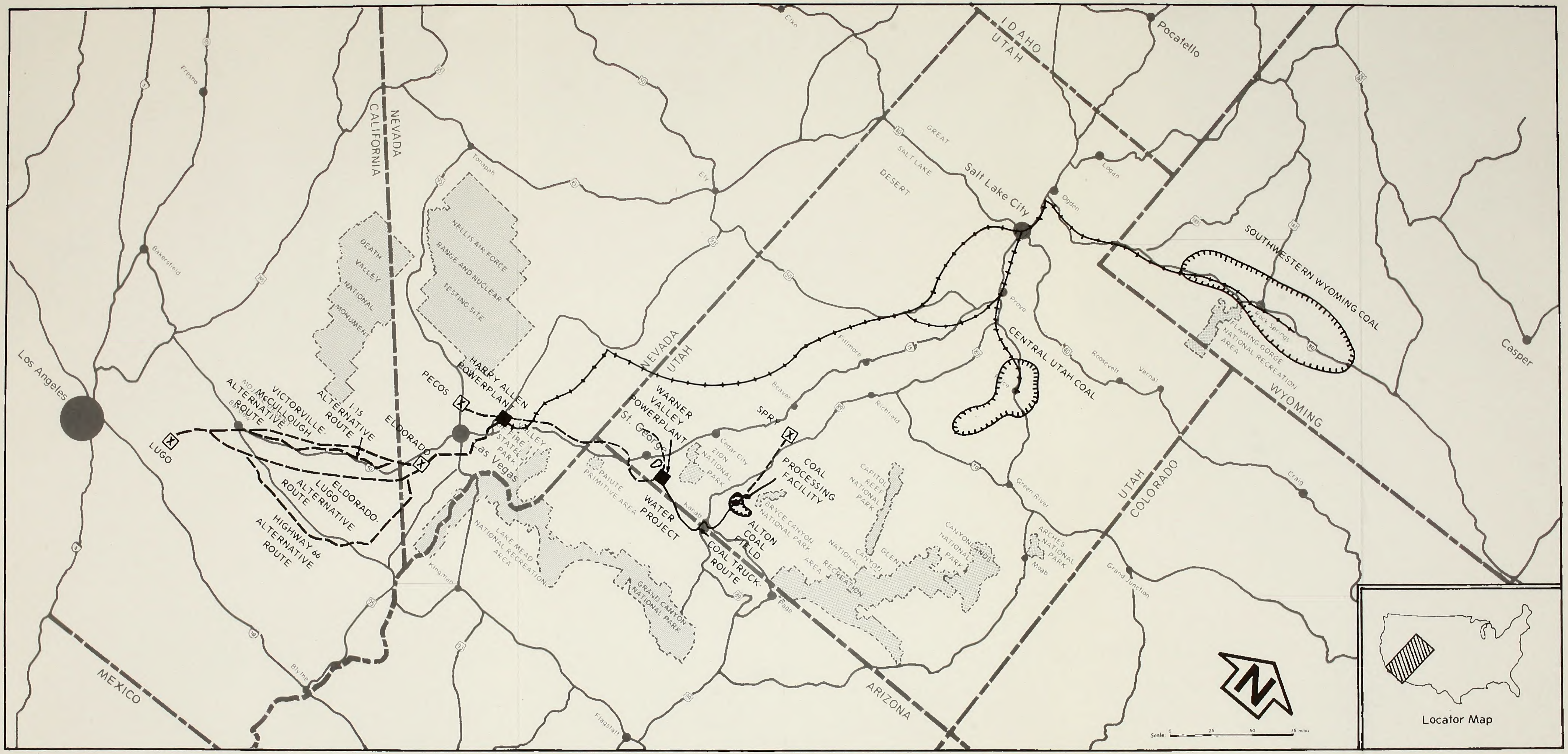
ALLEN-WARNER VALLEY ENERGY SYSTEM
ENVIRONMENTAL IMPACT STATEMENT

LEGEND

Transmission Route
Coal Source
Substation
Powerplant
Coal Slurry Pipeline

FIGURE 2-11

ALTERNATIVE 2
SYSTEM COMPONENTS



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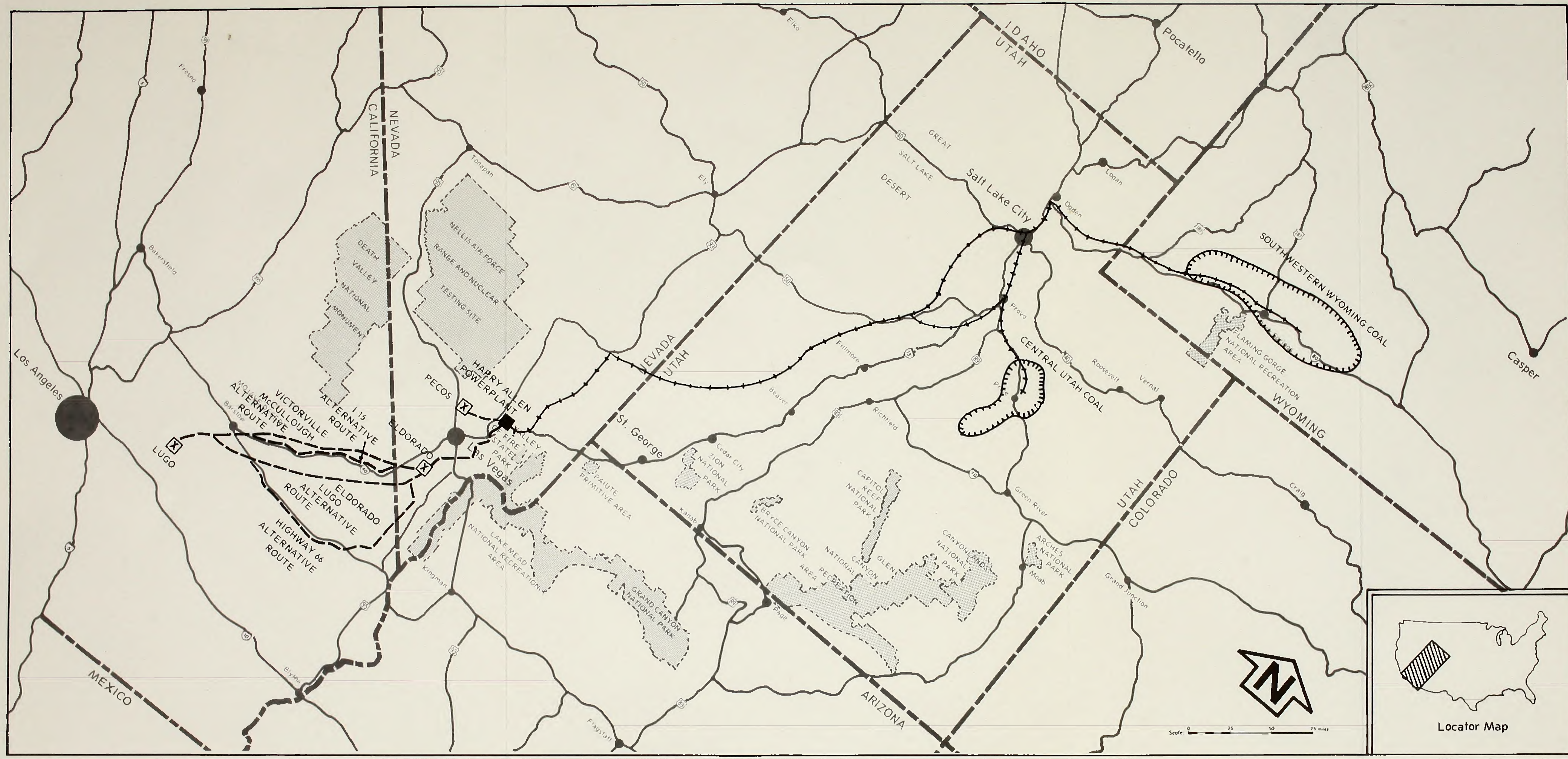
ALLEN-WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

LEGEND

- Railroad Lines
- Transmission Route
- Coal Source
- Substation
- Powerplant
- Coal Truck Route

FIGURE 2-12

ALTERNATIVE 3
SYSTEM COMPONENTS



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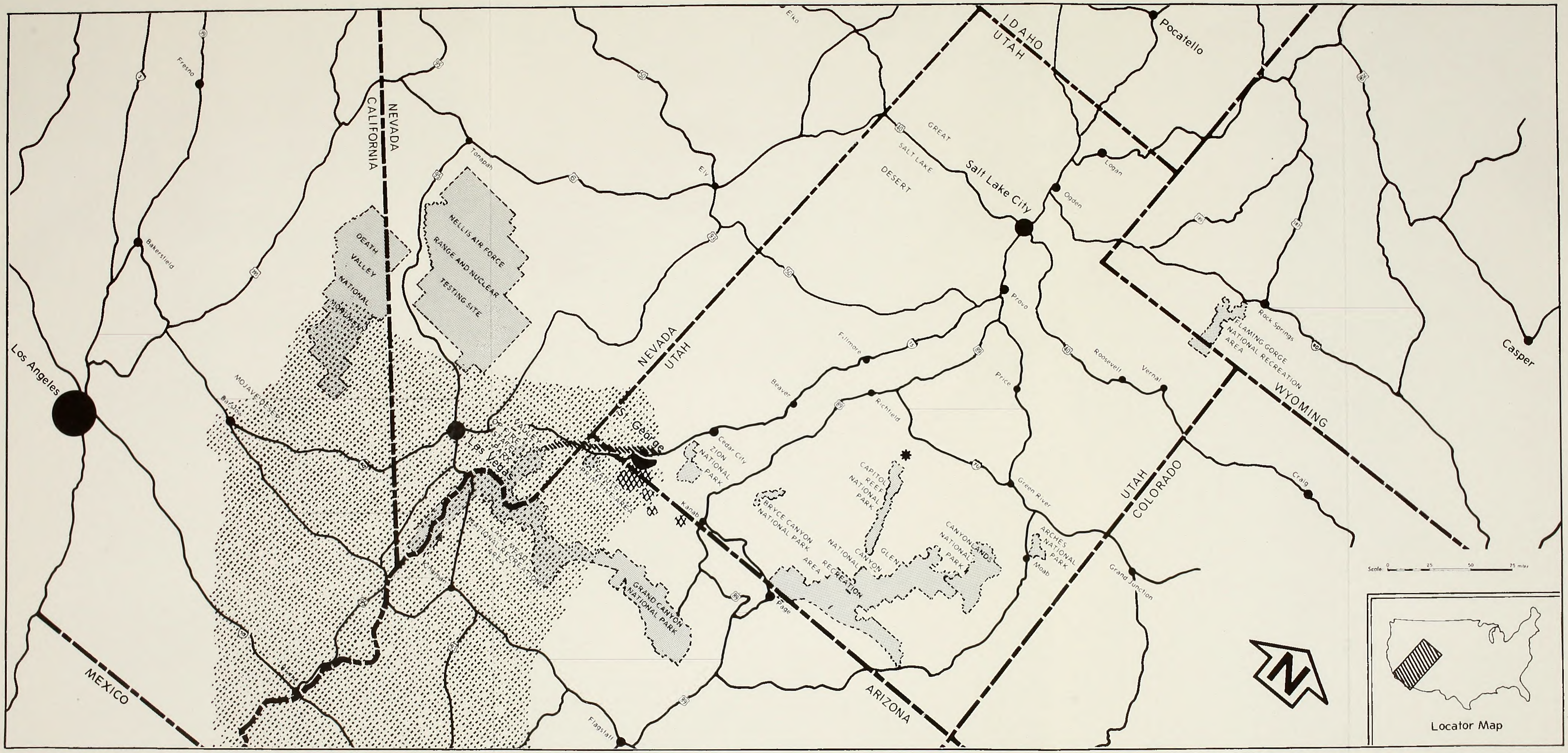
ALLEN-WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

FIGURE 2-14

ALTERNATIVE 4
SYSTEM COMPONENTS



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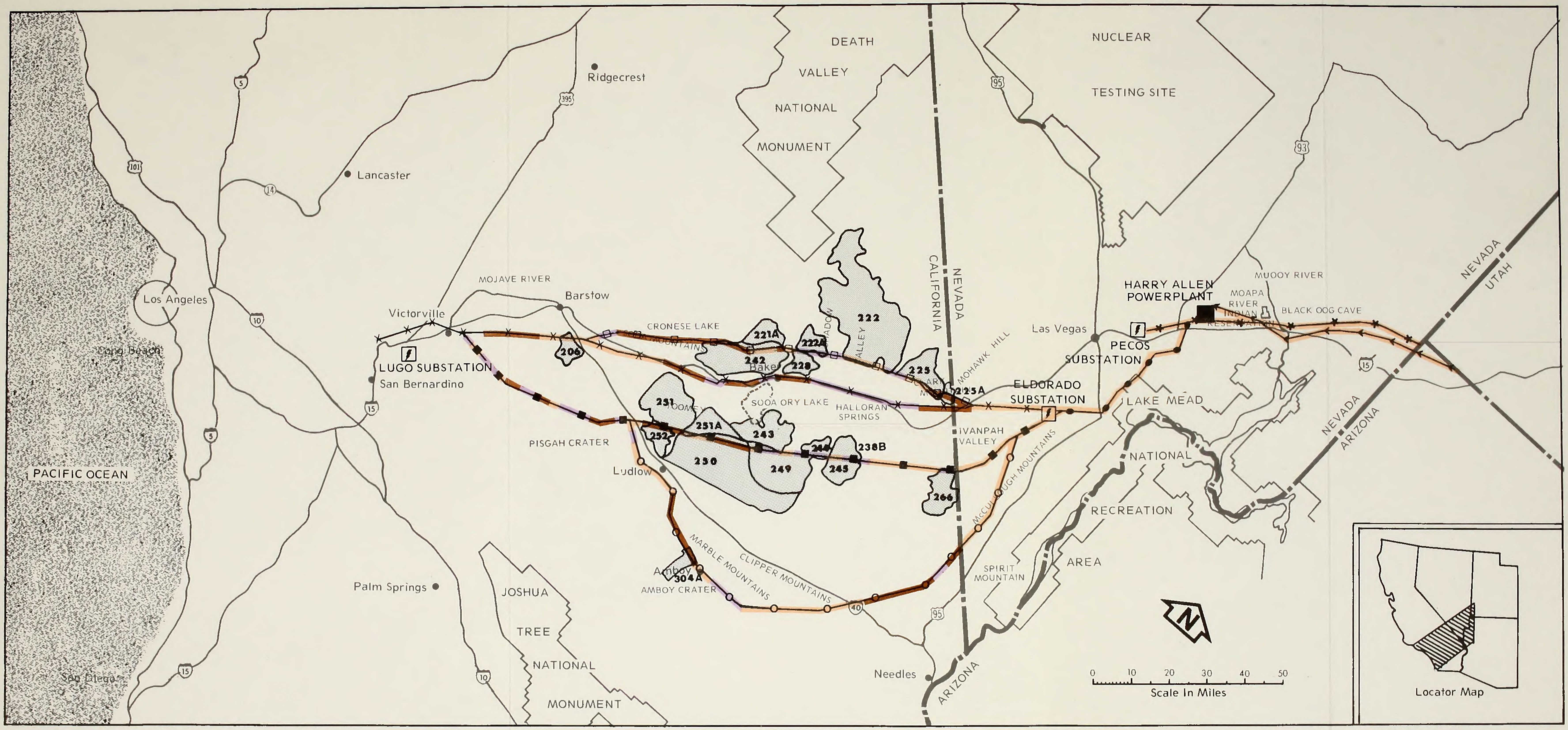
ALLEN-WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

LEGEND

- Desert Tortoise Habitat
- Woundfin and Roundtail Chub Habitat
- Dwarf Bearclaw Poppy (Arctomecon humilus)
- Siler Pincusion Cactus (Pediocactus sileri)
- Townsendia aprica.

FIGURE 3-6

VEGETATION AND WILDLIFE SPECIES OF CONCERN



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ALLEN - WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

LEGEND

PROPOSED ELECTRICAL TRANSMISSION ROUTES
- Highway 66 Route
- I-15 Route
- Eldorado-Lugo
- Victorville-McCullough
- Allen-Eldorado
- Warner-Pecos

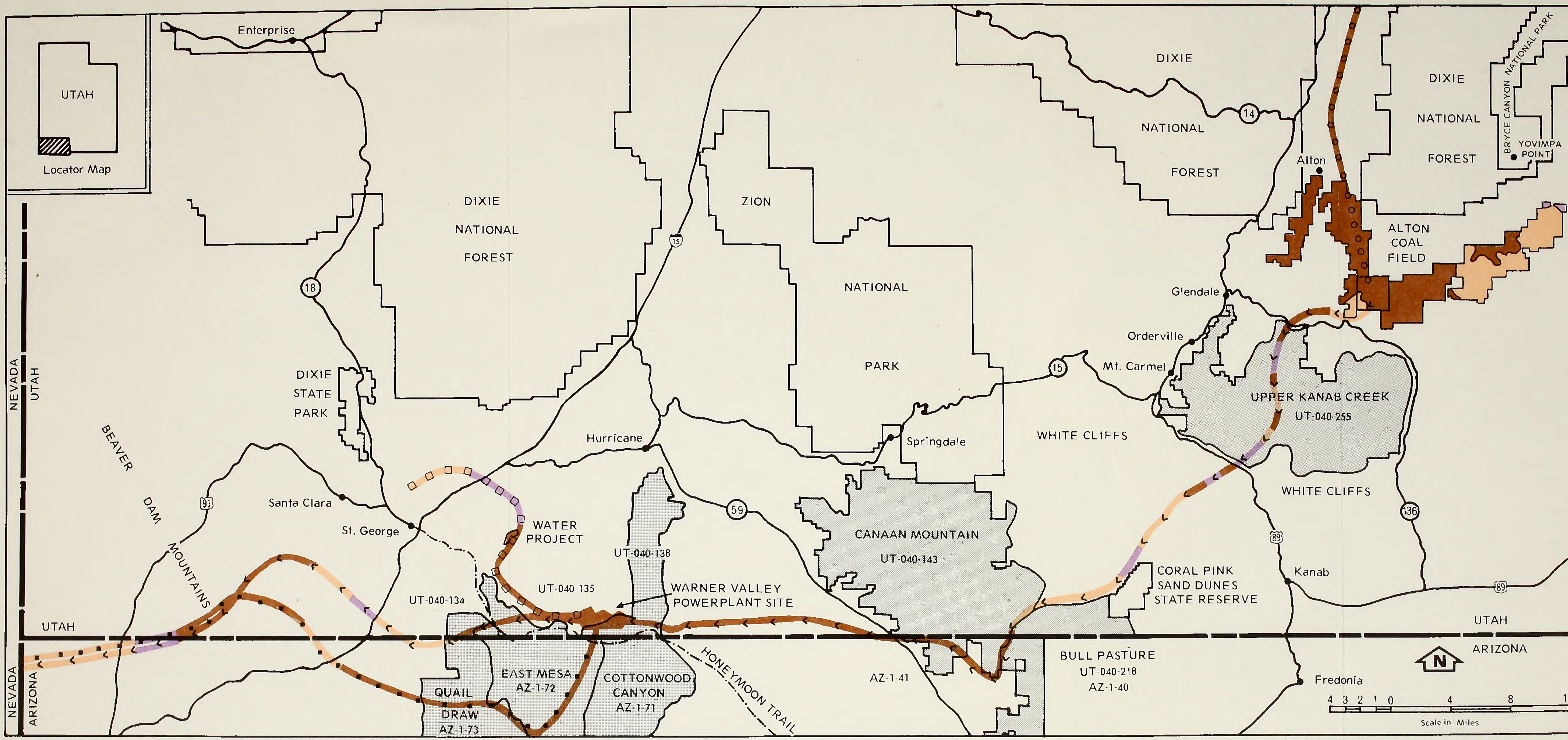
PROPOSED COAL TRANSPORTATION SYSTEM
- Coal Slurry Pipeline

WILDERNESS
- Wilderness Study Area

VISUAL RESOURCE MANAGEMENT CLASSES
- CLASS II-Changes in any of the basic elements caused by a management activity should not be evident in the characteristic landscape. A contrast may be seen but should not attract attention.
- CLASS III-Contrasts to the basic elements caused by a management activity may be evident and begin to attract attention in the characteristic landscape. However, the changes should remain subordinate to the existing landscape.
- CLASS IV-Contrasts may attract attention and be a dominant feature of the landscape in terms of scale. However, the change should repeat the basic elements inherent in the landscape.

FIGURE 3-8

PROPOSED ELECTRICAL TRANSMISSION ROUTES AND PROPOSED COAL SLURRY PIPELINE IN CALIFORNIA AND NEVADA



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ALLEN-WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

LEGEND

PROPOSED ELECTRICAL TRANSMISSION ROUTES

o o Spry To Alton

□ □ Warner To St. George

▪ ▪ Warner To Pecos

PROPOSED COAL TRANSPORTATION SYSTEM

< < Coal Slurry Pipeline

WILDERNESS

Intensive Wilderness Inventory Units

Visual Resource Management Classes

CLASS II-Changes in any of the basic elements caused by a management activity should not be evident in the characteristic landscape. A contrast may be seen but should not attract attention.

CLASS III-Contrasts to the basic elements caused by a management activity may be evident and begin to attract attention in the characteristic landscape. However, the changes should remain subordinate to the existing landscape.

CLASS IV-Contrasts may attract attention and be a dominant feature of the landscape in terms of scale. However, the change should repeat the basic elements inherent in the landscape.

FIGURE 3-9

PROPOSED ELECTRICAL TRANSMISSION ROUTES AND PROPOSED COAL SLURRY PIPELINE IN UTAH AND ARIZONA

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(June 1984)

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